

ISSN 0100-6991
ISSN ONLINE: 1809-4546



CBC

Revista do Colégio Brasileiro de Cirurgiões
Journal of the Brazilian College of Surgeons

ENGLISH

Volume 42 • Nº 6
outubro/ novembro de
2015

www.cbc.org.br



COLÉGIO BRASILEIRO
DE CIRURGIÕES

Orgão oficial de divulgação



Sociedade Brasileira de
Hérnia e Parede Abdominal

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Preço da assinatura anual: a vista, R\$ 150,00
ou três parcelas de R\$ 60,00
Números avulsos e/ou atrasados: R\$ 40,00
Preço da assinatura para o exterior: US\$ 248,00
Tiragem: 5.000 exemplares

International Standard Serial Number
ISSN 0100-6991

PUBLICIDADE



Tel.: (21) 3116-8300
E-mail: medline@medlineeditora.com.br

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Prevalence of alterations in chest computerized tomography in patients with head and neck cancer

Prevalência das alterações em tomografias computadorizadas de tórax em pacientes com câncer de cabeça e pescoço

DIÓGENES PAIVA¹; OTÁVIO ALBERTO CURIONI¹; RICARDO PIRES DE SOUZA²; DÉBORA VIANNA¹; LUCIANO JOSÉ FRANÇA¹; LUÍS EDUARDO SOBREIRO³; ROGÉRIO APARECIDO DEDIVITIS, TCBC-SP⁴; ABRÃO RAPOPORT, ECBC-SP⁵

A B S T R A C T

Objective: to assess the prevalence of abnormalities found by computed tomography (CT) of the chest in patients with squamous cell carcinoma of the head and neck. **Methods:** we retrospectively analyzed chest CT exams of 209 patients with squamous cell carcinoma of the head and neck. The CT findings were stratified as inflammatory / infectious, parenchymal, nodular uncharacteristic and nodular metastatic / tumoral. **Results:** alterations were diagnosed in 66.6% of patients. Of these, 25.3% represented emphysema; 18.8%, uncharacteristic micronodules; 12.9%, metastases; 11.9%, thoracic lymph node enlargements; and in 6.6% we detected active pulmonary tuberculosis or its sequelae, pneumonia or inflammatory / infectious signs and pleural thickening or effusion. **Conclusion:** the prevalence of exams with alterations and the considerable rate of detected metastases indicate that chest CT should be required for diagnostic and / or staging in cases of head and neck cancer.

Key words: Carcinoma, Squamous Cell. Head and Neck Neoplasms. Tomography, X-Ray Computed. Neoplasm Staging. Mass Screening.

INTRODUCTION

Squamous cell carcinoma of the head and neck is a worldwide public health problem and, despite advances in therapeutic and diagnostic methods, patients displayed no increase in overall survival in recent decades. This has been attributed, among other factors, to the emergence of distant metastases and the development of second primary tumors. The presence of these manifestations may affect prognosis and management¹⁻³.

The information arising from imaging analysis is an important component for the initial staging and post-treatment evaluation of patients with squamous cell carcinoma of the head and neck⁴. Additionally, the American Joint Committee on Cancer (AJCC) staging Manual states that any diagnostic information that contributes to the overall accuracy of pretreatment assessment should be considered in planning the treatment of such patients⁵.

A chest X-ray was used for several years to complement head and neck cancer diagnosis / staging. However, over time it showed not to be effective in providing early diagnosis of such alterations⁶. Pan-endoscopy was also used as an alternative method of screening, with reports of

2-16% of second primary tumor detection, but in the lung it tends not to have a good effectiveness in detecting metastases due to the peripheral distribution of such lesions².

It is noteworthy that computed tomography (CT) has a good accuracy in differentiating lesions with metastatic pattern from the ones without oncologic meaning, causing head and neck surgeons to resort to radiologists for the aid in planning the best treatment⁷. Even in non-neoplastic findings, alterations can be found which, although not increasing mortality, increase morbidity, such as emphysema.

The aim of this study was to evaluate the prevalence of alterations found in chest CT exams of patients with squamous cell carcinoma of the head and neck.

METHODS

This study was approved by the Ethics in Research Committee of the Hospital Heliópolis, under the number 400/2005.

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We retrospectively analyzed chest CT scans of 209 patients with squamous cell carcinoma of the head and neck, between August 2010 and April 2011, in order to determine and quantify the most prevalent alterations in these exams. Should the reports present diagnostic uncertainty, there was reevaluation of the images with the radiology team for clarification and final decision by consensus on the alterations found. For this study, CT findings were stratified as: inflammatory / infectious, parenchymal, nodular uncharacteristic and nodular metastatic / tumoral. The uncharacteristic nodules included the ones smaller than 7 mm, with no classic features of metastasis.

RESULTS

Alterations consistent with chronic obstructive pulmonary disease were the most frequent, followed by uncharacteristic micronodules (Figure 1), representing 25.3% and 18.8%, respectively. It should be noted that, in some cases, more than one alterations occurred in the same exam (Table 1). Lung metastases amounted to 12.9% (Figure 2).

DISCUSSION

The presence of synchronous lung tumors or thoracic metastases in patients with head and neck cancer have prognostic implications and may have major impact on treatment^{4,8}. In addition, second primary tumors account for approximately half of deaths in patients with successfully eradicated primary head and neck cancer⁹. Such second primaries are often located in the chest, showing the importance of screening in this region and the use of CT for this purpose. The most common site of distant metastasis are the lungs and various centers around the world consider screening for lung metastasis important in these patients⁷. However, the widespread use of CT is still controversial, since, theoretically, it would have a

greater impact on therapy by detecting alterations in initial cases, although some authors demonstrate limitations of its routine use in all cases, especially in the newly diagnosed¹⁰. Thus, there was search for parameters associated with a positive chest CT scan, such as the occurrence of regional metastases in stages N2 / N3 and the primary tumor having origin in the oropharynx, hypopharynx or supraglottic region¹¹.

The effectiveness of chest CT compared with conventional radiography in screening for metastases or concomitant primary tumors is not an issue, since CT can detect smaller lesions and certainly allows for better visibility of the lungs than plain radiography, although cost-effectiveness has been called into question in early ca-



Figure 1 - Computed tomography of the chest showing right uncharacteristic micronodule.



Figure 2 - Computed tomography of the chest showing right lung metastasis.

Table 1 - Prevalence of alterations in chest CT scans of patients with squamous cell carcinoma of the head and neck.

Tomographic Findings	Number of cases	%
COPD / emphysema	53	25.3
Uncharacteristic micronodules	38	18.8
Metastases	27	12.9
Intrathoracic lymph nodes	25	11.9
Tuberculosis (active or sequelae)	14	6.6
Inflammatory / infectious signs	14	6.6
Pleural effusion / thickening	14	6.6
Total tests with alterations	136	66.6

ses¹¹. In agreement with these authors, we do not believe that the use of chest CT for all patients with head and neck cancer will significantly encumber any health system; however, the selection of patients at higher risk of alterations, according to the parameters mentioned above, can lead to a more rational use of this method.

The PET/CT has been highlighted as effective in detecting chest metastases or synchronous primary lung tumors, but at the moment, it still has a higher cost than CT, is not as widespread, and some studies do not show diagnostic superiority both in early cases and in newly diagnosed ones as for the possible doubts, like the uncharacteristic micronodules^{8,11}. The dramatic change in technology in recent years also enhances the use of CT, the advent of multi-slice CT in the 1990s enabling shorter examination time, closer proximity in cuts and higher detailing of dimensions and objects' characteristics⁷.

Surgical treatment or rescue radiation therapy are the leading solution in managing patients with recurrent head and neck tumors. Distant metastasis must be properly identified for due treatment planning. In a meta-analysis of ten articles with 797 PET-CT scans of 756 patients, the sensitivity and specificity of the method were, respectively, 92% and 95%¹². CT is the single most important technique for the detection of distant metastases and second primary tumors, though with sensitivity ranging from 40% to 74%^{13,14}. However, when comparing the two methods in 37 patients, sensitivity, specificity and predictive values for positive and negative tests were, respectively, 100%, 94%, 86% and 100% for CT, and 92%, 87%, 74% 97% for PET-CT. The methods were strictly consistent in 32/37 (86%) cases¹⁵.

In our study, the high frequency of altered examinations (66.6%) reinforce its use and causes it to be incorporated as a complement in the diagnosis / staging of head and neck cancer cases in our department. These patients are often active smokers, which emphasizes the theory of field cancerization⁹, justifying a broader investigation, in addition to explaining the most frequently found change, pulmonary emphysema or alterations suggestive of COPD, which also have the cigarette as predominant etiologic agent.

The second most common finding was the presence of uncharacteristic micronodules. In the evaluation of pulmonary nodules, guidelines published by the Fleischner Society¹⁶ recommend that nodules measuring 4 mm or less in patients at high risk of developing malignancy should be followed by CT in 12 months, without repetition if remaining unchanged; nodules measuring 4-6mm must be followed by CT in 6-12 months intervals, and then at 18-24 months if unchanged; the ones measuring 6-8mm nodes must have a follow-up with CT every 3-6 months and then at 9-12 months when unchanged; and those measuring up to 8mm should be pursued with CT at months 3, 9 and 24 months,

with dynamic contrast, and PET / CT or biopsy should be considered, the latter being a n exception conduct, as it has low accuracy and is associated with pneumothorax.

The presence of thoracic metastases occurred in 12.9% of exams, a figure considered very important and crucial to the consolidation of the use of CT in the diagnostic workup of head and neck cancer, since their presence can dramatically change the initial therapy proposal. This prevalence is in line with other published data, which found the presence of metastases in 10.8% and 19%⁷. Also in relation to thoracic metastases, the majority affected the lung, but they also occurred in the mediastinum and spinal cord, all with good accuracy detection by CT. The mediastinal location also deserves special attention because, as seen in autopsies¹⁷, approximately 23% to 34% of patients with distant metastases had metastatic lymph nodes in that area, justifying a more accurate screening on these occasions.

Thoracic enlarged lymph nodes was the fourth most frequent finding and may, as in other regions of the body, be inflammatory, infectious or neoplastic in origin and can also mask neoplastic alterations. These enlarged lymph nodes were identified predominantly in the mediastinum, but also occurred in the perihilar region and in the armpit in one case of a patient with head and neck tumor and past breast cancer history, being referred to puncture biopsy.

Active tuberculosis or its sequelae was also an important finding, with 6.6%, consistent with the high prevalence of this disease in our country and the common characteristic of low socioeconomic status between it and head and neck cancer. In some cases it increased morbidity, and in others it caused the association the triple therapy with the initial treatment proposal. Lung inflammatory and infectious signs were common (6.6%), due to aspiration component peculiar to tumors in some regions of the head and neck, such as the larynx, besides the direct irritant and deleterious effect of smoking on lung parenchyma. Lastly, among the most important findings described herein, there is pleural thickening or effusions (6.6%), in some cases associated with the previously cited lung diseases or due to neoplasms arising in the lung, besides lung and spinal metastases. In such cases, we used puncture biopsy and cytologic evaluation for clarification, with a frequent need for a new puncture when the test was positive for malignancy.

Although there are still no well-stratified guidelines on the need for CT, particularly in the early cases, we routinely use this examination in all newly admitted cases and post-treatment follow-ups.

In conclusion, the prevalence of CT exams with alterations and the considerable rate of detected metastases indicate that chest CT should be required for diagnosis and / or staging in cases of head and neck cancer.

R E S U M O

Objetivo: avaliar a prevalência de alterações encontradas na tomografia computadorizada (TC) de tórax em pacientes com carcinoma epidermoide de cabeça e pescoço. **Métodos:** Foram analisadas retrospectivamente 209 TC de tórax de pacientes com carcinoma epidermoide de cabeça e pescoço. As alterações tomográficas foram estratificadas como: inflamatórias/infecciosas, parenquimatosas, nodulares incharacterísticas e nodulares metastáticas/tumorais. **Resultados:** foram diagnosticadas alterações em 66,6 % dos exames. Destes, 25,3% representaram enfisema pulmonar; 18,8% micronódulos incharacterísticos; 12,9% metástases; 11,9% de linfonomegalias torácicas; e, em 6,6%, foram detectadas tuberculose pulmonar ativa ou sequelas, pneumonia ou sinais inflamatórios/infecciosos e espessamento ou derrame pleural. **Conclusão:** a prevalência de exames com alteração e o considerável índice de metástases detectadas, indicam que a TC de tórax deve ser solicitada para complementação diagnóstica e/ou estadiamento nos casos de câncer de cabeça e pescoço.

Descritores: Carcinoma de Células Escamosas. Neoplasias de Cabeça e Pescoço. Tomografia Computadorizada por Raios X. Estadiamento de Neoplasias. Programas de Rastreamento.

REFERENCES

- Reiner B, Siegel E, Sawyer R, Brocato RM, Maroney M, Hooper F. The impact of routine CT of the chest on the diagnosis and management of newly diagnosed squamous cell carcinoma of the head and neck. *AJR Am J Roentgenol.* 1997;169(3):667-71.
- Ong TK, Kerawala CJ, Martin IC, Stafford FW. The role of thorax imaging in staging head and neck squamous cell carcinoma. *J Craniomaxillofac Surg.* 1999;27(6):339-44.
- Houghton DJ, Hughes ML, Garvey C, Beasley NJ, Hamilton JW, Gerlinger I, et al. Role of chest CT scanning in the management of patients presenting with head and neck cancer. *Head Neck.* 1998;20(7):614-8.
- Dinkel E, Munding A, Schopp D, Grosser G, Hauenstein KH. Diagnostic imaging in metastatic lung disease. *Lung.* 1990;168 Suppl:1129-36.
- American Joint Committee on Cancer. In: Greene FL, Page DL, Fleming ID, Fritz A, Balch CM, Haller DG, et al. Manual for staging of cancer. 6th ed. Philadelphia: Lippincott; 2002.
- Quint LE, Glazer GM, Gross BH. Primary and metastatic malignancy, In: Putman CE, editors. Diagnostic imaging of the lung. New York: Marcel Dekker; 1990. p.199-251.
- Beech TJ, Coulson C, Najran P, Olliff J, Jennings C. How good is a chest CT scan at predicting the risk of pulmonary metastatic disease in patients with head and neck cancer? A retrospective observational study. *Clin Otolaryngol.* 2010;35(6):474-8.
- McLeod NM, Jess A, Anand R, Tilley E, Higgins B, Brennan PA. Role of chest CT in staging of oropharyngeal cancer: a systematic review. *Head Neck.* 2009;31(4):548-55.
- Glynn F, Brennan S, O'Leary G. CT staging and surveillance of the thorax in patients with newly diagnosed and recurrent squamous cell carcinoma of the head and neck: is it necessary? *Eur Arch Otorhinolaryngol.* 2006;263(10):943-5.
- Hsu YB, Chu PY, Liu JC, Lan MC, Chang SY, Tsai TL, et al. Role of chest computed tomography in head and neck cancer. *Arch Otolaryngol Head Neck Surg.* 2008;134(10):1050-4.
- Loh KS, Brown DH, Baker JT, Gilbert RW, Gullane PJ, Irish JC. A rational approach to pulmonary screening in newly diagnosed head and neck cancer. *Head Neck.* 2005;27(11):990-4.
- Gao S, Li S, Yang X, Tang Q. 18FDG PET-CT for distant metastases in patients with recurrent head and neck cancer after definitive treatment. A meta-analysis. *Oral Oncol.* 2014;50(3):163-7.
- Ng SH, Chan SC, Liao CT, Chang JT, Ko SF, Wang HM, et al. Distant metastases and synchronous second primary tumors in patients with newly diagnosed oropharyngeal and hypopharyngeal carcinomas: evaluation of (18)F-FDG PET and extended-field multi-detector row CT. *Neuroradiology.* 2008;50(11):969-79.
- Krabbe CA, Pruijm J, van der Laan BF, Rödiger LA, Roodenburg JL. FDG-PET and detection of distant metastases and simultaneous tumors in head and neck squamous cell carcinoma: a comparison with chest radiography and chest CT. *Oral Oncol.* 2009;45(3):234-40.
- Fakhry N, Michel J, Colavolpe C, Varoquaux A, Dessi P, Giovanni A. Screening for distant metastases before salvage surgery in patients with recurrent head and neck squamous cell carcinoma: a retrospective case series comparing thoraco-abdominal CT, positron emission tomography and abdominal ultrasound. *Clin Otolaryngol.* 2012;37(3):197-206.
- MacMahon H, Austin JH, Gamsu G, Herold CJ, Jett JR, Naidich DP, et al. Guidelines for management of small pulmonary nodules detected on CT scans: a statement from the Fleischner Society. *Radiology.* 2005;237(2):395-400.
- de Bree R, Deurloo EE, Snow GB, Leemans CR. Screening for distant metastases in patients with head and neck cancer. *Laryngoscope.* 2000;110(3 Pt 1):397-401.

Received at: 02/04/2015

Accepted for publication: 02/06/2015

Conflict of interest: none.

Source of funding: none.

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Total esophagogastrectomy in the neoplasms of the esophagus and esofagogastric junction: when must be indicated?

Esofagogastrectomia total nas neoplasias do esôfago e transição esofagástrica: quando deve ser indicada?

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A B S T R A C T

Objective: to analyse the indications and results of the total esophagogastrectomy in cancers of the distal esophagus and esophagogastric junction. **Methods:** twenty patients with adenocarcinomas were operated with a mean age of 55 ± 9.9 years (31-70 years), and 14 cases were male (60%). Indications were 18 tumors of the distal esophagus and esophagogastric junction (90%) and two with invasion of gastric fundus (10%) in patients with previous gastrectomy. Preoperative colonoscopy to exclude colonic diseases was performed in ten cases. **Results:** the surgical technique consisted of median laparotomy and left cervicotomy, followed by transhiatal esophagectomy associated with D2 lymphadenectomy. The reconstructions were performed with eight esophagocoloduodenoplasty and the others were Roux-en-Y esophagocolojejunoplasty to prevent the alkaline reflux. Three cases were stage I / II, while 15 cases (85%) were stages III / IV, reflecting late diagnosis of these tumors. The operative mortality was 5 patients (25%): a mediastinitis secondary to necrosis of the transposed colon, abdominal cellulitis secondary to wound infection, severe pneumonia, an irreversible shock and sepsis associated with colojejunal fistula. Four patients died in the first year after surgery: 3 (15%) were due to tumor recurrence and 1 (5%) secondary to bronchopneumonia. The 5-year survival was 15%. **Conclusion:** the total esophagogastrectomy associated with esophagocoloplasty has high morbidity and mortality, requiring precise indication, and properly selected patients benefit from the surgery, with the risk-benefit acceptable, contributing to increased survival and improved quality of life.

Key words: Adenocarcinoma. Esophagus. Surgical Procedures, Operative. Esophagectomy.

INTRODUCTION

Total esophagogastrectomy and esophagocoloplasty is a complex surgical procedure, with mortality rates ranging from 2.5 to 29% and morbidity ranging from 13 to 75% in 1980-2010 published series. The magnitude of the operation and the severity of the disease which is the surgical indication are determining factors reported of the high morbidity and mortality¹.

Esophageal reconstructions involving the colon are described since 1911 by variables causes². The use of the colon and esophageal replacement is exceptional, once the stomach has better elasticity and vascularization. The total gastrectomy with concomitant esophagectomy is the main indication for esophagocoloplasty for the reconstruction of the digestive transit³⁻⁶.

The indications of total esophagogastrectomy are limited to certain conditions, particularly in radical resection of large tumors of the esophagogastric junction (EGJ) invading both viscera, esophageal tumors in patients with

previous gastrectomy, severe caustic esophageal lesions with irreversible loss and stomach and congenital esophageal atresia⁷. Therefore, considering the rarity of conditions that require total esophagogastrectomy, such procedure is the absolute minority of resection surgeries performed in the esophagus and / or stomach, and few institutions had experience with this type of operation⁸⁻¹¹.

The aim of this study is to analyse the indications and results of the total esophagogastrectomy in cancers of the distal esophagus and esophagogastric junction.

METHODS

From November 1989 to May 2011, 20 patients underwent total esophagogastrectomy followed by esophagocoloplasty at the Hospital de Clínicas da Unicamp. Of these, 14 (60%) were male. The mean age of patients was $55,7 \pm 9,9$ years, ranging from 31 to 73 years. Eighteen patients were white (90%) and two blacks (10%).

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The main symptoms preoperatively reported were the weight loss in 16 patients (80%), dysphagia in 15 (75%) and heartburn (seven cases - 35%). Tabagism was observed in 13 patients (55%), alcohol consumption in 11 (55%) and the combination of these two habits in 10 (50%).

The most number had low body weight and therefore low BMI (body mass index). The weight ranged from 32 kg to 86 kg (mean: 63.66 +/- 13.85) and BMI of 16.3 to 42.4 (mean: 23.8 +/- 5.4).

Among the surgical indications, there were a case of gastric stump tumor with distal esophageal invasion in late postoperative Billroth II gastrectomy performed in the other Service, for treatment of peptic ulcer (Siewert 3), an early adenocarcinoma in the Barrett's esophagus after Roux-en-Y gastrectomy previously operated in our Service, for treatment of gastroesophageal reflux disease (GERD), two advanced adenocarcinomas cases in Barrett's esophagus with esophageal and gastric invasion, and 16 cases of advanced adenocarcinomas of distal esophagus with invasion of the gastric fundus (Siewert 3). In none of them was possible the realization of the tumor resection with adequate surgical margin without removing en block the two organs involved, the esophagus and the stomach. Three cases (15%) were in the stages I / II, while 17 cases (85%) were in the stages III / IV, reflecting late diagnosis of these tumors (Table 1).

Ten patients underwent preoperative colonoscopy to exclude colonic diseases that contraindicated the esophagocoloplasty. The angiography to specific study of the intestinal vasculature was not performed. Mechanical preparation of the colon in the immediate preoperative period consisted of liquid diet and osmotic laxatives. The surgical technique used was described in the literature¹⁰⁻¹².

Were performed 20 total esophagogastrectomies and in all cases, surgical access consisted xypho-umbilical midline laparotomy and left neck incision, with an esophagectomy performed via transhiatal, with D2 lymphadenectomy. Reconstructions were performed in nine cases by esophacolo duodenoplasty and Roux-en-Y esophagocolojejunoplasty in 11 cases.

The decision on the colonic segment to be transposed and route of transposition was always taken in

accordance with the findings of intraoperative evaluation. Firstly, were performed total mobilization of the ascending colon, and / or descending through the release of the parietocolic peritoneum. Then were identified the colic arteries employing transillumination and palpation. The feasibility of the colonic segment chosen was then assessed by selective clamping of colic pedicle to be connected. The transverse colon nourished by the left colic pedicle was used in all patients (100%). The posterior mediastinal route option was 13 patients (65%), while retrosternal route was used in seven patients (35%). The continuity of colonic transit was restored by end-to-end manual anastomosis. The esophagocoloanastomosis was always performed in the neck, employing end-to-end manual technique in a single plane. Cervical drainage using a laminar drain was routine.

The integrity of the esophagocoloanastomosis was routinely assessed by contrast radiography on the eighth postoperative day or later. Fistula was defined as any leakage of contrast occurred, regardless of the presence of clinical manifestations. Outpatient follow-up consisted of reviews at least fortnightly during the first two postoperative months and quarterly for the first two years. Any complaint dysphagia was evaluated with upper digestive endoscopy being considered stenosis cases that required dilatation.

RESULTS

The average time of surgical hospitalization was 17,4 ± 9,49 days and the patient remained in the intensive care unit, on average, 5,85 ± 6,69 days. During this period, 12 patients (60%) presented clinical complications. Unilateral pleural effusion was noted in seven (35%), requiring chest drainage in five of them (25%). Bronchopneumonia was diagnosed in 3 patients (15%). The mean follow-up was 31,1 ± 62,9 months with a maximum of 255 months.

Additional procedures were necessary in some patients (Table 2). The jejunostomy was performed in 17 patients (85%). Splenectomy occurred in 17 patients (85%), cholecystectomy in 13 (65%), chest drain in 11 (55%), caudal pancreatectomy in two (10%) and hepatic nodulectomy in two (10%).

Table 1 - Age, gender, surgical indications and staging.

Age (years)		55.75 ± 9.93	
Gender			
	Male	14	(70%)
	Female	6	(30%)
Surgical Indications			
	Adenocarcinoma of esophagogastric junction	20	(100%)
	Squamous cell carcinoma	0	(0%)
Staging			
	I/II	3	(15%)
	III/IV	17	(85%)

Surgical complications were diagnosed in six cases (30%) during the immediate postoperative hospitalization. There was only one necrosis of the transposed colon (5%), which was treated with resection of necrotic bowel, followed by cervical esophagostomy and jejunostomy. One patient presented acute intestinal obstruction by adhesions (5%), and required surgical approach on the thirteenth postoperative day. Finally, in four cases were diagnosed cervical anastomotic leaks (20%), three of them treated properly only with clinical measures (15%). Were recorded two fistulas of the abdominal colonic anastomosis, treated medically and with total parenteral nutrition with favorable outcome.

Perioperative mortality observed was five cases (25%), due to one mediastinitis secondary to necrosis of the transposed colon; one abdominal cellulitis secondary to wound infection that evolved to severe sepsis; one patient with irreversible shock at the end of the operation and died in the first postoperative day; one severe pneumonia with sepsis and cervical fistula; and one sepsis associated with abdominal fistula of the colojejunoanastomosis. It was not registered intra-operative mortality.

Neoadjuvant chemoradiotherapy was not employed because it is not the Service Protocol. However, six patients received adjuvant chemoradiotherapy.

Considering the long-term ambulatory follow-up, they can eat solids, soft and well cooked foods, and the most common complaint in cases submitted to esophagocoloduodenoplasty was the alkaline reflux. Due to this complaint greatly exacerbated, two patients underwent reoperation for conversion to Roux-en-Y esophagocolojejunoanastomosis. Thus, this latter technique was adopted as a routine in the Service after 2004. Moreover,

stenosis of cervical anastomosis was diagnosed in three patients (15%), and two of them appear in the cases that presented previous anastomosis fistula. In all cases, endoscopic dilations were sufficient to treat this complication. Left vocal cord paralysis secondary to recurrent laryngeal nerve injury was observed in one patient (5%). There was no case of chylothorax or redundancy of the transposed colon.

Regarding late mortality, were recorded eight deaths (40%), half of them before one year in the postoperative period, including two due to tumor recurrence; one due to a severe lack of appetite, malnutrition and unconfirmed tumor recurrence; and the other due to bronchopneumonia, pulmonary embolism and sepsis. All the deaths during the late follow-up after one year were due to tumor recurrence or metastasis.

The histopathologies studies revealed in three patients (17.6%) involvement of radial margins. There was not, however, involvement of proximal and distal margins in any case. Tumor recurrence was recorded in nine patients (45%), and occurred between two months to eight years and nine months after the operation, with an average of 24.2 months. Interestingly, in the group of patients with I stages, no recurrences or deaths were observed, and such complications were restricted to cases of advanced tumors. The five year survival was 15%.

DISCUSSION

Few studies analyzing total esofagogastric resections exist in contemporary literature. In fact, only a few specialized services perform this procedure. German authors

Table 2 - Surgical procedures performed.

	Surgical Procedures	Number of patients
Resection	Total esophagogastrectomy	20
Reconstruction	Esophagocoloduodenoplasty	9 (45%)
	Roux-en-Y Esophagocolojejunoanastomosis	11 (55%)
Route of Reconstruction	Posterior mediastinal	13 (65%)
	Retroesternal	7 (35%)
Colon Transposition	Transverse colon (left colic artery)	20 (100%)
	Ascendent colon (middle colic artery)	0 (0%)
Other Procedures	Jejunostomy	17 (85%)
	Splenectomy	17 (85%)
	Cholecystectomy	13 (65%)
	Chest drainage	11 (55%)
	Caudal pancreatectomy	2 (10%)
	Hepatic nodulectomy	2 (10%)

state that only 13% of medical institutions in the country have any experience with this surgery^{8,9}. In published series of esophageal resection, total esofagogastrectomy represent no more than 10% of the procedures^{5,12,13}.

The mainly indication for such a complex operation are restricted and tumors of esophagogastric junction, and the minority that affect large portions of the esophagus and stomach, extrapolating Siewert classification (14). The advanced nature of these tumors at the time of diagnosis, justifies the prognosis of patients^{10,14-17}. This characteristic is clear in this series of cases, of which 80% belonging to stages III and IV.

The stomach is considered the main viscera for the reconstruction of the upper digestive tract, and of course the concomitant gastrectomy prevents such procedure, requiring the esophagocoloplasty, and in these cases it is predominant the esophageal squamous cell carcinoma. Among benign diseases, severe cases of caustic stenosis with concomitant esophageal and gastric lesions are the main indications. And such patients usually attempted prior endoscopic treatment employing dilations, but did not obtain satisfactory results^{2-4,18-22}.

The advantages of using the colon as esophageal substitute include its good vascularization, its long extension and its relative resistance to acid reflux. The disadvantages involve longer surgical time and the need for two extra anastomoses^{5,12,23,24}. In fact, many current studies show that the use of the colon esophageal replacement determines higher morbidity, but the mortality is the same^{3,21}.

There is no consensus as to the best colonic segment for transposition. There are authors that recommend the right colon and others who prefer the left. Similarly, there is controversy on the issue of better transposition pathway. Proponents of retrosternal route claim that infectious complications would be less disastrous⁶, while supporters of the posterior mediastinal route emphasize the shortest distance and better functional results^{12,20}. This study shows the functional quality of transposition through posterior mediastinal, dependent on the left colic pedicle, because it occurred to just one case of transposed colon necrosis case and no registered redundancy.

The total esophagogastrectomy associated with esophacoplasty makes more complex the operation, justifying the high levels of morbidity and mortality associated. Postoperative complications vary from 41 to 67% in the contemporary literature, mainly the pneumonia, pleural effusion and fistulas. In fact, cervical anastomosis fistulas are from 5.8 to 46% of the cases^{5,8,12,17,19,21,24}. Despite the frequency of this complication, treatment with oral fasting or soft diet associated with cervical drainage is resolving most of the time. Fortunately, transposed colon necrosis is rare, ranging from 0 to 9.4% and its outcome is often the patient's death. Finally, stenosis of the cervical anastomosis, late complication, occurs in 6-46% of cases with an endoscopic dilation treatment usually efficient. Regarding mortality associated with the procedure are values

between 0 and 17%, with survival rates at five years between 10 and 48%. These values reflect the severity of the disease^{5,8,12,19,21,24,25}.

Tumor recurrence affects the prognosis and quality of life of patients after total esofagogastrectomy. Factors associated with higher cancer recurrence risks include tumor differentiation, advanced stage, lymph node invasion and involvement of surgical margins. Treatment of local recurrence is extremely complex, with greater difficulty in the posterior mediastinal transposition²⁶⁻²⁸. The recurrence recorded in the patients described here was restricted to stages III and IV, attesting to the greater relevance of tumor aggressiveness.

The study in our Service²⁷, including 103 patients with adenocarcinoma of the esophagogastric junction, comparing 78 submitted to surgical treatment with 25 submitted to the operation followed by chemoradiation, using the protocol of Macdonald et al., showed no increase in survival at five years of follow-up.

Publications reporting this procedure in the literature are rare. Moreno-Gonzalez *et al*⁶ in Spain, reported three cases of total esophagogastrectomy in advanced tumors of esophagogastric junction. Abularach C *et al*.¹⁸ in Chile, reported the same surgery in five cases of tumors of esophagogastric junction, patients with a mean age of 50 years, mean hospital stay of 20 days, without mortality. Munoz-Bongrand *et al*². describe the surgical technic of the total esophagogastrectomy emphasizing the need for a jejunostomy for postoperative parenteral nutrition, and extensive drainage of the peritoneal cavity due to the risk of postoperative fistula. Yasuda *et al*⁶⁰ emphasize that the reconstruction of the digestive tract should preferably be isoperistaltic and using posterior mediastinum. This procedure has the advantage that a shorter path, however, has the disadvantage of occurrence of colon necrosis, which is fatal. Conclude that it is a procedure with high risk of complications and not negligible mortality.

Finally, there are few studies evaluating quality of life of patients undergoing total esophagogastrectomy. The most of them lose weight, but eventually stabilize at a new level that will not compromise your health, usually around 90% of preoperative weight^{6,11,29}. Yasuda *et al*³⁰. reported that the functional result of esophagocoloplasty looks worse than the reconstruction with gastric tube, but acceptable regarding the need of the patient. Other studies^{6,9,12,31} have shown that after three months of surgery, 49 to 78% of patients report good food intake, and this figure rises to 82 to 89% with one year of the procedure. The main symptoms reported in the late outpatient treatment include dysphagia (10 to 40%), reflux (8 to 24%), diarrhea (10 to 39%) and dumping syndrome (24%).

Concluding, the total esophagogastrectomy associated with esophagocoloplasty are a high morbidity and mortality procedure, therefore requiring precise indication, with the risk-benefit acceptable. The results of the procedures performed in our Service are similar to those

of the best international centers, encouraging us to continue to hold such a large operation, for the benefit of the

patient, both in survival and in improving their quality of life.

R E S U M O

Objetivo: avaliar as indicações e resultados da esofagogastrectomia total seguida de esofagocoloplastia, nas neoplasias do esôfago distal e da transição esofagogástrica. **Métodos:** foram avaliados os dados epidemiológicos, o quadro clínico, a indicação cirúrgica, o tipo de reconstrução, as complicações clínicas e cirúrgicas e a mortalidade. **Resultados:** Nas reconstruções foram realizadas oito esofagocoloduodenoplastias e as demais foram esofagocolojejunoplastias em Y de Roux, visando prevenir o refluxo alcalino. Três casos eram estádios III, enquanto 15 (85%) casos eram estádios III/IV, refletindo o diagnóstico tardio destes tumores. A mortalidade operatória foi cinco pacientes (25%): uma mediastinite secundária à necrose do cólon transposto, uma celulite abdominal secundária à infecção de ferida operatória, uma broncopneumonia grave, um choque irreversível e uma sepse associada à fístula colojejunal. Quatro doentes morreram no primeiro ano de pós-operatório, sendo que três (15%) deveram-se à recidiva tumoral e um (5%) secundário à broncopneumonia. A sobrevida de cinco anos foi 15%. **Conclusão:** a esofagogastrectomia total associada à esofagocoloplastia apresenta elevada morbimortalidade, necessitando indicação precisa. Os pacientes corretamente selecionados beneficiam-se da operação, sendo o risco-benefício aceitável, contribuindo para o aumento da sobrevida e melhora da qualidade de vida.

Descritores: Adenocarcinoma. Esôfago. Procedimentos Cirúrgicos Operatórios. Esofagectomia.

REFERENCES

- Bernard A, Obadia JF, Arnould H, Cougard P, Viard H. Factors influencing survival after resection of cancer of the cardia. Comparison of total esophagogastrectomy and upper pole esophagogastrectomy. *Ann Chir.* 1990;44(6):459-63.
- Celiku E, Draçini X, Dibra A, Maturo A. Surgical treatment of the adenocarcinoma of the cardia. *G Chir.* 2011;32(8-9):353-6.
- Cerfolio RJ, Allen MS, Deschamps C, Trastek VF, Pairolero PC. Esophageal replacement by colon interposition. *Ann Thorac Surg.* 1995;59(6):1382-4.
- Davis PA, Law S, Wong J. Colonic interposition after esophagectomy for cancer. *Arch Surg.* 2003;138(3):303-8.
- DeMeester SR. Colon interposition following esophagectomy. *Dis Esophagus.* 2001;14(3-4):169-72.
- DeMeester TR, Johansson KE, Franze I, Eypasch E, Lu CT, McGill JE, et al. Indications, surgical technique, and long-term functional results of colon interposition or bypass. *Ann Surg.* 1988;208(4):460-74.
- Doki Y, Okada K, Miyata H, Yamasaki M, Fujiwara Y, Takiguchi S, et al. Long-term and short-term evaluation of esophageal reconstruction using the colon or the jejunum in esophageal cancer patients after gastrectomy. *Dis Esophagus.* 2008;21(2):132-8.
- Fürst H, Hüttl TP, Löhe F, Schildberg FW. German experience with colon interposition grafting as an esophageal substitute. *Dis Esophagus.* 2001;14(2):131-4.
- Popovici Z. A new philosophy in esophageal reconstruction with colon. Thirty-years experience. *Dis Esophagus.* 2003;16(4):323-7.
- Lundell L, Olbe L. Colonic interposition for reconstruction after resection of cancer in the esophagus and gastroesophageal junction. *Eur J Surg.* 1991;157(3):189-92.
- Greene CL, DeMeester SR, Augustin F, Worrell SG, Oh DS, Hagen JA, et al. Long-term quality of life and alimentary satisfaction after esophagectomy with colon interposition. *Ann Thorac Surg.* 2014;98(5):1713-9; discussion 1719-20.
- Munoz-Bongrand N, Chirica M, Sarfati E. Transverse coloplasty, left coloplasty, colon interposition, reconstruction after total esophagogastrectomy. *J Chir.* 2009;146(6):559-64.
- Pompeo E, Nofroni I, Van Raemdonck D, Coosemans W, Van Cleynenbreughel B, Lerut T. Esophagocoloplasty for congenital, benign and malignant diseases. Surgical and long-term functional results. *Eur J Cardiothorac Surg.* 1996;10(7):561-7; discussion 567-8.
- Rüdiger Siewert J, Feith M, Werner M, Stein HJ. Adenocarcinoma of the esophagogastric junction: results of surgical therapy based on anatomical/topographic classification in 1,002 consecutive patients. *Ann Surg.* 2000;232(3):353-61.
- Břrlá R, Iosif C, Mocanu A, Gindea C, Hoarã P, Panaitescu E, et al. Long-term survival after eso-gastrectomy for esophagogastric junction adenocarcinoma—prospective study. *Chirurgia.* 2008;103(6):635-42.
- Gonzalez EM, Garcia JI, Selas PR, Azcoita MM, Garcia JI, Gonzalez JS. Extended esophago-gastrectomy as surgical treatment for carcinoma of the cardia. *Jpn J Surg.* 1981;11(5):311-6.
- Schiesser M, Schneider PM. Surgical strategies for adenocarcinoma of the esophagogastric junction. *Recent Results Cancer Res.* 2010;182:93-106.
- Abularach CR, Venturelli MF, Cerda CR, Urizar GA, Lira EE, Haito CY, et al. Transverse colon interposition as an alternative to reconstruction after total esophagogastrectomy. *Rev Chil Cir.* 2011;63(4):432-6.
- Moreno González E. Cancer of the cardia: the value of total extended esophago-gastrectomy. *Cancer Treat Res.* 1991;55:205-46.
- Motoyama S, Kitamura M, Saito R, Maruyama K, Sato Y, Hayashi K, et al. Surgical outcome of colon interposition by the posterior mediastinal route for thoracic esophageal cancer. *Ann Thorac Surg.* 2007;83(4):1273-8.
- Cheng BC, Xia J, Shao K, Mao ZF, Huang J, Wang TS. Surgical treatment for upper or middle esophageal carcinoma occurring after gastrectomy: a study of 52 cases. *Dis Esophagus.* 2005;18(4):239-45.
- Feith M, Stein HJ, Siewert JR. Adenocarcinoma of the esophagogastric junction: surgical therapy based on 1602 consecutive resected patients. *Surg Oncol Clin N Am.* 2006;15(4):751-64.
- Hüttl TP, Wichmann MW, Geiger TK, Schildberg FW, Fürst H. Techniques and results of esophageal cancer surgery in Germany. *Langenbecks Arch Surg.* 2002;387(3-4):125-9.
- Butte JM, Becker F, Visscher A, Waugh E, Meneses M, Court I, et al. Adenocarcinoma of the esophagogastric junction: retrospective analysis of 39 patients. *Rev Med Chil.* 2010;138(1):53-60.
- Klink CD, Binnebösel M, Schneider M, Ophoff K, Schumpelick V, Jansen M. Operative outcome of colon interposition in the treatment of esophageal cancer: a 20-year experience. *Surgery.* 2010;147(4):491-6.

26. Shirakawa Y, Naomoto Y, Noma K, Sakurama K, Nishikawa T, Nobuhisa T, et al. Colonic interposition and supercharge for esophageal reconstruction. *Langenbecks Arch Surg*. 2006;391(1):19-23.
27. Terciotti-Júnior V, Lopes LR, Sallum RAA, Andreollo NA, Malafaia O. Terapia adjuvante associada à esofagectomia melhora a sobrevida nos pacientes portadores de adenocarcinoma da junção esofagogastrica? *ABCD, arq bras cir dig*. 2013;26(2):77-9.
28. Popovici Z. A new concept in esophageal reconstruction with colon (considerations on 329 operated cases). *Chirurgia*. 2002;97(6):523-8.
29. Cense HA, Visser MR, van Sandick JW, de Boer AG, Lamme B, Obertop H, et al. Quality of life after colon interposition by necessity for esophageal cancer replacement. *J Surg Oncol*. 2004;88(1):32-8.
30. Yasuda T, Shiozaki H. Esophageal reconstruction with colon tissue. *Surg Today*. 2011;41(6):745-53.
31. Mine S, Udagawa H, Tsutsumi K, Kinoshita Y, Ueno M, Ehara K, et al. Colon interposition after esophagectomy with extended lymphadenectomy for esophageal cancer. *Ann Thorac Surg*. 2009;88(5):1647-53.

Received at: 15/05/2015

Accepted for publication: 20/07/2015

Conflict of interest: none.

Source of funding: none.

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Plastic surgery in chest wall reconstruction: relevant aspects – case series

A cirurgia plástica na reconstrução da parede torácica: aspectos relevantes – série de casos

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A B S T R A C T

Objective: to discuss the participation of Plastic Surgery in the reconstruction of the chest wall, highlighting relevant aspects of interdisciplinaryness. **Methods:** we analyzed charts from 20 patients who underwent extensive resection of the thoracic integument, between 2000 and 2014, recording the indication of resection, the extent and depth of the raw areas, types of reconstructions performed and complications. **Results:** among the 20 patients, averaging 55 years old, five were males and 15 females. They resections were: one squamous cell carcinoma, two basal cell carcinomas, five chondrosarcomas and 12 breast tumors. The extent of the bloody areas ranged from 4x9 cm to 25x40 cm. In 12 patients the resection included the muscular plane. In the remaining eight, the tumor removal achieved a total wall thickness. For reconstruction we used: one muscular flap associated with skin grafting, nine flaps and ten regional fasciocutaneous flaps. Two patients undergoing reconstruction with fasciocutaneous flaps had partially suffering of the flap, solved with employment of a myocutaneous flap. The other patients displayed no complications with the techniques used, requiring only one surgery. **Conclusion:** the proper assessment of local tissues and flaps available for reconstruction, in addition to the successful integration of Plastic Surgery with the specialties involved in the treatment, enable extensive resections of the chest wall and reconstructions that provide patient recovery.

Key words: Thoracic Wall/surgery. Breast Neoplasms/complications. Breast Neoplasms/surgery. Perforator Flap/surgery. Myocutaneous Flap/surgery.

INTRODUCTION

In the early twentieth century, surgery begins to turn into a less frightening and more reliable procedure. The three main problems were already under some control: pain, bleeding and infection. Much still lacked on the physiology and technology, but the paths were widening. Polyvalent surgeons were becoming less able to cover all diseases and all body areas, given the extent of knowledge and training required. The delicacy in handling tissue was more important than speed.

Specialties emerged and ancestral fears were overcome.

For Plastic Surgery, World War I created new circumstances. Large lesions that were previously fatal have ceased to be by the progress of medicine. It was therefore necessary to learn how to treat them. Many flaps still used today were proposed at this time. They were, however,

quite empirical, lacking anatomical and physiological knowledge of the circulation of small vessels, which did not occur until the 1980s.

It was after World War II that the Thoracic Surgery became independent from general surgery, thanks to innovations originating from the needs arising from it.

To maintain ventilation during intrathoracic surgery was initially the main obstacle to opening the chest. But it was the set of advances in anesthesia, diagnostic methods, prevention and treatment of shock and infection, as well as post-operative care, that made Thoracic Surgery a well-defined specialty.

For thoracic surgeons, any strategy requires the a final competent and closed rib cage. Resection of bone structures and extensive soft tissue, where necessary, indicate the use of synthetic material or grafts, which need to be covered by well vascularized flaps.

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For breast clinics, the current occurrence in Brazil of advanced tumor lesions requiring extensive resections transforms the closure of wounds in difficult problems. Even in cases attended at the appropriate time and in need of minor resections, there is demands for a good cosmetic result. The change in approach and acceptance of patients is significant: rather than mutilation, one gets breasts of nearly normal appearance, and in some cases even better than they were before.

This paper aims to discuss the participation of Plastic Surgery in the reconstruction of the chest wall, highlighting relevant aspects of interdisciplinarity.

METHODS

We collected data from patients operated between January 2000 and October 2014 at the Hospital Universitário Clementino Fraga Filho and the Instituto de Ginecologia, both from the Universidade Federal do Rio de Janeiro (UFRJ), undergoing extensive and / or deep resections of the thoracic integument for tumor removal.

As inclusion criteria, we considered resections that reached the muscular plane (fully or partially) and had the participation of the Plastic Surgery staff in the immediate reconstruction of the thoracic wall. We excluded patients who underwent operations directly performed by Thoracic, Pediatric and Mastology surgeons without the participation of the Plastic Surgery staff.

In the analysis of treatments carried out we searched information related to the following factors: 1- Indication of tumor resections: therapeutic or hygienic; 2- Extension of bloody areas found after tumor resection; 3- Depth of bloody areas resulting tumor resection: deep to the muscular plane or total thickness; 4- Type of reconstruction performed; and 5- Complications.

RESULTS

We evaluated the records of 20 patients. Their ages ranged from six to 82 years of age, with a mean of 55. Five patients were male and 15 were female.

All resections were indicated by the presence of tumors, with the initial diagnoses being: squamous cell carcinoma (one patient), basal cell carcinoma (two patients), chondrosarcoma (five patients), breast cancer (12 patients). The specialties associated with plastic surgery during treatment were: Pediatric Surgery (one case), Thoracic Surgery (nine cases) and Mastology (ten cases).

In four women who had extensive lesions due to locally advanced breast tumor, the proposals were hygienic resections. The other 16 patients had proposed therapeutic resections.

The extent of bloody areas ranged from 4x9 cm, in pediatric patients (age six) to 25x40 cm. Resections in 12

patients went deep until the muscular plane, with partial or complete muscle resection. In eight patients, tumor removal achieved a total wall thickness (including ribs and / or sternum).

For reconstruction of the chest wall held: one muscle flap (pectoralis major muscle) associated with skin grafting (Figure 1); nine myocutaneous flaps: transverse rectus abdominis muscle (TRAM – four cases – Figure 2); Vertical rectus abdominis muscle (VRAM – two cases – Figure 3); TRAM associated with VRAM (one case – Figure 4); and latissimus dorsi muscle (two cases); and ten regional fasciocutaneous flaps (Figure 5).

Patients undergoing resection of ribs and / or sternum had the bone structure reconstructed with the use of inorganic polypropylene mesh, associated with surgical cement made of polymethyl methacrylate, to stabilize the chest movement during breathing. Two patients undergoing reconstruction with fasciocutaneous flaps sustained flap partial suffering. Since these patients had undergone reconstruction of the bone structure with alloplastic material, we chose to perform a myocutaneous flap of latissimus dorsi to cover the raw areas, with good results. In other patients there were no complications with the techniques used, requiring only one operation.

The average length of stay was 15 days, ranging from five to 47. The minimum postoperative follow-up was three months, and the maximum, six years, with a mean 16 months. Two patients died due to the disease that caused the initial operation in the first year of postoperative follow-up. All flaps employed showed good aspect at the end of follow-up.



Figure 1 - A) Extensive basal cell carcinoma in the pre-sternal region. B) Bloody area with partial resection of the sternum. C) Pectoralis major muscle flap released and rotated. D) Postoperative – nine months with skin grafting on muscle flap.



Figure 2 - A) Preoperative – recurrent breast tumor. B) Bloody Area exposing ribs. C) Three months after immediate reconstruction with transverse rectus abdominis myocutaneous flap (TRAM).

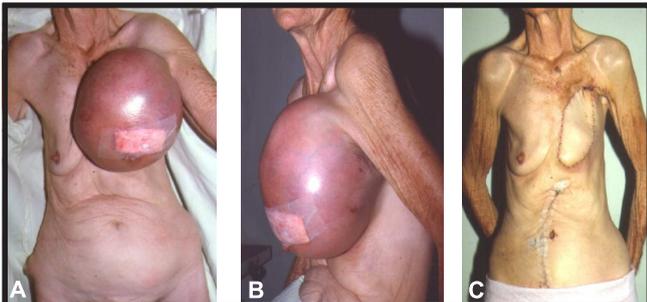


Figure 3 - A) Preoperative – chondrosarcoma. B) Profile. C) Outcome after using vertical rectus abdominis myocutaneous flap (VRAM).

DISCUSSION

The interdisciplinary treatment, regardless of disease etiology, usually brings benefits to patients, provided that the areas of action of each specialty are well-defined. Although the extent of resection should always be the one necessary and sufficient for effective treatment of the disease, the presence of a plastic surgeon at this point may allow some “negotiation” as for the structures which could be preserved without damaging treatment, but facilitating the subsequent reconstruction¹⁻³.

For interventions on the chest wall, planning must consider: the extent of soft tissue, bone and cartilage resection; the type of material to be used for reconstruction; the well vascularized flaps available, on the surroundings or at a distance; the resources to ensure adequate pulmonary expansion; and the aesthetic concern, when possible.

These items will directly influence the choice of the type of reconstruction to be held, the extent and composition of flaps and consequently the chances of successful treatment.

The bloody area resulting from resection often exposes bone or alloplastic material, in addition to presenting mobility due to chest expansion. In these cases, thick flaps, such as myocutaneous ones, are often more appropriate and safer than fine cutaneous flaps. Different types of flaps can be used. To determine the most

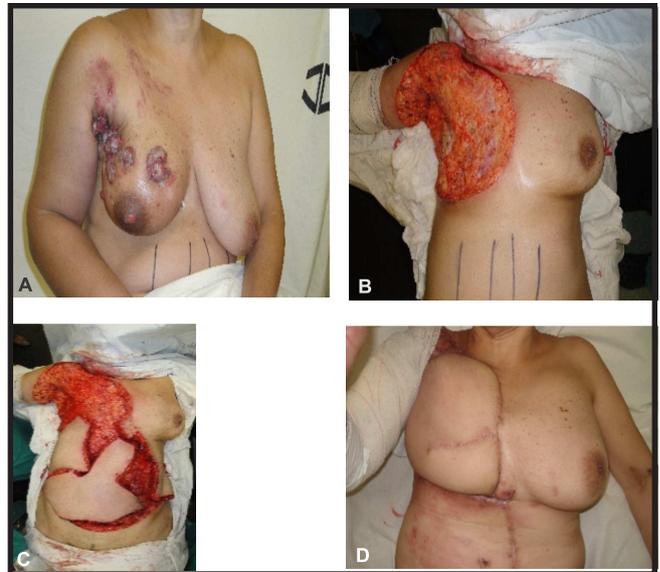


Figure 4 - A) Preoperative – recurrent breast tumor. B) Bloody area after tumor resection, exposing ribs. C) Association of flaps (TRAM + VRAM) ready for rotation. D) Two months after surgery.

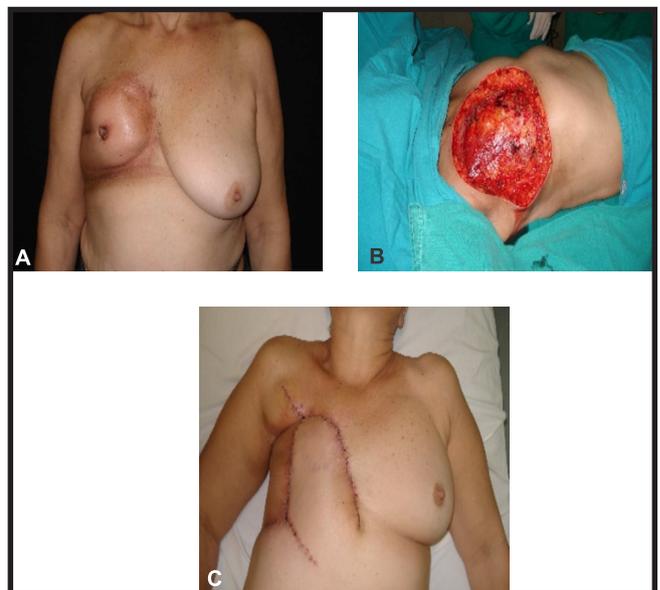


Figure 5 - A) tumor recurrence in the area of mastectomy and radiotherapy. B) Bloody area with ribs exposure. C) Follow-up after immediate reconstruction with regional fasciocutaneous flap.

appropriate, we evaluate mainly the tissues available and the needs of the bloody area. Fasciocutaneous flaps serve well for small to medium sized wounds, and when there is no alloplastic material underneath. Muscle flaps (eg pectoralis major, rectus abdominis, latissimus dorsi) bring well vascularized tissue to the reconstructed area⁴. They can also attach a skin-fat segment, determining best coverage of the underlying tissue (eg transverse rectus

abdominis muscle flap – TRAM; vertical rectus abdominis muscle flap – VRAM).

Gardner *et al.* Demonstrated the suitability of regional fasciocutaneous flaps in three cases, using them even on small fragments of marlex meshes, emphasizing that they should be well vascularized so there is no suffering, necrosis and destabilization of the wall⁵. In some situations, microsurgery flaps are indicated⁶, though not available in many hospitals.

There are few reports with extensive experience in the field. We highlight Arnold *et al.* and Mansour *et al.* In 1984, Arnold *et al.* had experience of 100 cases⁷. In 66 patients there were wall resection. Most reconstructions used the pectoralis major muscle. In 1996, they described a new sequence with 500 reconstructions in 18 years of observation⁸. There was skeletal resection in 443 individuals. The flaps used in the reconstruction were mainly the pectoralis major and the latissimus dorsi. The average number of operations per patient was 2.3 and the length of stay was around 21 days. They also participated in other studies: on the use of alloplastic materials in stabilizing the thoracic wall⁹; on the characteristics of the chest wall and the usual reconstruction indications¹⁰; and on the anatomical features and surgical techniques used in the making of major muscle flaps for reconstruction¹¹ (pectoralis major, latissimus dorsi and rectus abdominis).

Mansour *et al.* Presented a 25-year experience with 200 patients, analyzing surgical indications³. They found the main cause to be lung cancer, followed by chest wall cancer and breast cancer. All patients had at least two resected ribs. These defects were reconstructed with Vicryl® mesh, Prolene® mesh, or association of one of these with methacrylate (surgical cement). They employed pedicle muscle flaps in 48% of patients and microsurgical flaps in 9%. The most used muscles were latissimus dorsi, pectoralis major and rectus abdominis (TRAM). The average hospital stay was 18 days and 7% of the patients died perioperatively. They questioned whether the stabilization of the wall with meshes and methacrylate would be really necessary, but employed them in all operations.

Regarding the chest wall, Makboul *et al.* also reported that the use of alloplastic material for structuring was not necessary, using only latissimus dorsi flaps to close the defects. However, they state that their series of five patients had undergone local radiotherapy and that this leaves the thoracic wall more rigid¹². That same year, Sodha *et al.* encouraged the use of only acellular dermal matrix for the correction of wall defects after resection of ribs in selected cases¹³. They protected the material with a latissimus dorsi flap. We emphasize that, just like these authors, we also use alloplastic material to reconstruct the wall.

Chang *et al.* evaluated 113 patients over a period of ten years¹⁴. The most frequent diagnoses were breast cancer, followed by sarcoma. The type of reconstruction depended on the size and location of the defect, on the

rotation range of possible local flaps or on the availability of vessels for anastomoses. They recommended stabilizing the wall with alloplastic material. The most commonly used flaps were: latissimus dorsi, rectus abdominis, pectoralis major and external oblique. They used microsurgical flaps in 11% of cases. Seven patients (4%) had partial loss of employed flaps.

In Brazil, Luz *et al.* presented ten cases of latissimus dorsi flap use for the closure of bloody areas after chest wall resection of advanced breast cancer¹⁵. The defects ranged from 12x14 cm to 25x25 cm. Carvalho *et al.* reviewed the literature on the subject and concluded that: the flap should be chosen based on the lesion location; one needs to preserve good vascularization of the flaps; the osteocartilaginous defects must be stabilized; bone grafts have been substituted with alloplastic materials; and the prosthetic material does not increase infection rates, provided the area is well vascularised¹⁶. Tavares *et al.* reported two cases of omentum flap with skin autograft¹⁷. They stressed that the aesthetic result was poor, but effective. In 2014, Groth *et al.* described the correction of an extensive defect caused by resection of breast tumor (including wall resection) with an anterolateral thigh microsurgical flap¹⁸. Batista *et al.* presented a series of ten cases, highlighting the interdisciplinary work to good postoperative evolution¹⁹.

Complex operations, when combined, require thorough preoperative planning, with distribution of functions and responsibilities. It is not always possible to accurately assess the extent of resection that will be required and various treatment options and flaps must be provided, with the teams prepared to perform them. After the operation, the surgeon, or someone on the staff, should accompany the patient to the recovery bed to advise on the type of decubitus to be adopted. We should point out that in many cases the discomfort is great and some positions may interfere with evolution if there is compression of the flap pedicle. Complications in the immediate postoperative period are not rare and efficient service in a timely manner is of paramount importance in achieving good results. The aesthetic concerns often make sense in the usual mastectomies and the results are highly rewarding. However, for extensive chest wall resections, the aesthetic result can be poor and will require that the patient be previously clarified in this regard.

In conclusion, the participation of Plastic Surgery in combination with these specialties made possible the treatment of extensive and complex lesions, previously considered inoperable, and facilitated postoperative outcome, patient comfort and recovery from injuries or tumors of the chest wall or the breasts.

Acknowledgements

We thank the Associate Professor, Dr. Jacir Balen, from Department of Obstetrics and Gynecology at UFRJ, for his cooperation and in recognition of his work.

RESUMO

Objetivo: discorrer sobre a participação da Cirurgia Plástica na reconstrução da parede torácica, ressaltando os aspectos relevantes das associações interdisciplinares. **Métodos:** foram analisados prontuários de 20 pacientes submetidos a extensas ressecções do tegumento torácico, no período entre 2000 e 2014, quanto à indicação das ressecções, à extensão e à profundidade das áreas cruentas, aos tipos de reconstruções realizadas e às complicações. **Resultados:** entre os 20 pacientes, com média de 55 anos de idade, cinco eram do sexo masculino e 15 do feminino. Foram ressecados: um carcinoma espinocelular, dois carcinomas basocelulares, cinco condrossarcomas e 12 tumores de mama. A extensão das áreas cruentas variou de 4x9 cm até 25x40 cm. Em 12 pacientes as ressecções abrangeram o plano muscular. Nos oito restantes, a retirada do tumor atingiu a espessura total da parede. Para reconstrução foram utilizados: um retalho muscular associado à enxertia de pele, nove retalhos miocutâneos e dez retalhos fasciocutâneos da região. Em dois pacientes submetidos à reconstrução com retalhos fasciocutâneos houve sofrimento parcial do retalho, resolvido com o emprego de retalho miocutâneo. Nos outros pacientes não houve intercorrências com as técnicas empregadas, sendo necessária somente uma cirurgia. **Conclusão:** a adequada avaliação dos tecidos locais e dos retalhos disponíveis para a reconstrução, além da boa integração da Cirurgia Plástica com as especialidades envolvidas no tratamento, possibilitam extensas ressecções da parede torácica e reconstruções que propiciam a recuperação do paciente.

Descritores: Parede Torácica/cirurgia. Neoplasias da Mama/complicações. Neoplasias da Mama/cirurgia. Retalho Perfurante/cirurgia; Retalho Miocutâneo/ cirurgia.

REFERENCES

- Cohen M, Ramasastry SS. Reconstruction of complex chest wall defects. *Am J Surg.* 1996;172(1):35-40.
- Hodgkinson DJ, Arnold PG. Chest-wall reconstruction using the external oblique muscle. *Br J Plast Surg.* 1980;33(2):216-20.
- Mansour KA, Thourani VH, Losken A, Reeves JG, Miller JJ Jr, Carlson GW, et al. Chest wall resections and reconstruction: a 25-year experience. *Ann Thorac Surg.* 2002;73(6):1720-5; discussion 1725-6.
- Molitor M, Simek M, Lonskí V, Kaláb M, Veselí J, Záleák B. Pectoral muscle flap with V-Y skin paddle for covering sternal defects. *Ann Thorac Surg.* 2012;94(5):e131-3.
- Gardner B, Shin H, Alfonso A. Repair of large chest wall defects using pedicle flaps. *Am J Surg.* 1976;132(3):406-9.
- Dast S, Berna P, Qassemayr Q, Sinna R. A new option for autologous anterior chest wall reconstruction: the composite thoracodorsal artery perforator flap. *Ann Thorac Surg.* 2012;93(3):e67-9.
- Arnold PG, Pairolero PC. Chest wall reconstruction. Experience with 100 consecutive patients. *Ann Surg.* 1984;199(6):725-32.
- Arnold PG, Pairolero PC. Chest wall reconstruction: an account of 500 consecutive patients. *Plast Reconstr Surg.* 1996;98(5):804-10.
- Deschamps C, Tirnaksiz BM, Darbandi R, Trastek VF, Allen MS, Miller DL, et al. Early and long-term results of prosthetic chest wall reconstruction. *J Thorac Cardiovasc Surg.* 1999;117(3):588-91; discussion 591-2.
- Clemens MW, Evans KK, Mardini S, Arnold PG. Introduction to chest wall reconstruction: anatomy and physiology of the chest and indications for chest wall reconstruction. *Semin Plast Surg.* 2011;25(1):5-15.
- Bakri K, Mardini S, Evans KK, Carlsen BT, Arnold PG. Workhorse flaps in chest wall reconstruction: the pectoralis major, latissimus dorsi, and rectus abdominis flaps. *Semin Plast Surg.* 2011;25(1):43-54.
- Makboul M, Salama Ayyad MA. Is myocutaneous flap alone sufficient for reconstruction of chest wall osteoradionecrosis? *Interact Cardiovasc Thorac Surg.* 2012;15(3):447-51.
- Sodha NR, Azoury SC, Sciortino C, Sacks JM, Yang SC. The use of acellular dermal matrices in chest wall reconstruction. *Plast Reconstr Surg.* 2012;130(5 Suppl 2):175S-82S.
- Chang RR, Mehrara BJ, Hu QY, Disa JJ, Cordeiro PG. Reconstruction of complex oncologic chest wall defects: a 10-year experience. *Ann Plast Surg.* 2004;52(5):471-9; discussion 479.
- Luz DP, Lobo CAH, Hiraki P, Okada A, Montag E, Ferreira MC. Retalho miocutâneo de latíssimo do dorso em V-Y para reconstrução de grandes defeitos torácicos extensos. *Rev Bras Cir Plást.* 2010;25(3 Supl):64.
- Carvalho MVH; Rebeis EB, Marchi E. Reconstrução da parede torácica nos defeitos adquiridos. *Rev Col Bras Cir.* 2010;37(1):64-9.
- Oliveira-Tavares FM, Menezes CMGG, Moscozo MVA, Xavier GRS, Oliveira GMO, Amorim Jr MAP, et al. Retalho de omento: uma alternativa em cirurgia reparadora da parede torácica. *Rev Bras Cir Plást.* 2011;26(2):360-5.
- Groth AK, Silva ABD, Maluf Júnior I, Ono MCC, Faris NA, Chociai AC. A versatilidade do retalho anterolateral da coxa em reconstruções oncológicas: série de casos do Serviço de Cirurgia Plástica Reconstructora e Microcirurgia do Hospital Erasto Gaertnera. *Rev Bras Cir Plást.* 2014;29(1):176-8.
- Batista KT, Araujo HJ, Mammare EM, Aita AA, Silva RS. Reconstrução da parede torácica após a ressecção de extensos tumores. *Rev Bras Cir Plást.* 2014;29(4):550-6.

Received at: 12/03/2015

Accepted for publication: 30/05/2015

Conflict of interest: none.

Source of funding: none.

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Epidemiological profile and postoperative complications of women undergoing gynecological surgery in a reference center in the northern Brazilian legal Amazon

Perfil epidemiológico e complicações pós-operatórias das mulheres submetidas à cirurgia ginecológica em centro de referência do extremo setentrional da Amazônia legal brasileira

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A B S T R A C T

Objective: To evaluate the epidemiological profile and the operative complications of patients undergoing gynecological operations for benign diseases in a tertiary public hospital in the state of Roraima, Brazil. **Methods:** We conducted a retrospective survey through the analysis of 518 records of patients submitted to gynecological operations between January and June 2012. We included the three major operations during this period (n = 175): hysterectomy, colpoperineoplasty and suburethral sling placement. We excluded 236 cases of tubal ligation and 25 cases where it was not possible to access to medical records. **Results:** The mean age was 47.6 years; the education level of most patients was completed junior high (36.6%); 77% were from the State capital, 47.4% were in stable relationships and 26.3% were housewives. The majority of patients had given birth three or more times (86.6%), with previous vaginal delivery in 50.2%, and cesarean delivery, 21%. The main diagnostic indications for surgical treatment were uterine myoma (46.3%), urinary incontinence (27.4%) and genital dystopias (17.7%). We found three cases (1.7%) of high-grade intraepithelial lesions on Pap smear. The most common procedure was total hysterectomy (19.8%), 15.5% vaginally. The most common complication was wound infection (2.2%). **Conclusion:** Women undergoing gynecological operations due to benign disease had a mean age of 47 years, most had levels of basic education, came from the capital, were in stable relationships, predominantly housewives, multiparous and showed low operative complication rates.

Key words: Surgery. Hysterectomy. Suburethral Slings. Pelvic Organ Prolapse. Postoperative Complications.

INTRODUCTION

Gynecologic Surgery is a branch of General Surgery that treats the female genital tract and surgical diseases of women, considering the breasts and pelvis. As for the pelvic area, the main benign diseases requiring surgical procedures relate to the uterus and its appendages and correction of urinary incontinence. However, specific features of certain populations bring peculiarities to the indications and results obtained^{1,2}.

The city of Boa Vista, capital of Roraima, lies on the northern reaches of the Brazilian Amazon, has a population of 314,900 inhabitants (63% of the state population), of which around 70,000 women aged between 20 and 50 years. Most of this contingent inhabits the urban area, 2.5% living in rural areas. The per capita monthly income is R \$786.00, comparatively lower than

in São Paulo (R\$ 1,516.00), one of the main capitals of the country. As an example of local health care characteristics, according to IBGE data, the city has only four inpatient units in emergency obstetric and four mammography centers³.

Thus, knowing the results in Gynecological Surgery of this social model opens up the possibility of designing unique regional parameters. In general, the most common surgical procedures for gynecological benign diseases in women are hysterectomy and operations for urinary incontinence and pelvic organ prolapse correction^{1,2,4}. Hysterectomy is the second most common surgical procedure performed in women of reproductive age, only surpassed by cesarean section; about 20-30% of women will undergo this operation until the sixth decade of life. The way to perform hysterectomy include vaginal, abdominal and laparoscopic routes. In

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many countries, the mainly used is the abdominal (70-90%), with only 10-30% vaginal and less than 5% laparoscopic^{1,2,4}.

Urinary incontinence (UI), on its turn, represents about 10% of gynecological complaints⁵⁻¹⁰. The operative techniques of suburethral sling for correction of UI can use a wide variety of autologous and synthetic materials and consist of the use of a strip positioned inferiorly to the urethra or bladder neck without tension. Their cure rates range between 61% and 93%^{11,12}. The use of synthetic meshes in sling procedures reduces the operation time and eliminates the potential morbidity at the graft site extraction^{5,13}.

The aim of this study was to evaluate the clinical and epidemiological profile of patients undergoing gynecological surgeries due to benign disease in a reference center of Roraima.

METHODS

We conducted a cross-sectional, retrospective, descriptive study through the analysis of medical records of 518 patients who underwent surgical treatment between January and June 2012 at the Women's Health Reference Center (CRSM) of the Hospital Materno-Infantil Nossa Senhora de Nazaré (HMINSN), a public tertiary hospital in Boa Vista, Roraima, on the northern reaches of the Brazilian Amazon.

We selected the three major gynecological operations, totaling 436 patients. Of these, we excluded 236 tubal sterilizations (45.5%) and other 25 cases (12.5%) due to lack of access the medical records.

The epidemiological variables analyzed were type and number of deliveries, pre and postoperative diagnosis and postoperative complications, through measures of central tendency (median, mode and relative frequency). The study was approved by the Ethics in Research Committee of the Federal University of Roraima (UFRR), Protocol 609 239.

The patients underwent transvaginal ultrasound and Pap smear for preoperative evaluation. In cases of

hysterectomy, the uterus was sent for histopathological evaluation after the procedure.

The results obtained in the study were divided into categorical and continuous variables for analysis. Categorical variables were analyzed descriptively, by calculating absolute and relative frequencies. Continuous variables are expressed as means, medians, standard deviations, absolute and relative frequencies. To compare proportions we used the chi-square test and, where appropriate, Yates' correction. The level of significance was set at $p < 0.05$ for all tests.

RESULTS

We performed 518 operations. The most prevalent gynecological procedures in the Service were hysterectomy, colpoperineoplasty, vaginal sling surgery and cistopexy with or without perineoplasty, corresponding to 175 cases (Table 1). The average age of patients was 47.6 years, ranging from 24 to 84, with a predominance of the range between 40 and 49 years (45.7, CI: 38.18-53.40). The predominant level of education was completed junior high school, in 36.6% of cases, 27.4% had completed high school, and 5.7% of patients attended higher education (Table 2). The patients were mainly from the State capital (77%), married or in a stable relationship (47.4%) and housewives (26.3%).

Patients were multiparous (three or more previous deliveries) in 86.6% of cases, 50.2% with only vaginal deliveries and 21% had a history of at least one previous cesarean delivery. The Pap smear showed high-grade cervical intraepithelial neoplasia in 1.7% of patients.

Preoperative diagnoses were uterine myoma in 46.3%, urinary incontinence in 27.4%, and genital dystopia in 17.7% as indications for hysterectomy, vaginal Sling and colpoperineorrhaphy, respectively. All patients were followed for a minimum of six months postoperatively. Most patients had no postoperative complication (89.1%). The complications were wound infection, urinary tract infection, urinary retention, vaginal mesh extrusion, vaginal opening granuloma, thigh hematoma/pain, bladder injury and post-spinal anesthesia headache (Table 3).

Table 1 - Main operations performed (n = 518).

Surgery	N (%)
Tubal sterilization	236 (45.5)
Hysterectomy	103 (19.8)
Anterior Colpoperineoplasty	14 (2.7)
Posterior Colpoperineoplasty	37 (7.1)
Vaginal sling and anterior/posterior Colpoperineoplasty	18 (3.4)
Vaginal Sling	3 (0.5)

Source: medical records of the Centro de Referência de Saúde da Mulher (CRSM) do Hospital Materno-Infantil Nossa Senhora de Nazaré (HMINSN)– jan-jun/2012.

There was a correlation between postoperative histopathology with preoperative diagnosis of uterine leiomyoma, with statistical significance ($p = 0.004$ Yates X^2). There was no significant relationship between endometrial hyperplasia and endometrial thickening in the preoperative ultrasound. The main histopathological findings were 36 cases of leiomyoma, four cases of endometrial hyperplasia without atypia and 24 cases of adenomyosis.

DISCUSSION

The major benign gynecological conditions with surgical indication are uterine myoma and urinary incontinence. While in specialized centers they are treated today with minimally invasive techniques, in centers distant from large capitals the conventional surgical treatments dominate^{2,5}.

Interestingly, the average age of the patients submitted to surgery was 47.6 years, consistent with the literature¹⁴⁻¹⁶.

As for the origin of the patients, in Brazilian studies 81.5% to 92.6% of patients were from the town itself and 7.37% to 18.43% lived in the countryside¹⁴⁻¹⁶. In our study, most patients had urban origin (77%). It is believed that the prevalence of patients coming from the urban area served by the service is due to patients from the countryside and surrounding towns lacking access to information and public health services. In an IBGE survey in 2009 in the North of the country, only 1.8 hospital beds were available for every 1,000 inhabitants, below the standard recommended by the Ministry of Health, and, in Roraima, these beds are available for the SUS, the Brazilian NHS, in only four health establishments³.

With regard to deliveries, 86.6% of women were multiparous, concordant with world literature, but higher than other Brazilian samples, such as Primo et al., who found 37.5% multiparous¹⁷. The predominant level of education was complete junior high in 36.6%^{11,15,16}. Multiparity is a known risk factor for genital dystopias and urinary incontinence. Studies show that every birth increases by 1.2% the risk for dystopias and that among women who had two or more births, the number of hospitalizations for genital prolapse repair increases by up to eight times when compared to nulliparous women¹⁸.

The most common complication was wound infection, present in 2.2% of patients, consistent with the findings in the literature. Regarding the extrusion of synthetic mesh through the vagina, we found a frequency of 9.5% among patients undergoing sling surgery. In the literature mesh extrusion rate is 0-14%, and in other Brazilian studies, 4%⁷.

It should be noted that this study is a pioneering survey on the characteristics of gynecologic surgeries performed in the far north of the country. The limitation of

Table 2 - Epidemiological and clinical characteristics of the patients submitted to gynecological surgery (n = 175).

Characteristic	N (%)
Age (years)	47.6
Schooling	
Elementary school	64 (36.6)
High School	48 (27.4)
Higher Education	10 (5.7)
Unknown	53 (30.2)
Marital status	
Married	83 (47.4)
Single	48 (27.4)
History of three or more deliveries	13 (86.6)
Exclusive vaginal delivery	87 (50.2)

Source: medical records of the Centro de Referência de Saúde da Mulher (CRSM) do Hospital Materno-Infantil Nossa Senhora de Nazaré (HMINSN)– jan-jun/2012.

Table 3 - Postoperative complications of patients undergoing gynecological surgery (n = 175).

Complications	N (%)
No complication	156 (89.1)
Surgical wound infection	4 (2.2)
Urinary tract infection	3 (1.7)
Urinary retention	3 (1.7)
Mesh extrusion	2 (1.1)
Granuloma of vaginal introitus	1 (0.5)
Sore/bruise on thigh	2 (1.1)
Bladder Injury	1 (0.5)
Post-spinal anesthesia headache	1 (0.5)

Source: medical records of the Centro de Referência de Saúde da Mulher (CRSM) do Hospital Materno-Infantil Nossa Senhora de Nazaré (HMINSN)– jan-jun/2012.

the results lie in its retrospective nature, based on information collected from medical records and dependent on correct completion. From this data, the first time in our country, we wanted to know the characteristics of these patients, which could help promote management strategies adapted to the local population, as well as the establishment of possible preventive measures directed to these women.

The sample shows that women undergoing gynecological operations due to benign diseases in the Centro de Referência de Saúde da Mulher (CRSM) do Hospital Materno-Infantil Nossa Senhora de Nazaré (HMINSN) between January and June 2012 had an average age of 47, most had completed junior high, came from the State capital, were in a stable relationship, were predominantly housewives, multiparous and showed low operative complication rates.

R E S U M O

Objetivo: avaliar o perfil epidemiológico e as complicações operatórias das pacientes submetidas à operações ginecológicas realizadas devido à presença de doenças benignas em um hospital público terciário no Estado de Roraima, Brasil. **Métodos:** foi realizado um levantamento retrospectivo, por meio da análise de prontuários de 518 pacientes submetidas à operações ginecológicas entre os meses de janeiro e junho de 2012. Foram incluídas as três principais operações realizadas nesse período (n=175): histerectomia, colpoperineoplastia e colocação de sling suburetral. Foram excluídos 236 casos de laqueadura tubária e 25 casos em que não foi possível acesso ao prontuário médico. **Resultados:** A média etária foi 47,6 anos, predominaram pacientes com ensino fundamental (36,6%), provenientes da capital (77%), com relações estáveis (47,4%) e ocupação prevalente “do lar” (26,3%). As pacientes, em sua maioria, tinham antecedentes três ou mais partos (86,6%), com via vaginal prévia em 50,2% e parto cesáreo prévio em 21%. Os principais diagnósticos indicativos de tratamento cirúrgico foram: mioma uterino (46,3%), incontinência urinária de esforço (27,4%) e distopias genitais (17,7%). Foram encontrados três casos (1,7%) de lesões intraepiteliais de alto grau na colpocitologia oncológica. A operação mais realizada foi a histerectomia total (19,8%), sendo 15,5% por via vaginal. A complicação mais frequente foi a infecção de ferida operatória (2,2%). **Conclusão:** as mulheres submetidas às operações ginecológicas devido à doenças benignas apresentavam média etária de 47 anos, a maioria tinha nível de escolaridade fundamental, eram provenientes da capital, tinham união estável, eram predominantemente do lar, múltiparas e apresentaram taxas de complicações operatórias baixas.

Descritores: Cirurgia. Histerectomia. Slings Suburetrais. Prolapso de Órgão Pélvico. Complicações Pós-Operatórias.

REFERENCES

- Merighi MAB, Oliveira DM, Jesus MCP, Hoga LAK, Pedrosa AGO. Experiências e expectativas de mulheres submetidas à histerectomia. Texto contexto – enferm. 2012;21(3):608-15.
- Costa AAR, Amorim MMR, Cursino T. Histerectomia vaginal versus histerectomia abdominal em mulheres sem prolapso genital, em maternidade-escola do Recife: ensaio clínico randomizado. Rev Bras Ginecol Obstet. 2003;25(3):169-76.
- Brasil. Ministério da Saúde. IBGE – Instituto Brasileiro de Geografia e Estatística [Internet]. Estatísticas da saúde. Assistência médico-sanitária; 2009. [acessado em: 2014 outubro 8]. Disponível em: <http://www.ibge.gov.br/home/estatistica/populacao/condicaoodevida/ams/2009/ams2009.pdf>.
- Chen B, Ren DP, Li JX, Li CD. Comparison of vaginal and abdominal hysterectomy: A prospective non-randomized trial. Pak J Med Sci. 2014;30(4):875-9.
- Tanuri ALS, Feldner Jr PC, Bella ZIKJ, Castro RA, Sartori MGF, Girão MJBC. “Sling” retropúbico e transobturário no tratamento da incontinência urinária de esforço. Rev Assoc Med Bras. 2010;56(3):348-54.
- Feuser MR, Luz CM, Virtuoso JF, Luz SCT, Longo EK, Espíndola DS. Comportamento da continência urinária após tratamento cirúrgico com faixa sintética (sling): um estudo de sete casos. ACM arq catarin med. 2011;40(2):41-6.
- Silveira ABFN, Fogiatto D, Kulak Júnior J, Busato D, Francisco JAF. Sling transobturário: resultados de um centro de uroginecologia em Curitiba no ano de 2004. Rev Col Bras Cir. 2007;34(2):123-6.
- Sartori JP, Martins JAM, Castro RA, Sartori MGF, Girão MJBC. Sling de aponeurose e com faixa sintética sem tensão para o tratamento cirúrgico da incontinência urinária de esforço feminina. Rev Bras Ginecol Obstet. 2008;30(3):127-34.
- Feldner Jr PC, Bezerra LRPS, Girão MJBC, Castro RA, Sartori MGF, Baracat EC, et al. Valor da queixa clínica e exame físico no diagnóstico da incontinência urinária. Rev Bras Ginecol Obstet. 2002;24(2):87-91.
- Feldner Jr PC, Sartori MGF, Lima GR, Baracat EC, Girão MJBC. Diagnóstico clínico e subsidiário da incontinência urinária. Rev Bras Ginecol Obstet. 2006;28(1):54-62.
- Rovner ES, Ginsberg DA, Raz S. The UCLA surgical approach to sphincteric incontinence in women. World J Urol. 1997;15(5):280-94.
- Martins JAM, Castro RA, Girão MJBC, Sartori MGF, Baracat EC, Lima GR. Correção da incontinência urinária de esforço com sling: resultados iniciais. Rev Bras Ginecol Obstet. 2000;22(5):301-5.
- Cândido EB, Triginelli SA, Silva Filho AL, Noviello MB, Santos Filho AS, Silva LB. Utilização de pericárdio bovino no sling pubovaginal para o tratamento da incontinência urinária de esforço. Rev Bras Ginecol Obstet. 2003;25(7):525-8.
- Carvalho Júnior AM, Carretette FB, Muller V, Vaz FP. Estudo comparativo entre sling pubovaginal de parede vaginal e sling de fásca do reto abdominal no tratamento da incontinência urinária de esforço. Rev Col Bras Cir. 2003;28(3):203-7.
- Frare JC, Souza FT, Silva JR. Perfil de mulheres com incontinência urinária submetidas a procedimento cirúrgico em um hospital de ensino do sul do país. Semina cienc biol saude. 2011;32(2):185-98.
- Santos CRS, Santos VLGC. Prevalência da incontinência urinária em amostra randomizada da população urbana de Pouso Alegre, Minas Gerais, Brasil. Rev Latino-Am Enfermagem. 2010;18(5):903-10.
- Primo CC, Plaster FA, Bravin MF, Leite FMC, Lima EFA. Perfil epidemiológico de mulheres submetidas à cirurgia na Unidade de Ginecologia de um hospital universitário. REME rev min enferm. 2012;16(4):494-501.
- Lima MIM, Lodi CTC, Lucena AA, Guimarães MVMB, Meira HRC, Lima LM, Lima SA. Prolapso genital. Revisão. FEMINA. 2012;40(2):69-77.

Received at: 06/04/2015

Accepted for publication: 20/06/2015

Conflict of interest: none.

Source of funding: none.

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Modified pubovaginal sling technique in the surgical management of female stress urinary incontinence

Técnica modificada do sling pubovaginal no tratamento cirúrgico da incontinência urinária de esforço feminina

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A B S T R A C T

Objective: To assess the application of aponeurotic sling by a modified technique with direct visualization of needles in patients with stress urinary incontinence. **Methods:** we applied the Kings Health Questionnaire (KHQ) for quality of life, gynecological examination, urinalysis I and urine culture approximately seven days prior to the urodynamic study (UDS) and the one-hour PAD test in patients undergoing making aponeurotic sling with its passing through the retropubic route with direct visualization of the needle, PAD test and King's Health Questionnaire before and after surgery. **Results:** The mean age was 50.6 years, BMI of 28 and Leak Pressure (LP) 58,5cm H₂O; 89% were Caucasian. Forty-six of them were monitored for three and six months, 43 for 12 months. The objective cure rate at 12 months postoperatively was approximately 93.5%. In evaluating quality of life, we observed a significant improvement in 12 months postoperatively compared with the preoperative period. There was no urethral/bladder injury. As adverse results, we had one persistent urinary retention (2.3%), who was submitted to urethrolisis, currently without incontinence. **Conclusion:** The proposed procedure is safe as for the risk of bladder or urethral injuries, promoting significant improvement in quality of life and objective cure.

Key words: Urinary Incontinence/Surgery; Suburethral Slings; Urologic Surgical Procedures/Methods.

INTRODUCTION

The operation using a pubovaginal slings for the correction of stress urinary incontinence (SUI) was described in 1907 by Von Giordano¹. In 1910, Goebell² describes a technique that releases the pyramidal muscles involving the proximal urethra. Price, in 1933, first described the sling. Aldridge, in 1942, innovated and combined the Goebell-Frangenheim-Stoeckel operation with the Price² one by removing two aponeurotic bands from the rectus abdominis muscle, keeping the median portion intact, rotating the free lateral edges down through the rectus abdominis muscles to the urethra, where they were joined.

For a long time the techniques of pubovaginal sling (PVS) fell into disuse due to technical difficulties and the high incidence of complications. In 1978, the aponeurotic sling operation was reintroduced³ with good results.

From the 1990 Integral Theory⁴, a new surgical technique was developed, using a synthetic polypropylene sling positioned in the middle urethra, through the passage of needles for fixation in the retropubic position and without tension, known as tension-free vaginal tape (TVT). Currently, this operation with synthetic sling is considered the gold

standard in the correction of SUI^{5,6}. However, it is not without its adversities, such as extrusion, erosion, infection, and vessels, bowel or bladder perforations⁷⁻¹¹.

Taking into account all these factors and the clarification that it is necessary to the patient, an important part in the treatment choice, we decided to evaluate the implementation of an aponeurotic sling through a modified technique with direct visualization of the needles in patients with stress urinary incontinence.

METHODS

We conducted a prospective cohort study on placement of aponeurotic sling under direct visualization, a prospective analysis of cure rate and quality of life in women with stress urinary incontinence, involving 64 women with clinical and urodynamic diagnosis of SUI, from the Urogynecology and Vaginal Surgery Clinic, Department of Obstetrics and Gynecology (DOGI) of the Hospital Central da Irmandade da Santa Casa de Misericórdia de São Paulo (ISCMCSP) and the Complexo Hospitalar Padre Bento de Guarulhos, from August 2008 to August 2013. The urodynamic exams were carried out with a Uranus®

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equipment of Alacer and Urosystem ds 2600® of Viotti and associates.

The study was approved by the Ethics in Medical Research of the Faculty of Medical Sciences Research Committee of the Santa Casa de São Paulo, under protocol number 334/08.

The study included patients who had urinary leakage at clinical examination and urodynamic study. As exclusion criteria, there were: pure urgency urinary incontinence, urinary tract infection, chronic decompensated diseases, severe genital dystopias (prolapse grade III or IV by the POP-Q), neurogenic bladder and patients who refused to participate in the study.

Patients were submitted to anamnesis, application of the Kings Health Questionnaire (KHQ) on quality of life¹² and gynecological examination. We ordered urinalysis I and urine culture seven days prior to the urodynamic study (UDS) and one-hour PAD test¹³. The PAD test showing small leakages was regarded as an objective cure criterion, and the 12 months KHQ, a subjective one. We considered urinary retention the need for intermittent vesical catheter after 30 days.

All participants were asked to return in three, six and 12 months after surgery to control and re-evaluation of PAD test and KHQ. To assess urinary leakage through the PAD test, we performed analysis of variance with repeated measures (ANOVA).

Surgical technique

We initiated with a transverse abdominal incision approximately two centimeters above the pubic symphysis, exposing the aponeurosis of the rectus abdominis, and resecting it in a diamond-shaped sling with about 10 cm in longitudinal diameter and 1.5 cm in transverse diameter at its central portion. We then held a suture with 0 mononylon in the edges of the aponeurosis and placed the sling in saline to keep it hydrated.

We exposed the retropubic space by blunt dissection till the identification of the bladder neck. We then followed to the vaginal time, with an incision in the anterior vaginal wall mucosa 1.5 cm from the external urethral meatus, at the level of the middle urethra, of approximately 2.5 cm, in the midline. The dissection was carried out bilaterally with a curved Metzenbaun scissor toward the patient's ipsilateral shoulder and the aspect of the collected urine was checked.

The first assistant positioned and kept his index and middle fingers in the retropubic space, leaving the Foley catheter at the level of the middle urethra, after traction of the catheter and identification of the balloon (bladder neck). The classic needle for passage of the synthetic retropubic slings with attached suture was passed vaginally toward the first assistant's finger lateral edge, transfixing the endopelvic fascia up to the aponeurosis of the rectus abdominis muscle. We repeated the passage on the other side.

After each passage of the needle the suture was released from the needle and the urine aspect checked. Should it present with hematuria, cystoscopy was performed. The sling adjustment was made without tension, leaving the space of a hystrometer cable between the urethra and the sling. The ends of the nylon stitches were attached to the aponeurosis by transfixation without traction.

RESULTS

Sixty-four patients underwent the proposed operation, 46 meeting the minimum following criteria of three and six months and 43, twelve months, comprising the sample. Most were white (89%), with mean and median of 52.3 and 53 years for age, BMI 28 and 29 Kg/m², and effort loss pressure (ELP) of 66.2 and 58 cm H₂O, respectively.

We evaluated the absolute (n) and relative (%) frequencies of the PAD test results (Table 1). We observed regression in urine loss. Over time, patients evolved to better states: at six months, 89% showed no loss and 11% had low losses, while at end of 12 months, these figures were 80.4% and 13.1%, respectively, with loss of the information of some patients who did not return to the visits (6.5%).

There was a marked fall in urinary loss in grams from the preoperative time up to three months, and a smooth reduction from three to 12 months (Figure 1).

We found a significant difference ($p < 0.001$) in the overall assessment of urine losses in the postoperative period. The intervals pre-3m, pre-6m, pre-12m and 3m-6m showed significant differences, but we did not observe significant differences in the intervals 3m-12m and 6m-12m, despite improvements in the reported complaints (Table 2).

Table 1 - Pad test- Absolute (n) and relative (%) frequencies.

Time	Negligible (0 - 1g)	Mild (1.1 - 9.9g)	Moderate (10 - 49.9g)	Severe (Above de 50g)	Without information
Preoperative	0 (0.0)	17 (36.9)	24 (52.2)	5 (10.9)	0 (0.0)
3 Months	34 (73.9)	11 (23.9)	1 (2.1)	0 (0.0)	0 (0.0)
6 Months	41 (89.1)	5 (10.9)	0 (0.0)	0 (0.0)	0 (0.0)
12 Months	37 (80.4)	6 (13.1)	0 (0.0)	0 (0.0)	3 (6.5)

For evaluating the impact of stress urinary incontinence on quality of life, we calculated averages in the various fields, all displaying identical plots. We present only the impact of urinary incontinence (Figure 2). We found significant differences when comparing the preoperative period with the averages of the several domains (Table 3).

DISCUSSION

Female SUI is a disorder that causes negative impact on quality of life of women, can not and should not be considered natural, since it causes emotional, personal and social difficulties, as well as biological alterations, greatly affecting their self-esteem.

Of the 64 patients submitted to the proposed treatment in our study, none had urethral or bladder injury as adverse outcome due to the passage of the needles.

The Pad test showed 93.5% cure in 12 months. This value is consistent with the literature ones, 83% to 94%^{8,14-16}.

Table 2 - PAD test comparison for the different intervals.

Pad test	p-value
General	<0,001
Multiple comparisons	
Pre - 3m	<0.001
Pre - 6m	<0.001
Pre - 12m	<0.001
3m - 6m	0.007
3m - 12m	0.098
6m - 12m	0.068

General significance level = 5%

Level of significance of each comparison = $0.05/6 = 0.008$

Table 3 - Analysis of variance with summary measures (General).

Variable	Anova MR	Multiple comparisons					
		3m-pre	6m-pre	12m-pre	6m-3m	12m-3m	12m-6m
Pad test	< 0.001	< 0.001	< 0.001	< 0.001	0.007	0.098	0.068
General Perception	< 0.001	< 0.001	< 0.001	< 0.001	0.008	0.008	1.000
Impact of incontinence	< 0.001	< 0.001	< 0.001	< 0.001	0.020	0.020	1.000
Limitation of daily activities	< 0.001	< 0.001	< 0.001	< 0.001	0.070	0.070	1.000
Physical Limitation	< 0.001	< 0.001	< 0.001	< 0.001	0.014	0.014	1.000
Social Limitação	< 0.001	< 0.001	< 0.001	< 0.001	0.016	0.011	0.317
Personal Relationships	< 0.001	< 0.001	< 0.001	< 0.001	0.024	0.024	1.000
Emotions	< 0.001	< 0.001	< 0.001	< 0.001	0.006	0.006	1.000
Sleep and Mood	< 0.001	< 0.001	< 0.001	< 0.001	0.034	0.034	1.000
Measures of Severity	< 0.001	< 0.001	< 0.001	< 0.001	0.027	0.027	0.317

Significance level = 5%

Urinary retention is a frequent adverse outcome in the postoperative period. In this study, we had three (6.9%) patients with urinary retention in the immediate postoperative period and one with persistent retention (2.3%), which is consistent with the literature (19.7%)^{7,8,17-23}. These patients were referred for pelvic floor

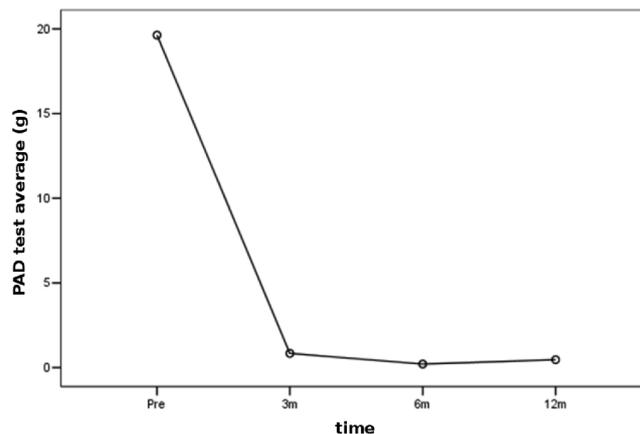


Figure 1 - Profile of averages - PAD test (g).

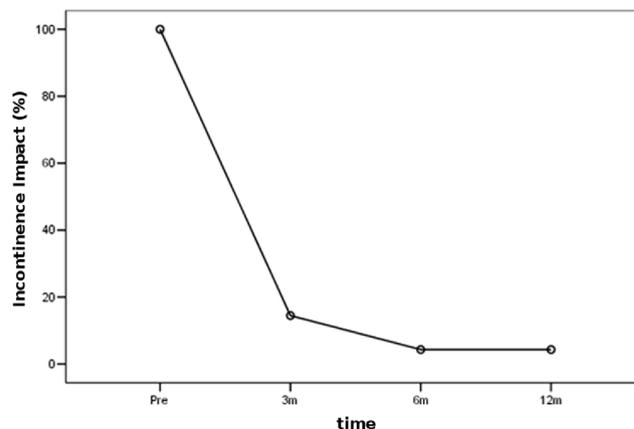


Figure 2 - Profile of averages - Impact of incontinence.

physiotherapy. Two of them had resolution of the condition and voiding study compatible with normality. One patient still had urinary retention requiring intermittent catheterization, the voiding study revealing urethral opening pressure of 45 cmH₂O. The patient underwent urethrolisis, with good evolution, being continent and without complaints.

The rate of bladder / urethral injury reported, according to several authors, ranges from zero to 13.8%^{19-21,24-27}. In our series, we had no adverse outcomes in this regard.

When separately analyzing each of the domains, comparing the preoperative period with three, six and 12

months postoperatively, we noted that there was a statistically significant difference.

We believe that, from the points of view of surgical results and improving the life of our patients, our technique proved to be efficient. We believe there is room for its use in SUI relapsing from conventional techniques^{21,23} and in cases of rejection of synthetic materials or selected patients, considering that the ideal treatment for female SUI is yet to come²⁸.

In conclusion, the retropubic placement of aponeurotic sling with direct visualization proved to be safe as for the risk of bladder or urethral injuries, with objective cure rate and improved quality of life.

R E S U M O

Objetivo: avaliar a aplicação de faixa aponeurótica por técnica modificada com visibilização direta das agulhas em pacientes com incontinência urinária de esforço. **Métodos:** foi aplicado o questionário Kings Health Questionnaire (KHQ) de qualidade de vida, exame ginecológico, exame de urina I e urocultura aproximadamente sete dias antes da realização do estudo urodinâmico (EUD) e PAD test de uma hora submetidas à confecção de faixa aponeurótica com passagem de faixa pela via retropúbica, com agulha sob visibilização direta, PAD test e King's Health Questionnaire, no pré e pós operatórios. **Resultados:** a média de idade foi 50,6 anos, 89% da cor branca, IMC de 28 e PPE de 58,5cm de H₂O. Quarenta e seis delas tiveram acompanhamento de três e seis meses, 43 de 12 meses. A taxa de cura objetiva, em 12 meses de pós-operatório foi aproximadamente 93,5%. Ao avaliarmos a qualidade de vida das pacientes, observamos a melhora significativa em 12 meses de pós-operatório, quando comparada ao pré-operatório. Não foi observada nenhuma lesão uretral/vesical. Como resultados adversos tivemos uma retenção urinária persistente (2,3%), sendo submetida à uretrolise, estando atualmente sem perda. **Conclusão:** a operação proposta é segura quanto ao risco de lesões vesicais ou uretrais, promovendo melhora acentuada na qualidade de vida e cura objetiva.

Descritores: Incontinência urinária/cirurgia. Slings suburetrais. Procedimentos cirúrgicos urológicos/métodos.

REFERENCES

- Giordano V. Vingtieme Congress Français de Chirurgie 1907; p.506.
- Ridley JH. A operação de Goebell-Stoeckel. In: Mattingly RF, Thompson JD. TeLinde Ginecologia operatória. Tradução de J. Israel Lemos e André Luis Melgaço. 6ª ed. Rio de Janeiro: Guanabara Koogan;1988. p.583-96.
- Mcquire EJ, Lytton B. Pubovaginal sling procedure for stress incontinence. J Urol. 1978;119(1):82-4.
- Petros PE, Ulmsten UI. An integral theory of female urinary incontinence. Acta Obstet Gynecol Scand Suppl. 1990;153:7-31.
- Nilsson CG, Falconer C, Rezapour M. Seven-year follow-up of the tension-free vaginal tape procedure for the treatment of urinary incontinence. Obstet Gynecol. 2004;104(6):1259-62.
- Novara G, Ficarra V, Boscolo-Berto R, Secco S, Cavalleri S, Artibani W. Tension-free midurethral slings in the treatment of female stress urinary incontinence: a systematic review and meta-analysis of randomized controlled trials of effectiveness. Eur Urol. 2007;52(3):663-78.
- Sergent F, Sebban A, Verspyck E, Sentilhes L, Lemoine JP, Marpeau L. Complications per et post-opérateiros du TVT (tension-free vaginal tape). Prog Urol. 2003;13(4):648-55.
- Winckler JA, Ramos JG, Dalmolin BM, Winckler DC, Doring M. Comparative study of polypropylene and aponeurotic slings in the treatment of female urinary incontinence. Int Braz J Urol. 2010;36(3):339-47.
- Sabadell J, Poza JL, Esgueva A, Morales JC, Sánchez-Iglesias JL, Xercavins J. Usefulness of retropubic tape for recurrent stress incontinence after transobturator tape failure. Int Urogynecol J. 2011;22(12):1543-7.
- Petri E, Ashok K. Comparison of late complications of retropubic and transobturator slings in stress urinary incontinence. Int Urogynecol J. 2012;23(3):321-5.
- Rajendra M, Han HC, Lee LC, Tseng LA, Wong HF. Retrospective study on tension-free vaginal tape obturator (TVT-O). Int Urogynecol J. 2012;23(3):327-34.
- Fonseca ESM, Camargo ALM, Castro RA, Sartori MGF, Fonseca MCM, Lima GR, et al. Validação do questionário de qualidade de vida (King's Health Questionnaire) em mulheres brasileiras com incontinência urinária. Rev Bras Ginecol Obstet. 2005;27(5):235-42.
- Albuquerque MT, Micussi BC, Soares EMM, Lemos TMAM, Brito TNS, Silva JB, et al. Correlação entre as queixas de incontinência urinária de esforço e o pad test de uma hora em mulheres na pós-menopausa. Rev Bras Ginecol Obstet. 2011;33(2):70-4.
- Sharifiaghdas F, Mortazavi N. Tension-free vaginal tape and autologous rectus fascia pubovaginal sling for the treatment of urinary stress incontinence: a medium-term follow-up. Med Princ Pract. 2008;17(3):209-14.
- Jeon MJ, Jung HJ, Chung SM, Kim SK, Bai SW. Comparison of the treatment outcome of pubovaginal sling, tension-free vaginal tape, and transobturator tape for stress urinary incontinence with intrinsic sphincter deficiency. Am J Obstet Gynecol. 2008;199(1):76.e1-4.
- Tsui KP, Ng SC, Yeh GP, Hsieh PC, Lin LY, Chen GD. Outcomes of autologous fascial slingplasty procedure for treating female urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct. 2008;19(7):949-54.

17. Abouassaly R, Steinberg JR, Lemieux M, Marois C, Gilchrist LI, Bourque JL, et al. Complications of tension-free vaginal tape surgery: a multi-institutional review. *BJU Int.* 2004;94(1):110-3.
 18. Latthe PM, Foon R, Toozs-Hobson P. Transobturator and retropubic tape procedures in stress urinary incontinence: a systematic review and meta-analysis of effectiveness and complications. *BJOG.* 2007;114(5):522-31.
 19. Noblett KL, Shen B, Lane FL. Lynx midurethral sling system: a 1-year prospective study on efficacy and safety. *Int Urogynecol J Pelvic Floor Dysfunct.* 2008;19(9):1217-21.
 20. Sartori JP, Martins JAM, Castro RA, Sartori MGF, Girão MJBC. Sling de aponeurose e com faixa sintética sem tensão para o tratamento cirúrgico da incontinência urinária de esforço feminina. *Rev Bras Ginecol Obstet.* 2008;30(3):127-34.
 21. Pradhan A, Kearney R. Surgical management of stress urinary incontinence. *Obstet, Gynecol Reprod Med.* 2010;20(7):207-11.
 22. Goldman HB. Urethrolisis. *Urol Clin North Am.* 2011;38(1):31-7, vi.
 23. Welk BK, Herschon S. The autologous fascia pubovaginal sling for complicated female stress incontinence. *Can Urol Assoc J.* 2012;6(1):36-40.
 24. Kuuva N, Nilsson CG. A nationwide analysis of complications associated with the tension-free vaginal tape (TVT) procedure. *Acta Obstet Gynecol Scand.* 2002;81(1):72-7.
 25. Lord HE, Taylor JD, Finn JC, Tsokos N, Jeffery JT, Atherton MJ, et al. A randomized controlled equivalence trial of short-term complications and efficacy of tension-free vaginal tape and suprapubic urethral support sling for treating stress incontinence. *BJU Int.* 2006;98(2):367-76.
 26. Roth CC, Winters JC, Woodruff AJ. What's new in slings: an update on midurethral slings. *Curr Opin Urol.* 2007;17(4):242-7.
 27. Tcherniakovsky M, Fernandes CE, Bezerra CA, Del Roy CA, Wroclawski ER. Comparative results of two techniques to treat stress urinary incontinence: synthetic transobturator and aponeurotic slings. *Int Urogynecol J Pelvic Floor Dysfunct.* 2009;20(8):961-6.
 28. Kassardjian ZG. Sling procedures for urinary incontinence in women. *BJU Int.* 2004;93(5):665-70.
- Received at: 05/03/2015
Accepted for publication: 06/05/2015
Conflict of interest: none.
Source of funding: none.
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Epidemiological analysis of polytrauma patients with kidney injuries in a university hospital

Análise epidemiológica de politraumatizados com lesões renais em um hospital universitário

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A B S T R A C T

Objective: To analyze the characteristics of trauma patients with renal lesions treated at a university hospital in Curitiba. **Methods:** We conducted a retrospective, cross-sectional study guided by review of medical records of trauma victims who underwent surgical treatment. The variables analyzed were age, gender, mechanism of injury, degree of kidney damage, conduct individualized according to the degree of renal injury, associated injuries, complications and deaths. We classified lesions according to the American Association of Trauma Surgery (TSA). **Results:** We analyzed 794 records and found renal lesions in 33 patients, with mean age 29.8 years, most (87.8%) being male. Penetrating trauma accounted for 84.8% of cases. The most common renal injuries were grade II (33.3%), followed by grade I (18.1%), III, IV and V. Nephrectomy treated 45.4% of injuries, 73.3% being total nephrectomy, and 45.4% by nephrorraphy. In 9% treatment was non-surgical. Only 12.1% of patients had isolated renal lesions. Complications ensued in 15.1% and mortality was 6.06%. **Conclusion:** The surgical approach was preferred due to penetrating trauma mechanism. We achieved low rates of complications and deaths, and neither case could be directly related to kidney damage, and there were patients with multiple lesions. In this sample, we could not observe a direct relationship between kidney damage and complications, deaths or the type of conduct employed.

Key words: Kidney. Wounds and injuries. Epidemiology. Traumatology. Wounds, Penetrating.

INTRODUCTION

Trauma is the leading cause of death in the population under 40 years and is largely responsible for deaths in young adults in Brazil. Renal trauma, although unusual¹, is of great importance due to the high morbidity and mortality resulting from renovascular injuries², and the definition of conducts and protocols.

The kidneys are retroperitoneal organs, protected by a layer of perirenal fat and contained by the Gerota's fascia². With these characteristics, they remain the third most affected organ in abdominal trauma, being present in 10% of such occurrences³.

The initial assessment of the trauma patient must follow the protocols of trauma care (ATLS). Renal injury should be suspected from the mechanism of trauma, bruising or presence of holes in the abdominal wall and back². Moreover, clinical signs contribute to the diagnosis, such as hematuria, which present in up to 90% of patients, although its intensity does not correlate directly with the degree of renal injury².

The hemodynamic findings in patients with abdominal solid organs trauma becomes the reference for the diagnosis and treatment algorithm, determining or excluding the selective non-operative treatment⁴.

The conduct in renal trauma has adopted a more conservative management¹, seeking to decrease nephrectomy rates and increase the number of kidney reconstructions and nonsurgical treatment.

To assist in choosing the best treatment, we use evidence-based guidelines, an important method to standardize the approach to be adopted. However, these guidelines are not always followed in daily practice, especially in trauma⁵.

This study aimed to analyze the profile of patients with renal trauma treated at a university hospital in Curitiba.

METHODS

We conducted a study with transversal and descriptive design, with retrospective analysis of medical

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records of trauma patients from January 2010 to September 2011.

The variables analyzed were age, gender, mechanism of injury, degree of kidney damage, conduct individualized according to the degree of renal injury, overall conduct, associated injuries, complications and deaths. Lesions were classified according to the updated AAST scale⁴.

Data were stored and analyzed using spreadsheet software.

RESULTS

Of the 794 records analyzed, 33 reported renal lesions, a 4.15% prevalence and an average of 1.5 cases per month. The average age was 29.8 years and male gender was the most affected (87.8%).

The most prevalent trauma mechanism was penetrating, accounting for 84.8% of the injuries, while 15.2% occurred due to blunt trauma. Injuries by firearms prevailed among penetrating wounds.

The grade I renal injury accounted for 18.1% of cases, second only to grade II injury, the most common (33.3%). Lesions of Grade III, IV and V corresponded to 16.1% each.

We opted for non-operative management in 9% of cases and surgical one in 90.8%: in 45.4% we held suture of the injury and in 45.4%, nephrectomy. The total nephrectomy was used to treat 73.3% of kidney lesions, and partial nephrectomy, in 26.7%, (Table 1).

Fifty percent of grade I lesions were managed with conservative treatment and 50% with surgical treatment, all by nephrorraphy. We performed nephrectomy in 18.8% of grade II lesions and nephrorraphy in 81.8%, including the use of omentum patch in 22.2% of such operations. For grade III injuries, the nephrectomy rate increased to 60%, but the nephrorraphy was possible in 40% of cases. Grade IV injuries were treated with total nephrectomy in 60%, in 20%, partial nephrectomy, and nephrorraphy in the remaining. Total nephrectomy was the choice for all grade V lesions.

Most patients (87.9%) had associated visceral lesions and 12.1% of patients, isolated renal injury. Among the prevalent associations, liver injuries occurred in 25.13% and splenic ones in 18.45%.

The occurrence of complications was 15.1%. However, we observed that none of the them were directly related to kidney damage or choice of treatment, but to the associated lesions. There have been no deaths directly related to primary renal trauma, but 6.06% of the patients died, the associated lesions being mainly responsible.

DISCUSSION

Renal injury is responsible for 1% to 5% of hospitalizations due to trauma^{2,6,7}. Our data show a similar rate, that is, 4.15% of the lesions over a period of approximately two years were renal lesions. Among the urological traumas resulting from car accidents, renal trauma is the most common, ranging from 43%⁸ to 51%, and the parenchymal injuries are the most frequent⁹.

Renal injuries occur most commonly after blunt abdominal trauma, in 80% to 90%, but may also be due to penetrating injuries or deceleration trauma². These data differ from ours, as 84.8% of renal trauma resulted from penetrating injuries, while only 15.2% occurred in patients with blunt trauma.

While renal injuries by firearms are unusual, they favor the occurrence of complex lesions of the urinary system. Thus, only a minority of these lesions is submitted to nonoperative treatment^{10,11}. In addition, there are few services that have a sufficient number of patients with penetrating renal injuries, especially those produced by firearms, which enables studying their experience¹⁰. This, despite not being the most common, is the majority in our study, since the our sample shows wounds by firearms as the most prevalent mechanism of trauma, which further supports our results and may contribute to the medical literature. We employed the surgical approach to 90.8 of patients.

About 90% of patients with blunt renal trauma are not surgically managed, while the majority of patients with penetrating trauma must be submitted to surgical

Table 1 - Results - Treatment according to the injury grade.

	Patients	Nonoperative	Nephrorraphy	Partial Nephrectomy	Total Nephrectomy
Grade I	18.1%	50% (n=3)	50% (n=3)	X	X
Grade II	33.3%	X	81.8% (n=9)	X	18.2% (n=2)
Grade III	16.1%	X	40% (n=2)	X	60% (n=3)
Grade IV	16.1%	X	20% (n=1)	20% (n=1)	60% (n=3)
Grade V	16.1%	X	X	X	100%
Total	33%	9%	45.4%	26.7%	73.3%

Source: Medical records of trauma victims at Hospital Universitário Cajuru (January / 2010 to September / 2011).

treatment, a fact associated with higher injury severity. Nephrectomy is the choice in blunt traumas in only 4% of patients, while it is held in 21% of penetrating ones², a much lower rate than ours, and this fact probably is due to the high frequency of associated intra-abdominal injuries¹², found in 87.9% of our patients.

Anatomically, the only kidneys supporting structures are its vascular pedicle and the ureters⁶, making them exposed to avulsions by violent displacements and decelerations, yielding pedicle injuries in 4% to 10% of renal trauma⁸. The high renal blood flow makes bleeding a major difficulty in the approach of the injured kidney, suggesting that the kidney bleedings sometimes require some invasive procedure to stop hemorrhage¹³. However, in most cases, they cease spontaneously, contained in the retroperitoneum¹⁰.

Helical CT with intravenous contrast is standardized and carried out within two hours of hospital admission. Radiological findings, such as perirenal hematoma, contrast extravasation and complex lacerations, are risk factors that can guide hemostatic interventions as angioembolization, and greatly increase the risk of intervention in these patients^{4,14}, being the best method to assess renal lesions and guide treatment¹⁵.

In a study¹⁰ covering non-operative treatment of right thoracoabdominal injuries by firearms, most patients, 91.9% were male, the mean age was 24 years, slightly lower than the average age of our patients (29.8 years), 87.8% of which were men and the most common lesion was grade II (46%), as found in our analysis (33.3%), followed by grade III lesions (35.1%).

The intimate anatomical relationship of the right kidney with the visceral surface of the liver explains the higher frequency of this organ in lesions associated with the kidney². Similarly, the proximity of the left kidney to the spleen justifies the lesions associated with this organ, the second most incident. Our results corroborate this information: liver injuries occurred in 25.13% of our patients, followed by splenic ones in 18.45%.

For Grade I lesion, in which there is only renal contusion, the treatment of choice is conservative, even for penetrating trauma, provided there are no other associated organ injury, nor entrance orifice dorsal to the the posterior axillary line. Grade I lesions were conservatively managed in 50% of our patients. Conservative treatment

can be employed in grade II, III and IV injuries as well, but it should be remembered that hemodynamic stability is required².

Conservative treatment for renal injuries by firearms should only be adopted after careful patient selection. We believe that patients initially considered without immediate surgical indication should be monitored by means of computed tomography with intravenous contrast. This approach is used in 10% to 40% of renal injuries by firearms, with a success rate ranging from 91% to 100%^{11,16}.

A study in a single hospital using diagnostic angiography and angioembolization in 9,000 cases of renal trauma has identified a high success rate, reducing nephrectomies in grade IV and V by 78% and 83%, respectively. But penetrating trauma were more prone to embolization failure¹⁷.

There is a tendency to seek predictors for nephrectomy, since it is the most commonly performed surgery in renal trauma, although less invasive methods have been increasingly used for its complications¹.

Complications most commonly found in renal trauma are urinoma and perinephric abscess, secondary hemorrhage, hypertension and kidney failure.

The management of renal trauma can be conservative or surgical, and the conduct should be defined according to the classification of lesions. There is also the decision between nephrorraphy and nephrectomy, for which we noted no preference in this study, since both had rates of 45.4%, despite published data^{1,2,6} evidencing a remarkable rate of unwanted nephrectomies, mainly after penetrating trauma. The overall incidence of complications in traumatic kidney injury ranges from 3% to 33%², enclosing the data resulting from our work, in which complications occurred in 15.1%.

We conclude that the surgical approach was preferred due to penetrating trauma mechanism, which leads to more complex lesions, and also due to the high frequency of associated visceral lesions. We achieved low rates of complications and deaths, and neither outcome could be directly related to kidney damage, occurring in patients with multiple lesions. In this sample, we could not prove a direct relationship between kidney damage and complications, deaths or the type of conduct employed.

RESUMO

Objetivo: analisar as características de pacientes vítimas de trauma, com lesões renais atendidos em um hospital universitário de Curitiba. **Métodos:** estudo transversal retrospectivo guiado por revisão de prontuários de vítimas de trauma submetidos ao tratamento cirúrgico. As variáveis analisadas foram idade, sexo, mecanismo de trauma, grau das lesões renais, conduta individualizada de acordo com o grau da lesão renal, lesões associadas, complicações e óbitos. As lesões foram classificadas de acordo com a Associação Americana de Cirurgia do Trauma (AAST). **Resultados:** foram analisados 794 prontuários, a lesão renal foi encontrada em 33 pacientes, a média de idade foi 29,8 anos, a maioria dos pacientes era (87,8%) do sexo masculino. O trauma penetrante foi responsável por 84,8% dos casos. As lesões mais frequentes foram as de grau II (33,3%), seguidas pelas lesões de grau I (18,1%) e pelas lesões de grau III, IV e V. Foram tratadas com nefrectomia, 45,4% das lesões, 73,3% por nefrectomia total e 45,4%, por nefrorrafia. Em 9% o tratamento não foi cirúrgico. Apenas 12,1% dos pacientes apresentaram lesões renais isoladas. Complicações foram observadas em 15,1% e a taxa de óbito foi 6,06%. **Conclusão:** a abordagem cirúrgica foi a preferencial devido ao mecanismo de trauma penetrante. Obtivemos baixos índices de óbitos e complicações, sendo que nenhum dos casos pôde ser relacionado diretamente à lesão renal, e ocorreram em pacientes com múltiplas lesões. Nesta amostra, não foi possível provar relação direta entre lesão renal e complicações, óbitos ou com o tipo de conduta empregada.

Descritores: Rim. Ferimentos e Lesões. Epidemiologia. Traumatologia. Ferimentos Penetrantes.

REFERENCES

1. Wright JL, Nathens AB, Rivara FP, Wessells H. Renal and extrarenal predictors of nephrectomy from the national trauma data bank. *J Urol.* 2006;175(3 Pt 1):970-5; discussion 975.
2. Silva LF, Teixeira LC, Rezende Neto JB. Abordagem do trauma renal – artigo de revisão. *Rev Col Bras Cir.* 2009;36(6):519-24.
3. Lima TFN, Andrade PR, Carvalho JAR, Pereira RN, Livrini VA, Hachul M. Trauma Renal: algoritmo de investigação e conduta. *Emerg Clin.* 2011;6(28):11-6.
4. Reis LO, Kim FJ, Moore EE, Hirano ES, Fraga GP, Nascimento B, et al. Atualização da classificação e tratamento das lesões renais complexas. *Rev Col Bras Cir.* 2013;40(4):347-50.
5. van der Vlies CH, Olthof DC, van Delden OM, Ponsen KJ, de la Rosette JJ, de Reijke TM, et al. Management of blunt renal injury in a level 1 trauma centre in view of the European guidelines. *Injury.* 2012;43(11):1816-20.
6. Shoobridge JJ, Corcoran NM, Martin KA, Koukounaras J, Royce PL, Bultitude MF. Contemporary management of renal trauma. *Rev Urol.* 2011;13(2):65-72.
7. Yeung LL, Brandes SB. Contemporary management of renal trauma: differences between urologists and trauma surgeons. *J Trauma Acute Care Surg.* 2012;72(1):68-75; discussion 75-7.
8. Paparel P, N'Diaye A, Laumon B, Caillot JL, Perrin P, Ruffion A. The epidemiology of trauma of genitourinary system after traffic accidents: analysis of a register of over 43,000 victims. *BJU Int.* 2006;97(2):338-41.
9. Starling SV, Azevedo Filho TV, Drumond DAF, Leal IV PAON. Ruptura isolada da pelve renal secundária ao trauma abdominal contuso. *Rev Col Bras Cir.* 2007;34(3):208-9.
10. Cesar BP, Starling SV, Drumond DAF. Tratamento não operatório das lesões renais por arma de fogo. *Rev Col Bras Cir.* 2013;40(4):330-34.
11. Voelzke BB, McAninch JW. Renal gunshot wounds: clinical management and outcome. *J Trauma.* 2009;66(3):593-600; discussion 600-1.
12. Kansas BT, Eddy MJ, Mydlo JH, Uzzo RG. Incidence and management of penetrating renal trauma in patients with multiorgan injury: extended experience at an inner city trauma center. *J Urol.* 2004;172(4 Pt 1):1355-60.
13. Peterson NE. The significance of delayed post-traumatic renal hemorrhage. *J Urol.* 1978;119(4):563-5.
14. Dugi DD 3rd, Morey AF, Gupta A, Nuss GR, Sheu GL, Pruitt JH. American Association for the Surgery of Trauma grade 4 renal injury substratification into grades 4a (low risk) and 4b (high risk). *J Urol.* 2010;183(2):592-7.
15. Muir MT, Inaba K, Ong A, Barmparas G, Branco BC, Zubowicz EA, et al. The need for early angiography in patients with penetrating renal injuries. *Eur J Trauma Emerg Surg.* 2012;38(3):275-80.
16. Navsaria PH, Nicol AJ. Selective nonoperative management of kidney gunshot injuries. *World J Surg.* 2009;33(3):553-7.
17. Hotaling JM, Sorensen MD, Smith TG 3rd, Rivara FP, Wessells H, Voelzke BB. Analysis of diagnostic angiography and angioembolization in the acute management of renal trauma using a national data set. *J Urol.* 2011;185(4):1316-20.

Received at: 10/03/2015

Accepted for publication: 02/06/2015

Conflict of interest: none.

Source of funding: none.

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Analysis of natural history of the diaphragmatic injury on the right in mice

Análise da evolução natural dos ferimentos diafragmáticos à direita em ratos

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A B S T R A C T

Objective: to evaluate natural evolution of right diaphragmatic injury after the surgical removal of a portion from hemi diaphragm. **Methods:** the animals were submitted to a surgical removal of portion from right hemi diaphragm by median laparotomy. The sample consists of 42 animals being 2 animals from pilot project and 40 operated animals. And the variables of the study were herniation, liver protection, healing, persistent diaphragm injury, evaluation of 16 channels tomography and the variables "heart rate" and "weight". **Results:** we analyzed 40 mice, we had two post-operative deaths; we had 17 animals in this group suffered from herniation (42.5%) and 23 animals didn't suffer from herniation (57.5%). Analyzing the tomography as image method in the evaluation of diaphragmatic hernia, we had as a method with good sensitivity (78.6%), good specificity (90.9%), and good accuracy (86.1%) when compared to necropsy. **Conclusion:** there was a predominance of healing of right hemi diaphragm, the size of initial injury didn't have influence on occurrence of the liver protection or hernia in mice.

Key words: Thoracic Surgery. Wound Healing. Diaphragm. Animal Experimentation. Animal Experimentation. Hernia, Diaphragmatic, Traumatic. Thoracic Injuries.

INTRODUCTION

Isolated diaphragmatic injuries are a major challenge for physicians working in the field of traumatology. They may go unnoticed both by the uncertainty of their evolution and by the acute or chronic clinical repercussions^{1,2}.

The leading cause of diaphragmatic lesions are the penetrating injuries in the thoracoabdominal transition zone (TATZ), limited anteriorly by the fourth intercostal space, laterally by the sixth intercostal space, posteriorly by the tip of the scapula and inferiorly by the epigastric region and the costal margin³. Such penetrating injuries to the TATZ can display up to 48% of diaphragmatic injuries⁴. The most affected organs in diaphragmatic injuries are: lung, stomach, liver, spleen and colon, the left hemidiaphragm being the most affected both in penetrating and blunt trauma; stabbing wounds are the most frequent, and, in most cases, have less than two centimeters⁵. Even with a substantial number of publications showing the high incidence of diaphragmatic injuries in TATZ trauma, this incidence is still unclear, given that a large numbers of these lesions still goes unnoticed¹⁻⁶.

Symptoms of patients with diaphragmatic injuries can range from referred pain in the shoulder, decreased chest expansion, bowel sounds on auscultation, dug abdomen or even no symptoms, and patients may progress

from asymptomatic in and isolated small injuries to circulatory collapse, with severe respiratory failure, resembling tension pneumothorax⁷. The most common symptoms are related to the digestive and respiratory systems, however, it is estimated that 25% of these patients may go asymptomatic⁸.

For the diagnosis of a diaphragmatic injury, the main tools are the clinical examination and the imaging studies. A simple chest X-ray often shows nonspecific signs, such as hemothorax, pneumothorax, elevated hemidiaphragm and even a simple opacity in the costophrenic angle and, often, these changes may persist after thoracic drainage⁹. Examinations with contrast media may render diagnoses when there is herniation of abdominal structures into the chest, but most of the injuries that affect the diaphragm are small, resulting in a low rate of herniations^{10,11}.

The use of computed tomography with three-dimensional reconstruction decreases the chances of a false negative. There are reports showing failure in diagnosing diaphragm lesions with the use of conventional tomography¹²⁻¹⁵. Magnetic resonance imaging has shown promising results when evaluating diaphragmatic lesions in chest and abdomen, injuries but it is still a method with little use, is not yet available in most trauma services, is costly and requires a long time for its realization¹⁶.

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Even when using all the above cited diagnostic tools along with a clinical exam, still we cannot achieve a good sensitivity and specificity of these tests for diaphragmatic injury, especially when faced with diaphragmatic injuries without hernia and with the patient stable. Healing is supposed to take place in parts of these injuries, many of whom, non-operated, showed good recovery without herniation⁸.

Nowadays, there is still no consensus in the treatment of diaphragmatic injuries in stable patients, and in most emergency departments we did not find thoracoscopy as a test for routine use. We then decided to evaluate the natural evolution of diaphragmatic injuries after resection of a portion of the right diaphragm.

METHODS

We used 40 *Rattus norvegicus albinus* rats, known as the albino Wistar strain, with about 90 days of life (250g). They were kept in collective cages for ten days, with a population density of five animals per cage, with free and unrestricted access to water and food given to rodents, and light / dark cycle of 12 hours. The research project was submitted to the Ethics in Animal Experimentation Commission the of Dr. Paulo Prata Health Sciences School of Barretos (FACISB), which issued a favorable opinion under protocol 009/2013.

The identification of each animal was performed by numbered hidrocolor fountain on the tail and ear. After performing the surgical procedure, the animals were housed in individual cages. During the postoperative period of 30 days, we measured the heart rate and weight on days 0, 5, 10, 15, 20, 25 and 30. The heart rate was measured with the aid of a stethoscope. Weight was measured with a SF-400 CE precision balance. After this period, the animals underwent a CT scan of the chest and, soon after, euthanasia through a laparotomy associated with a double thoracotomy. During the autopsy we evaluated: 1) diaphragmatic hernia; 2) Liver protection; 3) diaphragmatic healing; and 4) persistent diaphragmatic injury without hernia or protection. Subsequently, we compared the occurrence of hernia or protection in the chest tomography with microscopy, checking whether the initial size of the lesion and the local inflammatory reaction (size of fibrosis and thickness of the membrane) influenced the occurrence of hernia or protection in the diaphragmatic injury.

Under general anesthesia, we performed a laparotomy and dissection of the right diaphragm in two Wistar rats of approximately 250g weight. The right diaphragm was withdrawn from one rat for the calculation of its total area, and from the other, to define the the portion of the right hemidiaphragm to be removed. The size of the lesion and the calculation of the right diaphragm area were measured using a computer graphics program (AutoCAD[®] by Autodesk[®], version 2006), using integral calculus. We

could not standardize the withdrawal of exactly 10% of the diaphragm due to difficulties of finding a surgical instrument able to extract a proper portion of the assessed hemidiaphragm and to anatomical and physiological conditions.

We performed the anesthesia to animals subjected to fasting ten hours before the procedure. The drugs chosen were ketamine hydrochloride at a dose of 50mg/kg intraperitoneally, and 2% xylazine 5mg/kg, intraperitoneally. The animals were ventilated with a continuous positive airway pressure (CPAP) mask fitted with a rubber tube at pressure 1.5Kgf/cm² and positive end-expiratory pressure (PEEP) 5mm of water, by an oxygen concentrator.

Once the anesthesia ensued and after abdominal trichotomy, they underwent laparotomy measuring 3cm in length, starting under the xiphoid process for viewing and incision of the right diaphragm with a scalpel (blade 11) to carry out a ipsilateral pneumothorax and cause pulmonary collapse, thus avoiding lung injury when performing the diaphragmatic injury. We performed resection of a portion of the right diaphragm on 40 animals, between the costal insertion and the central tendon of the diaphragm, without including it in the place where we had held the pneumothorax (Figure 1). There was a variation of 5.18% to 20% in the size of the resection portion withdrawn. Upon completion of the injury, we placed an open anatomical clamp next to the injury and photographed for later calculation of lesion size by the computer graphics software "AutoCAD", since we already had knowledge of the size of the right hemidiaphragm. After the procedure and before the laparotomy closure, we held a lung hyperinflation followed by Valsalva maneuver to empty the pneumothorax and prevent atelectasis in the immediate postoperative period.

All animals were assisted till the end of anesthetic procedure and hydrated after surgery by applying 5ml of

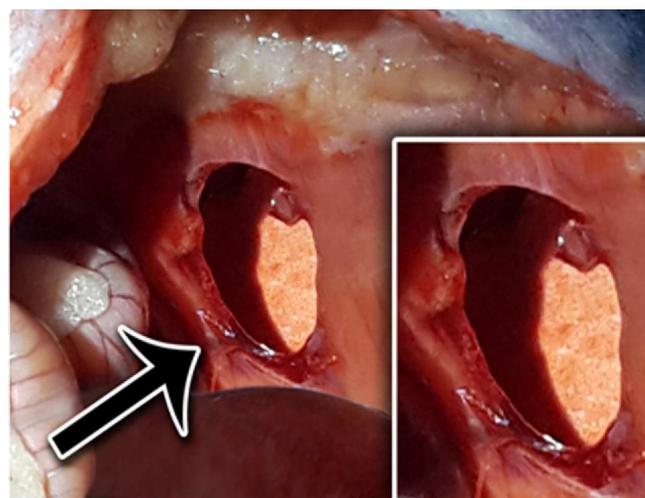


Figure 1 - Photograph of the surgical wound caused by the removal of a portion of the right hemidiaphragm.

0.9% saline per animal, performed by subcutaneous injection, going through a recovery period in a heated room. After anesthetic recovery, the animals were returned to their individual cages, where they received food and water throughout the postoperative period (30 days). Analgesia was performed to severe pain during the first four days with tramadol hydrochloride, 50mg/kg subcutaneously three times a day, associated with acetaminophen 1-2 mg/ml diluted in water and given orally for seven days.

After 30 days, the animals were anesthetized and underwent chest computed tomography (16 channels), to observe the occurrence of diaphragmatic hernia. Upon completion of the CT scan, the animals underwent laparotomy and double thoracotomy and were killed according to the international euthanasia standards in laboratory animals by intracardiac lethal injection of 10% Potassium chloride (KCL) at a dose of 2mmol/kg. We then started the autopsy study. After wide opening of cavities, we recorded the position of abdominal organs and how they were found: in the abdominal cavity; in the chest cavity; or adhered to the diaphragm making the protection of the injury, assessing the occurrence of healing, protection or hernia. Completed the autopsy, we withdrew the entire portion of the right diaphragm together with the viscera herniated or attached to it for subsequent histological analysis.

The specimen (with or without diaphragm adhered structures) was removed and immersed in a jar containing 10% formaldehyde. Tissue sections were prepared in the routine pathology laboratory for the slides preparation. One slide was stained with hematoxylin-eosin (HE) for classical morphologic assessment and the other was stained with the Masson technique for evaluation of fibrosis. Microscopic evaluation was a blinded procedure, in a double microscope observation.

Initially examining the slide stained by HE, we analyzed the histological changes, the structures that were attached to the diaphragmatic injury and the occurrence of liver protection or liver herniation and other abdominal viscera. The examination of the slides stained by the Masson technique quantified the area of greatest fibrous thickness of the membrane that covered the diaphragm on the edge of the lesion and the extent of fibrosis from the edge of the surgical injury.

Forty animals constituted the study group. Two animals died, one on the tenth day after surgery and another in the 11th, both being included in the study.

We performed descriptive analyzes of the data by calculating the mean, standard deviation, minimum, maximum, median and 25th and 75th percentiles, for the quantitative variables and frequency tables for qualitative variables. We used the Kolmogorov-Smirnov test to assess normality of the numerical variables. For all variables we obtained $p > 0.05$.

To verify whether the size of the initial lesion was statistically equal between the variables "protection"

and "herniated", and to compare the size of the diaphragm initial injury with the thickness of the membrane and the extent of fibrosis (microscopy), we used the Student's t-test for independent samples.

Considering the autopsy as the gold standard, we checked the agreement between microscopy and tomography. For this, for the three variables (necropsy, microscopic and tomography) we classified each animal as protection or hernia, and subsequently compared the groups. We calculated the sensitivity, specificity, accuracy and their respective confidence intervals (95%). Reproducibility between the methods was evaluated by the Kappa coefficient. To compare the evolution of weight and heart rate over time between groups, we used the Analysis of Variance (ANOVA) with mixed design. For this, we verified the effect of the interaction between time and group, the effect of time and the effect of the group.

RESULTS

We operated 40 rats. There were two deaths, with operative mortality of 5%. The deaths occurred on the tenth and 11th days postoperatively, the two animals had hernia and both were included in the study.

The result of the autopsy, according to the distribution of the evolution pattern of the lesion, showed liver protection in 50% of animals; there was herniation of abdominal structures, predominantly the liver followed by the omentum, large intestine, small intestine and spleen in 42.5% of animals and healing occurred in 7.5% (Table 1).

When we compared the variables protection and hernia with the size of the initial lesion, which varied from 5.18% to 20% of right diaphragm removed, we found no statistically significant difference between them (Table 2).

When comparing the results of tomography and the microscopic analysis of the material in relation to what we consider the gold standard (necropsy), we noted that both microscopy and chest computed tomography showed good sensitivity (hernia), good specificity (protection) in evaluation of diaphragmatic hernia (Tables 3 and 4). Considering the reproducibility between the microscopy and tomography with the autopsy, we found acceptable Kappa coefficients. For microscopy versus autopsy it was 0.734 ($p < 0.001$), while for computerized tomography, 0.704 ($p < 0.001$).

This heart rate evaluation showed a statistical significance with respect to time, all animals displaying decreased heart rate over the days postoperatively ($p < 0.001$), but there was no statistical significance between protection and hernia groups ($p = 0.250$). Regarding the variable weight, we noted that there were significant differences over time ($p < 0.001$), all gaining weight during the postoperative period; and when comparing rats with protection and hernia, those with protection had more weight gain ($p = 0.039$) than those who had hernia.

Table 1 - Macroscopic, microscopic and tomographic characterization of injuries.

Variable	Category	n	%
Macroscopy	Protection	23	57,5
	Hernia	17	42,5
Microscopy *	Protection	15	40,5
	Hernia	22	59,5
Hernia diagnosed by tomography **	Protection	23	63,9
	Hernia	13	36,1
Total		40	100

* There are missing values, since it was not possible to manufacture and further evaluate the slides of three rats.

** There are missing values, since it was not possible to complete the tomographic report of four rats.

Table 2 - Comparison of the size of the initial diaphragm injury of the hernia and the protection groups.

Group	n	Average	Standard deviation	Minimum	1 st Quartile	Median	3 rd Quartile	Maximum	P
Protection	23	10.48	3.72	5.76	6.03	9.41	12.75	19.37	0.530
Hernia	17	9.69	4.16	5.18	5.18	8.29	11.79	20.00	

In assessing the size of the initial lesion (macroscopic), the thickness of the diaphragm membrane at the injury site and the size of fibrosis at the site of injury (microscopic) in relation to the variables hernia and protection (microscopy), we noted no statistical significance that might explain the occurrence of hernia or protection (Table 5). When we evaluated the occurrence of persistent diaphragm injury without protection or hernia in both microscopy and in macroscopic, we found no cases of such injury in the animals studied.

DISCUSSION

When the diagnosis is made and the complications of diaphragmatic injury are repaired in the acute phase, there is a low morbidity and mortality. However, the results are different when it comes to a complication of diaphragmatic lesion with months or years of evolution^{17,18}, There are rates of approximately 48% mortality and 30% morbidity when treatment is started too late, reaching 80% of morbidity and mortality¹³.

The reason that led some authors to reveal the possibility of spontaneous healing of diaphragmatic injuries was that, in clinical practice, only a relatively small number of patients with penetrating TATZ injuries developed hernia during clinical monitoring^{9,19}.

The pressure gradient between the pleural and peritoneal cavities, the constant movement of the diaphragm during the respiratory cycle and the radial tension between the center and its parietal tendon insertions are cited as factors that prevent diaphragmatic healing after trauma²⁰.

In a study²¹ with a porcine model using laparotomy, diaphragmatic injuries of 1.5cm to 2cm in length located at the central tendon of a hemidiaphragm and muscle of the contralateral hemidiaphragm, with pleural drainage for emptying of pneumothorax, using general anesthesia and sacrificing the animals after six weeks, they concluded that most stabbing injuries, regardless of the location, the central tendon or muscle part, heal spontaneously, not justifying the evaluation of diaphragm conditions in all patients with injuries in the thoracoabdominal transition area.

Evaluating existing studies in the literature, we found that healing is the rule dir perforating injuries to the

Table 3 - Evaluation of the occurrence of hernia in microscopy and chest tomography compared with necropsy.

		Necropsy			
		Protection		Hernia	
		N	%	n	%
Microscopy -	Protection	15	75.0%	0	0.0%
	Hernia	5	25.0%	17	100.0%
Tomography -	Protection	20	90.9%	3	21.4%
	Hernia	2	9.1%	11	78.6%

Table 4 - Evaluation of sensitivity and specificity of Microscope and multidetector chest tomography in the evaluation of diaphragmatic Hernia.

Assessment	Sensitivity	Specificity	Accuracy
Microscopy	100.0% [81.57% ; 100.0%]	75.0% [53.1% ; 88.8%]	86.5% [72.0% ; 94.1%]
Tomography	78.6% [52.4% ; 92.4%]	90.9% [72.2% ; 97.5%]	86.10% [71.3% ; 93.9%]

Table 5 - Comparison of the initial injury size with the microscopic variables: 1) Thickness of the injury membrane; 2) Size of the fibrosis on the injury site.

Variable Group	n	Average	Standard deviation	Minimum	1 st Quartile	Median	3 rd Quartile	Maximum	P
Size of the initial diaphragmatic injury									
Protection	15	10.11	3.73	5.76	6.76	9.41	12.62	19.37	0.866
Hernia	22	9.89	3.95	5.18	6.76	8.50	11.79	20.00	
Membrane thickness in mm (Microscopy)									
Protection	15	0.25	0.32	0.01	0.08	0.11	0.20	1.00	0.379
Hernia	22	0.16	0.32	0.00	0.03	0.05	0.10	1.50	
Fibrosis size in mm (Microscopy)									
Protection	15	0.61	0.41	0.15	0.30	0.45	0.90	1.40	0.645
Hernia	22	0.70	0.68	0.20	0.30	0.48	0.82	3.30	

thoracoabdominal transition zone, which is contrary to what is done in clinical practice. It is worth remembering that, in most cases, the wounds are small (2 cm in most), between the central tendon and the costal wall, especially on the left, since most of the perpetrators are right-handed²².

In our experimental model, we sought to create a condition of healing difficulty when we removed a portion of the right hemidiaphragm, what none of the cited studies did, hampering the approach of the damaged edges, which would be conducive to wound healing.

We were careful to specify the exact extent of the injury we carried out, which was located between the central tendon of the right hemidiaphragm and its insertion in the lateral thoracic wall, causing in this way an injury in one of the phrenic nerve branches, a fact which further corroborated the poor healing of the injury caused. We found, after reviewing the literature, that most works did not detail the site of injury, but one article²¹ which detailed and assessed the extent of the injury in the two main regions of the diaphragm (the central tendon and muscle part).

Regarding the anesthetic technique, the drugs chosen for the anesthesia were ketamine hydrochloride and xylazine to cause good analgesia, not having hypotensive action on the cardiovascular system and hardly causing respiratory depression. In this way, we did not establish a definitive airway and only held a ventilatory assistance by

a rubber with intermittent pressure of 5 mm water, adapted as a CPAP, getting a good lung expansion during the procedure and a good evacuation of the pneumothorax, with no need of pleural drainage during the closure of the abdominal cavity.

We chose the median abdominal incision, approximately 3cm in length from the xiphoid appendix, as a gateway to the right hemidiaphragm. Although there are reports of diaphragmatic dysfunction associated with laparotomy²³, we did not observe this fact, nor did other authors who used models similar to ours^{24,25}. This might be explained by the rapidity of the procedure and also by the use of CPAP, as we found no respiratory fatigue of the animals after the end of anesthesia.

The determination of 30 days for observation time of was based on a work by Perlingeiro *et al.*⁹, showing no statistical significance between the dead animals in the period 11th to 60th day with the 120th to 150th days.

To this day, no one knows the exact timing of the herniation, since injuries undiagnosed in the acute phase will be discovered only when there are symptoms, often unspecific²⁶, and sometimes dramatically, with drastic obstructive symptoms or acute respiratory failure, in most cases one to three years after the traumatic event. Symptoms such as abdominal pain, nausea, vomiting, constipation, dyspnea and chest pain are related to the

progressive herniation of abdominal organs into the chest²⁷.

In our study with 40 animals, there were two deaths with great herniation of abdominal organs into the chest cavity, there was protection of the injury in 50% of animals, complete healing of the diaphragm in 7.5%, and even a possible healing with muscles filling the wound. We found no cases of persistent injury without protection or herniated diaphragm. It was not possible in this study to determine why some animals evolve with hernia and others

do not, since we showed that the lesion size was not statistically significant as for the occurrence of diaphragmatic hernia or protection. Many questions are still to be answered. It is still difficult to understand the natural evolution of perforating injuries to the thoracoabdominal transition zone.

In conclusion, there was a predominance of healing of the right hemidiaphragm injury, yet the size of the initial injury did not influence the occurrence of liver protection or hernia.

R E S U M O

Objetivo: avaliar a evolução natural do ferimento diafragmático à direita após a retirada cirúrgica de uma porção do hemidiafragma. **Métodos:** os animais foram submetidos à ressecção de uma porção do hemidiafragma à direita através da laparotomia mediana. Foram operados 40 ratos. As variáveis analisadas foram: herniação, proteção hepática, cicatrização, lesão persistente do diafragma, avaliação da tomografia computadorizada, frequência cardíaca e peso. **Resultados:** foram analisados 40 ratos. Houve duas mortes no pós-operatório. Dezesete animais tiveram herniação (42,5%) e 23 (57,5%), não. Analisando emprego da tomografia computadorizada na avaliação da hérnia diafragmática, tivemos um método com boa sensibilidade (78,6%), boa especificidade (90,9%) e boa acurácia (86,1%) quando comparados com a necrópsia. **Conclusão:** houve predomínio de cicatrização do hemidiafragma à direita e o tamanho da lesão inicial não influenciou na ocorrência de proteção hepática ou hérnia em ratos.

Descritores: Cirurgia Torácica. Cicatrização. Diafragma. Experimentação Animal. Hérnia Diafragmática Traumática. Traumatismos Torácicos.

REFERENCES

- Leppäniemi A, Haapiainen R. Occult diaphragmatic injuries caused by stab wounds. *J Trauma*. 2003;55(4):646-50.
- Von Bahten LC, Smaniotta B, Kondo W, Vasconcelos CN, Rangel M, Laux GL. Papel da laparoscopia no trauma abdominal penetrante. *Rev Col Bras Cir*. 2005;32(3):127-31.
- Asensio JA, Demetriades D, Rodriguez A. Injury to the diaphragm. In: Mattox KL, Feliciano DV, Moore EE, editors. *Trauma*. 4th ed. New York: McGraw-Hill; 2000. p.603-32.
- Zantut LF, Ivatury RR, Smith RS, Kawahara NT, Porter JM, Fry WR, et al. Diagnostic and therapeutic laparoscopy for penetrating abdominal trauma: a multicenter experience. *J Trauma*. 1997;42(5):825-9; discussion 829-31.
- Ordog GJ, Wasserberger J, Balasubramaniam S, Shoemaker W. Asymptomatic stab wounds of the chest. *J Trauma*. 1994;36(5):680-4.
- Friese RS, Coln CE, Gentilello LM. Laparoscopy is sufficient to exclude occult diaphragm injury after penetrating abdominal trauma. *J Trauma*. 2005;58(4):789-92.
- Hirshberg A, Thomson SR, Bade PG, Huizinga WK. Pitfalls in the management of penetrating chest trauma. *Am J Surg*. 1989;157(4):372-5; discussion 376.
- Saad Júnior R. E o diafragma? *Rev Col Bras Cir*. 2012;39(5):351-2.
- Perlingeiro JAG. História natural do ferimento diafragmático produzido por agente perfuro-cortante: estudo experimental em ratos [tese]. São Paulo: Santa Casa de São Paulo, Faculdade de Ciências Médicas; 2001.
- Meyers BF, McCabe CJ. Traumatic diaphragmatic hernia. Occult marker of serious injury. *Ann Surg*. 1993;218(6):783-90.
- Feliciano DV, Cruse PA, Mattox KL, Bitondo CG, Burch JM, Noon GP, et al. Delayed diagnosis of injuries to the diaphragm after penetrating wounds. *J Trauma*. 1988;28(8):1135-44.
- Shanmuganathan K, Killeen K, Mirvis SE, White CS. Imaging of diaphragmatic injuries. *J Thorac Imaging*. 2000;15(2):104-11.
- Reber PU, Schmied B, Seiler CA, Baer HU, Patel AG, Büchler MW. Missed diaphragmatic injuries and their long-term sequelae. *J Trauma*. 1998;44(1):183-8.
- Israel RS, Mayberry JC, Primack SL. Diaphragmatic rupture: use of helical CT scanning with multiplanar reformations. *AJR Am J Roentgenol*. 1996;167(5):1201-3.
- Chiu WC, Shanmuganathan K, Mirvis SE, Scalea TM. Determining the need for laparotomy in penetrating torso trauma: a prospective study using triple-contrast enhanced abdominopelvic computed tomography. *J Trauma*. 2001;51(5):860-8; discussion 868-9.
- Boulanger BR, Mirvis SE, Rodriguez A. Magnetic resonance imaging in traumatic diaphragmatic rupture: case reports. *J Trauma*. 1992;32(1):89-93.
- Giannini JA, Rasslan S, Silva LE, Coimbra R, Saad Júnior R. Ferimentos penetrantes tóraco-abdominais e de tórax e abdome: análise comparativa da morbidade e da mortalidade pós-operatórias. *Rev Col Bras Cir*. 1998;25(5):297-304.
- Mariadason JG, Parsa MH, Ayuyao A, Freeman HP. Management of stab wounds to the thoracoabdominal region. A clinical approach. *Ann Surg*. 1988;207(3):335-40.
- Saad Júnior R, Gonçalves R. Toda lesão do diafragma por ferimento penetrante deve ser suturada? *Rev Col Bras Cir*. 2012;39(3):222-5.
- Perlingeiro JA, Saad R Jr, Lancelotti CL, Rasslan S, Candelária PC, Soldá SC. Natural course of penetrating diaphragmatic injury: an experimental study in rats. *Int Surg*. 2007;92(1):1-9.
- Shatney CH, Sensaki K, Morgan L. The natural history of stab wounds of the diaphragm: implications for a new management scheme for patients with penetrating thoracoabdominal trauma. *Am Surg*. 2003;69(6):508-13.

22. Ivatury RR, Simon RJ, Weksler B, Bayard V, Stahl WM. Laparoscopy in the evaluation of the intrathoracic abdomen after penetrating injury. *J Trauma*. 1992;33(1):101-8; discussion 109.
 23. Dureuil B, Cantineau J, Desmots JM. Effects of upper or lower abdominal surgery on diaphragmatic function. *Br J Anaesth*. 1987;59(10):1230-5.
 24. Gonçalves R. Análise da evolução natural das feridas pérfuro-cortantes equivalentes a 30% do diafragma esquerdo. Estudo experimental em ratos [dissertação]. São Paulo: Santa Casa de São Paulo, Faculdade de Ciências Médicas; 2008.
 25. Rivaben JH, Saad Júnior R, Dorgan Neto V, Botter M, Gonçalves R. História natural do ferimento diafragmático extenso à direita: estudo experimental em ratos. *Rev Col Bras Cir*. 2014;41(4):267-71.
 26. Cameron EW, Mirvis SE. Ruptured hemidiaphragm: unusual late presentation. *J Emerg Med*. 1996;14(1):53-8.
 27. Crandall M, Popowich D, Shapiro M, West M. Posttraumatic hernias: historical overview and review of the literature. *Am Surg*. 2007;73(9):845-50.
- Received at: 16/02/2015
Accepted for publication: 15/05/2015
Conflict of interest: none.
Source of funding: none.
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Evaluation of liver regeneration diet supplemented with omega-3 fatty acids: experimental study in rats

Avaliação da regeneração hepática com dieta suplementada com ácidos graxos ômega-3: estudo experimental em ratos

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A B S T R A C T

Objective: to evaluate liver regeneration in rats after partial hepatectomy of 60% with and without action diet supplemented with fatty acids through the study of the regenerated liver weight, laboratory parameters of liver function and histological study. **Methods:** thirty-six Wistar rats, males, adults were used, weighing between 195 and 330 g assigned to control and groups. The supplementation group received the diet by gavage and were killed after 24h, 72h and seven days. Evaluation of regeneration occurred through analysis of weight gain liver, serum aspartate aminotransferase, alanine aminotransferase, gamma-glutamyltranspeptidase, and mitosis of the liver stained with H&E. **Results:** the diet supplemented group showed no statistical difference ($p>0.05$) on the evolution of weights. Administration of fatty acids post-hepatectomy had significant reduction in gamma glutamyltransferase levels and may reflect liver regeneration. Referring to mitotic index, it did not differ between period of times among the groups. **Conclusion:** supplementation with fatty acids in rats undergoing 60% hepatic resection showed no significant interference related to liver regeneration.

Key words: Hepatectomy. Liver Regeneration. Fatty acids. Fatty acids, Omega-3.

INTRODUCTION

The early evolution of liver surgery was in 1716, with the partial liver resection in a trauma patient. However, the first successful liver resection was performed in 1888 by Langenbuch and the technique of vascular control, with great improvement on the procedure, was introduced by Pringle in 1908¹.

In the last decades, the surgical safety increased considerably because of new techniques, new equipment and materials, reducing the morbidity and mortality of patients submitted to hepatectomy².

In recent years elements involvement on liver regeneration process took place on the scenario, such as the hepatocyte growth, the alfa growth transformer and the epidermal growth of fibroblasts, which determine mitogen stimulus affecting other liver cells³.

The regeneration of the liver is a cellular phenomenon that confers special responsiveness to injurious stimuli. It differs from other types of regeneration. Under normal circumstances, the liver remains with a very low basal cell renewal, where the average lifetime of an adult hepatocyte ranges from 200 to 300 days. After hepatectomy

happens quick increase levels of interleukin 6 (IL-6) and tumor necrosis factor (TNF- α)⁴.

It is known that the nutritional status of the patient influences of the regenerative capacity of the liver, as well as, it has an important role in the nutritional regulation, metabolization, distribution and use the nutrients⁵. The changes in the nutritional status of patients with cirrhosis, especially the malnutrition, may contribute to the low resistance to infections, fluid retention and delayed healing, increasing morbidity and mortality after surgical procedures⁶.

Some specific nutrients, denominated pharmaconutrients, showed in clinical and laboratory studies to have ability to modulate the immune and inflammatory responses in animals and humans. Among them can be cited: arginine, glutamine, fatty acids and nucleotides⁷.

The use of diets enriched with fatty acids showed benefits on liver regeneration in rats that were submitted at partial hepatectomy of 90%⁸. Thus, it is interesting to study the relationship between supplemented immunonutrition diet with fatty acids and liver regeneration. Reduction of pro-inflammatory cytokines and increase expression of cytokine, as anti-inflammatory agent, can

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retard the process of acute liver failure and can promote the liver regeneration process⁸.

The objective of this study was to evaluate liver regeneration after 60% partial hepatectomy in rats with and without action of diet supplemented with fatty acids evaluating regenerated liver weight, laboratory parameters of liver function and histological findings.

METHODS

This study was approved by the Ethics Committee and Animal Experimentation, Universidade Estadual do Maranhão, São Luis, MA, Brazil under protocol 036/12. It were used 36 Wistar rats (*Rattus norvegicus albinus*, Rodentia mammalia), males, adults, weighing between 195 and 330 g. The survey was conducted in the laboratory of experimental surgery of the Federal University of Maranhão. The animals were accommodated three for cage receiving water and standard ration for species (Purina[®]Labina), at temperatures of 23±2°C, in a cool environment, without noise and dark/light cycle at 12/12 hours. It were randomly divided in two groups of 18, and all of them were submitted the same hepatectomy.

The first was the control group; the animals received oral nutrition in adequate quantities for their species, age and weight. To determine this amount, an experiment was done for 24 hours where the rat was fed freely, weighting the feed before administration and also at the end. It is noteworthy that at the end of 24 hours the ration was weighed again including the rest that was deposited at the bottom of the cage. Thus, it was obtained the exact amount that the animal would consume in a day. After knowing this value, the control group was fed daily with this amount of ration, and water added with saline solution (1ml/100g) freely.

In the second group, besides being fed with ration, was administered 15 minutes before the surgical procedure 1ml/100g of lipid emulsion 10%, with the formulation: (10%), carboxymethyl cellulose(0,2%), Tween (50%), distilled water q.s.p (100%). The equal dose was taken every 24h until the date of death, administered by gavage to ensure full administration of the nutrient; what characterized each subgroup was the time of preoperative supplementation on 24h, 72h and seven days.

The weight control was performed in the beginning of the experiment after acclimatization and daily at pre- and postoperative phases. The measurements were used in order to perform the calculation of diet daily doses to be supplemented.

The liver resection was standardized according to the animal weight and liver weight. This was established after test in four rats out of study. They were weighed and defined the average weight. After it, they were anesthetized, sacrificed and their livers removed for weighing and set the ratio rat/liver. After the completion of the cavity,

they liver was located and then was made the hepatic resection ligament. The resected segment was weighed on a precision balance. The calculation of the weight-based regeneration was done by Kwon⁹: % of regeneration = $D/E \times 100$ (D =liver weight per 100g of animal weight on the day of death; $E = R/0,7$; E = the estimated resected liver per 100g before hepatectomy, which is calculated by the weight of the resected liver (R)).

The resected liver lobes were preserved in 10% formalin and later sent for histopathologic study, staining the histological sections by H&E. The analysis was performed by a single pathologist blinded to the study groups. After the surgical procedure, each rat was placed alone in a cage for recovery from anesthesia and kept in ambient air until full recovery. Postoperative analgesia was made with application of 0.1 ml dipyrone 500 mg/ml, intramuscularly in the left hind limb.

Six hours after surgery, they had free access to water, food; after 12 hours, they were put at the same conditions of temperature and light as in preoperative phase. Weight, behavioral conditions and appearance of the surgical wound were checked-out daily.

In each subgroup was collected 4ml of blood from caudal vena cava, placed in a test tube for analysis of: albumin, total protein, globulin, total direct and indirect bilirubin, urea, creatinine, AST, ALT, gama-GT, glucose and alkaline phosphatase.

For statistical analysis, the data were analyzed using SPSS for Windows 20 (2011). Initially it was done the Shapiro Wilk normality test, and only the initial weight of rat variables, percentage of late liver regeneration, glucose, creatinine and alkaline phosphatase showed normal distribution ($p < 0,05$). The remaining distributions were asymmetric ($p > 0,05$). In the variables with normal distribution was applied multivariate analysis of variance (MANOVA) with two factors (group and time) and, after, the Tukey test to post-hoc comparison over time. In the variables that did not showed normal distribution, the nonparametric Mann-Whitney test to evaluate the effect of time was applied. The significance level for rejecting the null hypothesis was 5%, it was considered as significant value of $< 0,05$.

RESULTS

In the omega-3 group, one animal died within the first 24 hours after operation. When the initial weights of the liver and the liver resected fragment were analyzed, they were comparable ($p < 0,05$) (Table 1).

Evaluating the results of liver weight gain in relation to time of death, using the formula of Kwon⁹, it was observed that there was no difference between the group and the control ($p \geq 0,05$) (Table 2).

It was made the evaluation of liver function in relation to groups by laboratory parameter settings. It was observed alterations of gama-GT in both groups (Table 3).

However, the omega-3 group showed lower levels compared with the control ($p < 0,05$).

When performed the control group and comparison on mitotic number (Table 4), the results showed no differences between the two groups ($p = 0,215$). On the days of death, both control and omega-3 group, showed no significant differences ($p > 0,05$) (Figures 1 e 2).

DISCUSSION

The use of pre- and postoperative supplementation in rats, in this study, was based on clinical and experimental evidence that it can interfere beneficially in liver regeneration but not clearly understood^{7,10}. The daily supplementation in this experiment was performed by gavage to ensure that the correct administration of the dietary doses, calculated by the weight of the animal, was done. Problems with this process in animal models, such stress by the procedure in itself or injury to the mouth, esophagus and stomach are described. Through previous training, use of sedation and standardization of the procedure, the gavage could be performed safely without noticeable complications. To reduce the risk of regurgitation, the rat was maintained with cephalic portion in higher position after gavage.

Several studies have shown benefit from the use of supplementation with arginine, fatty acids and nucleotides

in the reduction of infectious complications and the time of hospital stay in critical and surgical patients¹¹⁻¹³.

The process of liver regeneration after being triggered can be evaluated by several methods: liver weight, number of mitosis, components of deoxyribonucleic acid, synthesis rate of nuclear antigens, immunohistochemistry, gene expression, changes in serum protein levels, serological tests, enzymatic determination of proliferation markers and flow cytometry¹⁴.

It was observed using the formula of Kwon for the weight gain evaluation, there was no difference between and control group ($p > 0,05$), as it can be observed in table 2. The variable weight was not different in either group (both the control group and the group supplemented with fatty acids) for 24h, 72h and seven days. This fact is consistent with the literature showing that the weight in perioperative nutrition is not superior to the one in preoperative period, considering group without nutritional deficits¹⁵.

In the evaluation of liver regeneration by laboratory tests between groups (table 3), only gama-GT showed significant differences ($p > 0,05$) and was observed that in the group it was even in a lower level.

Statistical analysis of the values obtained for total protein, albumin and globulin between the groups showed no significant difference. Serological reference values considered in this study were similar to those obtained in the control group.

Table 1 - Evaluation of the initial liver weight and percentage of hepatectomy between the control and omega-3 group.

Group	Control		Omega 3		p
	N	Median	N	Median	
Initial liver weight	18	4,8	18	5,4	0,141
% of hepatectomy	18	51,5	18	56,6	0,181

Teste of Mann-Whitney in relation to group.

Table 2 - Analysis of the percentage of liver regeneration using the Kwon⁹ formula.

Group	Time	N	Median	Mean rank	p
Control		18	101.5	19.1	0.715
	24 h	6	1.1	5.3	
	72 h	6	80.0	8.8	
	7 dias	6	144.1	14.3	
Omega-3		18	78.9	17.9	0.086
	24 h	6	0.2	5.7	
	72 h	6	115.8	12.2	
	7 dias	5	81.0	10.7	

Test of Kruskal-Wallis in relation to group

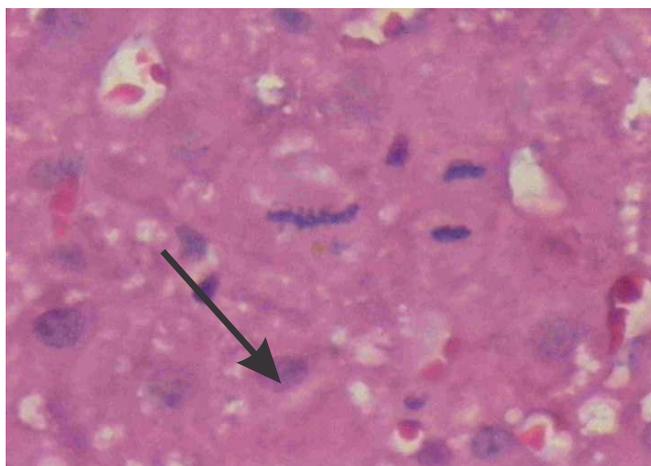
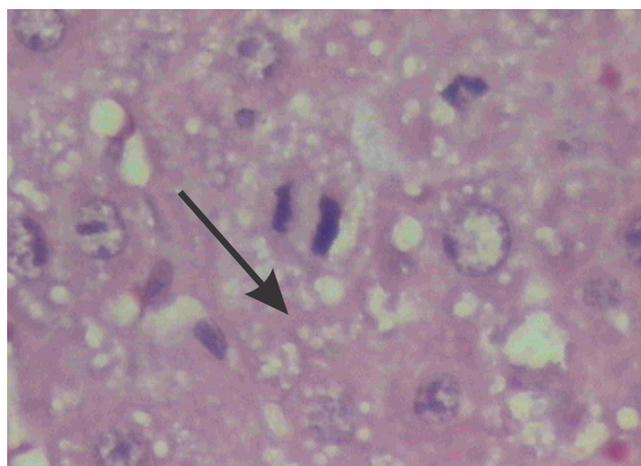
Table 3 - Evaluation of liver regeneration by laboratory tests between control groups and omega-3 group.

Group	Control		Omega 3		p
	N	Median	N	Median	
Urea (mg/dl)	18	54.0	17	53.0	0.684
AST (U/l)	18	243.5	17	314.0	0.118
ALT (U/l)	18	164.5	17	155.0	0.443
Gama-GT (U/l)	18	5.0	17	3.0	0.025
Total protein (g/dl)	18	1.3	17	1.3	0.684
Albumin (g/dl)	18	0.9	17	0.9	0.525
Globulin (g/dl)	18	0.4	17	0.4	0.546
Total bilirubin (mg/dl)	18	0.9	17	0.9	0.546
Indirect bilirubin (mg/dl)	18	0.3	17	0.3	0.083
Direct bilirubin (mg/dl)	17	0.6	17	0.6	0.339

Test of Mann-Whitney

Table 4 - Analysis of mitosis.

Group	Time	N	Median	Mean rank	p
Control		18	4.0	20.1	0.215
	24 h	6	7.5	10.3	0.088
	72 h	6	10.5	12.4	
	7 days	6	2.0	5.8	
Omega-3		17	3.0	15.8	
	24 h	6	2.5	9.1	0.105
	72 h	6	4.5	11.8	
	7 days	5	1.0	5.5	

**Figure 1** - Photomicrograph of liver section from group stained with H&E: presence of mitosis (arrow).**Figure 2** - Photomicrograph of liver section from control group stained by H&E: presence of mitosis (arrow).

Some biochemical tests can also be used to observe the hepatic profile as dosage ALT, AST, AST/ALT, gama-GT, alkaline phosphatase, prothrombin time, bilirubin and albumin. However severe liver disease can still have normal liver enzyme levels, or cause changes of 1.5 to three times above the reference levels^{16,17}.

The counting of mitosis process stained by H&E is one of the most commonly used parameters for evaluation of liver regeneration by being easy to replicate at low cost and thus is considered the reference method for experimental studies¹⁴. For evaluation of liver regeneration, assessed by mitotic index in this study, it was found no alterations among 24h, 72h and seven days groups.

The administration of fatty acids in rats after partial hepatectomy of 60% in 24h, 72h and seven days

periods of observation did not play a significant role in liver regeneration.

R E S U M O

Objetivo: avaliar a regeneração hepática em ratos submetidos à hepatectomia parcial de 60% com e sem ação de dieta suplementada com ácidos graxos ômega-3 através do estudo ponderal do fígado regenerado, parâmetros laboratoriais da função hepática e estudo histológico. **Métodos:** foram usados 36 ratos machos, distribuídos em dois grupos: grupo controle e grupo ômega-3. Cada um foi subdividido em mais três subgrupos com óbito em 24h, 72h e sete dias. O grupo ômega-3 recebeu água e dieta padrão suplementada com emulsão lipídica de ácidos graxos ômega-3 a 10% e o controle solução fisiológica a 0,9%. Em todos os subgrupos foi feita análise da regeneração hepática através da fórmula de Kwon, estudo da função hepática: dosagem de AST, ALT, gama-GT, bilirrubina total, bilirrubina indireta e indireta e albumina, e análise de mitose celular pela coloração de Hematoxilina-Eosina. **Resultados:** o grupo com dieta suplementada não apresentou diferença estatística ($p>0,05$) quanto à evolução dos pesos. Administração de ácidos graxos ômega-3 pós-hepatectomia mostrou que os níveis de gama-GT tiveram redução significativa, podendo refletir na regeneração hepática. Na avaliação do índice mitótico não houve diferença entre os momentos estudados. **Conclusão:** a suplementação com ácidos graxos ômega-3 em ratos submetidos à ressecção hepática a 60% não apresentou papel expressivo relacionados à regeneração do fígado.

Descritores: Hepatectomia. Regeneração Hepática. Ácidos graxos. Ácidos Graxos Ômega-3.

REFERENCES

- Coelho JCU, Claus CMP, Machuca TN, Sobottka WH, Gonçalves CG. Liver resection: 10-year experience from a single institution. *Arq Gastroenterol.* 2004;41(4):229-33.
- Torres OJM, Pantoja PB, Barbosa ES, Melo LAL, Miranda Filho AR, Coelho JC. Ressecções hepáticas: experiência inicial e resultados cirúrgicos a médio prazo. *ABCD, arq bras cir dig.* 2004;17(1):3-7.
- Michalopoulos GK. Liver regeneration. *J Cell Physiol.* 2007;213(2):286-300.
- Zimmermann A. Regulation of liver regeneration. *Nephrol Dial Transplant.* 2004;19 Suppl 4:iv6-10.
- Bianchi G, Marzocchi R, Lorusso C, Ridolfi V, Marchesini G. Nutritional treatment of chronic liver failure. *Hepatol Res.* 2008;38 Suppl 1:S93-S101.
- Merli M, Nicolini G, Angeloni S, Riggio O. Malnutrition is a risk factor in cirrhotic patients undergoing surgery. *Nutrition.* 2002;18(11-12):978-86.
- Heyland DK, Novak F, Drover JW, Jain M, Su X, Suchner U. Should immunonutrition become routine in critically ill patients? A systematic review of the evidence. *JAMA.* 2001;286(8):944-53.
- Qiu YD, Wang S, Yang Y, Yan XP. Omega-3 polyunsaturated fatty acids promote liver regeneration after 90% hepatectomy in rats. *World J Gastroenterol.* 2012;18(25):3288-95.
- Kwon AH, Uetsuji S, Yamamura M, Hioki K, Yamamoto M. Effect of administration of fibronectin or aprotinin on liver regeneration after experimental hepatectomy. *Ann Surg.* 1990;211(3):295-300.
- Tarlá MR, Ramalho F, Ramalho LNZ, Castro e Silva T, Brandão DF, Ferreira J, et al. Cellular aspects of liver regeneration. *Acta Cir Bras.* 2006;21(Suppl 1):63-6.
- Tepaske R, Velthuis H, Oudemans-van Straaten HM, Heisterkamp SH, van Deventer SJ, Ince C, et al. Effect of preoperative oral immune-enhancing nutritional supplement on patients at high risk of infection after cardiac surgery: a randomised placebo-controlled trial. *Lancet.* 2001;358(9283):696-701.
- Braga M, Gianotti L, Nespoli L, Radaelli G, Di Carlo V. Nutritional approach in malnourished surgical patients: a prospective randomized study. *Arch Surg.* 2002;137(2):174-80.
- Waitzberg DL, Saito H, Plank LD, Jamieson GG, Jagannath P, Hwang TL, et al. Postsurgical infections are reduced with specialized nutrition support. *World J Surg.* 2006;30(8):1592-604.
- Assy N, Minuk GY. Liver regeneration: methods for monitoring and their applications. *J Hepatol.* 1997;26(4):945-52.
- Gianotti L, Braga M, Nespoli L, Radaelli G, Beneduce A, Di Carlo V. A randomized controlled trial of preoperative oral supplementation with a specialized diet in patients with gastrointestinal cancer. *Gastroenterology.* 2002;122(7):1763-70.
- Aguiar LRF, Nassif PAN, Ribas CAPM, Czezko NG, Ribas MM, Marinho Júnior CH, et al. Regeneração do fígado após hepatectomia parcial em ratos submetidos à hipertensão portal pós-hepática. *ABCD, arq bras cir dig.* 2011;24(2):144-51.
- Zamin Jr I, Mattos AA, Perin C, Ramos GZ. A importância do índice AST/ALT no diagnóstico da esteatohepatite não-alcoólica. *Arq Gastroenterol.* 2002;39(1):22-6.

Received at: 02/04/2015

Accepted for publication: 30/05/2015

Conflict of interest: none.

Source of funding: none.

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Effect of *Carapa guianensis* Aublet (Andiroba) and *Orbignya phalerata* (Babassu) in colonic healing in rats

Efeito da Carapa guianensis Aublet (Andiroba) e *Orbignya phalerata* (Babaçu) na cicatrização de colorrafias em ratos

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A B S T R A C T

Objective: to evaluate the healing effect of the babassu aqueous extract and andiroba oil on open wounds in the cecum of rats.

Methods: fifty-four Wistar rats were divided into three groups of 18: 1) babassu group with application of aqueous extract of babassu; 2) andiroba group with application of the oil; and 3) control group, with application of saline solution. All procedures were done by gavage. Each group was divided into three subgroups of six animals according to the observation period of 7, 14 or 21 days. From each animal was removed caecum fragment of 1.5cm² diameter. The areas of the lesions were analyzed macroscopically and resected specimens by light microscopy using hematoxylin-eosin and Masson's trichrome. **Results:** abscess and infection were observed in two aroeira group animals, and in one only hematoma. In relationship to adhesions degree, babassu group had higher incidence of grade II while in the control and aroeira groups predominated adhesions grade I. On microscopic examination on day 7 fibroblast proliferation was greater in aroeira and lower in babassu group (p=0.028). On the 14th day polymorphonuclear were less pronounced in babassu (p=0.007). As for the resistance test of air insufflation, it was observed that in all andiroba group in all tested days showed be higher. As for collagen, on the 7th day it was present in 100% of animals of aroeira group. On the 14th day was more pronounced in the control group and at day 21 similar results were found in the control and aroeira groups. **Conclusion:** animals in babassu and andiroba groups showed better cecum healing compared to the control group.

Key words: Rats. Healing. Phytotherapy.

INTRODUCTION

The healing process is similar in all wounds and is based on a complex sequence of events ranging from trauma to injured tissue repair. It consists on a perfect and coordinated cascade of cellular, molecular and biochemical events that are interrelated in order to occur tissue reconstitution¹. Such process can be divided into three phases that temporally and continuously overlap: inflammatory, proliferative or granulation, and remodeling or maturation phases^{1,2}.

The interest in wound healing began in antiquity, with records dating back to 3000-2500 b. C. Among them, honey-based, grease, and flax strings are mentioned as medicine that constituted Egyptian pharmacopoeia^{3,4}.

The record of plant use to cure diseases is also reported in 5.000 years old historical records, in which ancient people used herbs for medicinal purposes. Nowadays, there is a growing interest in herbal medicine, which consists of plant use techniques in the treatment of diseases and health recovery⁵.

Herbal medicines are considered as those obtained with exclusive use of plant active raw materials, whose efficacy and safety are validated through ethnopharmacological surveys, techno-scientific documentation or clinical evidence⁶. The use of plants as therapeutic resources is still underutilized. From 300,000 plants currently known, only 2,000 are used in medicine⁵.

In Brazil, internationally known as having the largest diversified forest reserve in the world, the state of Maranhão is highlighted, not only for having a dense diverse flora, but also by the tradition in research of medicinal plants, having its own herbarium with artisanal production of various products⁷.

The use of herbal medicines in wound healing has been stimulated by the need to find new substances that play an effective role in surgical repair because, although it is a systemic process, favorable local conditions, through appropriate topical therapy stimulating the physiological process, are necessary⁸.

Research on natural products to aid healing has been intensified. Among the various plants with healing

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properties, *Orbignya phalerata* and *Carapa guianensis* Aublet have been widely mentioned in experiments.

Orbignya phalerata (babassu) is found more frequently in the North, Northeast and Midwest regions of Brazil, with more than 50% being concentrated in Maranhão. It has anti-inflammatory and analgesic properties proven in studies⁹. Martins *et al.*, in an attempt to verify its healing action in surgical skin wounds, also noted satisfactory effects on the healing process, through microscopic analysis, in mononuclear variables and collagen fibers¹⁰.

The species *Carapa guianensis* Aublet belongs to the family *Meliaceae*, commonly known as "andiroba". It is mainly found in wetlands and flooded areas, but it can be grown on land. It has physicochemical properties that gives it anti-inflammatory action¹¹⁻¹³. However, Brito *et al.*, when assessing the effect of andiroba oil in open wounds in rats, observed a delay in contraction and epithelialization of wounds, suggesting a possible anti-inflammatory action resulting in a loss during the healing process¹⁴.

It is then necessary to understand the therapeutic effects of *Orbignya phalerata* and *Carapa guianensis* Aublet today in order to expand their use in wound healing.

This study with rats aimed to use both substances in colon wound healing to verify their healing effect.

METHODS

This study was performed at the Experimental Surgery Laboratory of the Universidade Federal do Maranhão, São Luís, MA, Brazil, and complied with animal testing requirements of the Sergio Arouca Law (n° 11.794/2008). It was approved by the Ethics and Animal Experimentation Committee of the Medical School of Veterinary of the Universidade Estadual do Maranhão, protocol n° 039/2012.

Fifty-four Wistar rats, male, aged between 50 to 60 days, with an average weight of 275.64g, were used. The animals were weighed and kept under observation for a seven-day adaptation period prior to the operation. The animals were placed in nine polypropylene cages with a stainless metal grill cover, with six animals per cage, receiving water and species' standard ration ad libitum at 23±2°C, in a noise-free environment, with a light/dark cycle of 12h. They were randomly distributed in three groups with 18 animals: CG (control group), BG (babassu group), AG (andiroba group), which in turn were divided into six subgroups according to the day of death (7th, 14th and 21st).

Preparation of phytotherapics

Aqueous extract of *Orbignya phalerata* (Babassu)

The exsiccate specimen of babassu was cataloged in the Herbarium Ático Seabra of the Universidade Federal do Maranhão. The mesocarp was obtained from mature coconut, which was considered as mature when falling

naturally from bunches. To remove the mesocarp, a wood artifact was used, manually beating the top until the rupture of the shells and after it, with the aid of a spatula, the mesocarp was separated. The material was spread on a bench for three days to dry. After dried, it was placed in a drying oven at a temperature of 45-50°C for 24h in order to complete the total removal of moisture. The mesocarp was subjected to a grinding process in an electric grinder, where a powdery flour was obtained. For the preparation of the aqueous extract, the powder was weighed on an analytical digital balance and diluted in saline solution at 25mg/ml. Chemical analysis has shown it to have starch (68.3%), moisture (14.9%), fiber (2.51%), protein (1.54%), soluble carbohydrates (1.25%), lipids (0.27%) and other substances - amino acids, hemicellulose and pentosans (11.23%)

Carapa guianensis oil (Andiroba)

The oil is a transparent liquid, yellow, with a very bitter taste, which, below 25°C, solidifies as petrolatum (the oil becomes a solid white fat, whose starting point is 22° C and is completed at 28°C). The seeds contain 70% of insect-repelling substances and medicinal oil¹⁵. The traditional extraction process is complex, lasting about two months, and can be divided into three stages: 1) collection, selection of good seeds and a first storage time (3-5 days); 2) bulk preparing by baking the seeds in water (1-3h) and a second storage time (up to 20 days), finishing with the withdrawal of the peel and the kneading of the seeds; 3) extraction of oil by dripping (30 days), placing the bulk on an inclined surface¹⁶.

The sample used in the study was from the city of Arixá, MA, and 50ml were analyzed by the Laboratory of Food and Water Quality Control, at the Department of Chemistry Technology of the Universidade Federal do Maranhão, with the following grease composition: myristic acid (18.1%); oleic acid (58.9%); linoleic acid (9.2%) and palmitic acid (9.3%); and among the non-fatty compounds, triterpenes and tannins stand out, besides two alkaloids, andirobine and carapine.

The andiroba oil is cataloged in the Herbarium Ático Seabra of the Department of Pharmacy of the Biological and Health Science Center of the Universidade Federal do Maranhão, with registration n° 01253.

Surgical procedures

After the seven-day adaptation period, six hours prior to the surgical procedure, animal feed was removed, remaining only free access to water. The animals were anesthetized with an intramuscular injection of 5% ketamine hydrochloride at a dose of 20 mg/kg associated with xylazine 2% at 10mg/kg, with an application made on the posterior side of the animal's thigh. Anesthesia was considered complete when the animal was still, with interdigital and corneal reflexes abolished, normal breathing and pink ends¹⁷.

Surgical technique

After anesthetized, each mouse was placed in decubitus position, immobilized on a wooden plank with containment of the fore and hind limbs; cryoepilation of the upper ventral abdomen with a 4.0cm² area was made; anti-disinfection with topic polyvinylpyrrolidone-iodine 10%; and placed one fenestrated field on the animal, delimiting the surgical area.

The animals underwent cross laparotomy from 1 cm below the xiphoid process, extending 5cm caudally; skin and subcutaneous tissue diuresis using a scalpel blade #15 was made, also in musculoaponeurotic and peritoneum plans entering the abdominal cavity, which was inspected. After identification and exteriorization of the colon, a longitudinal incision with 1cm in length in the anterior wall of the cecum, near the anti-mesenteric line, was made, and separated through four points using a 6-0 polypropylene string in a single plane, cecorrhaphy was made. After this procedure had been done in all groups, each subgroup received by gavage different preparations according to determination prior to the surgical procedure. CG received distilled water in the same volume of the largest of the substances (*andiroba*), AG received *andiroba* oil at a dose of 5ml/kg/dose and BG was treated with aqueous extract of mesocarp of *Orbignya phalerata*, in the dose of 50 mg/kg/body weight, quantifying 0.6 ml. The synthesis of the abdominal wall occurred in two planes with a mononylon 5-0 thread.A

Post-operative

After surgical procedure and recovery from anesthesia, each animal was placed in its cage, with free access to water and food after six hours of the procedure, and packed under the same conditions of temperature and brightness of the pre-operative. The animals were submitted to daily clinical assessment where motor activity, food acceptance, surgical wound and death were observed. It was recorded in an individual protocol until the day of death.

The animals were induced to death on days previously established (7th, 14th and 21st) by a lethal dose of anesthetic, which is four times the standard dose. Subsequently, they were weighed and transferred to the wooden plank.

Macroscopic evaluation

After the death of the animals, the surgical scar was inspected and evaluated for the presence of signs of infection, wall dehiscence, hematoma and fistulas. Then, a laparotomy consisting of two parallel transverse incisions was made, one cranial and one caudal, one in middle-left 1 cm parallel to the median incision and perpendicular to the two transverse incisions, aiming to secure access to the abdominal cavity. Following, the abdominal cavity was examined, looking for findings suggestive of infection, collections, fistulas and adhesions, the latter being classified and reviewed by the Nair score¹⁸. The surgical specimen

containing 2cm above and below the suture was removed (cecum, ascending colon and terminal ileum), not undoing the structures and organs attached to the bowel suture in order not to jeopardize insufflation tests.

Resistance to atmospheric air insufflation test

It consisted on the introduction of silicone tubes #6 in the terminal ileum and fixing them with cotton thread 2-0; connection to pressure gauge and hemostatic graspers at the beginning of the ascending colon; specimen submersion in water; ambient air insufflation at speed of 0.1ml/s until the occurrence of air bubbles, the pressure being recorded at the time of the rupture of the specimen in mmHg (Figures 1 A and B).

Microscopic evaluation

The resected segment was opened on its dorsal wall and divided into fragments, measuring an area with 1.5cm². The inner side of the suture line was turned downwards, fixed in a styrofoam plate with 2cm² using pins. The specimen was fixed in 10% formalin for 48h and sent for histological study, preserved in paraffin blocks and cut with microtome set to thickness of 5 µm and stained with hematoxylin & eosin and Masson trichrome analyzed by a single pathologist. Data obtained from the cecorrhaphy area were classified according to the intensity found and transformed into quantitative variables using an index for the histological finding (0-absent, 1-mild, 2-moderate and 3-severe). The presence of vascular congestion, edema and polymorphonuclear were indicative of an acute inflammatory process (acute phase). The presence of monomorphonuclear, angiogenesis, fibroblast proliferation (fibrosis) and collagenation was indicative of a chronic inflammatory process.

Statistical analysis

Data were evaluated using IBM SPSS Statistics 20.0 statistical software (2011). Initially, numeric variables such as the initial weight, final weight, xylazine, ketamine

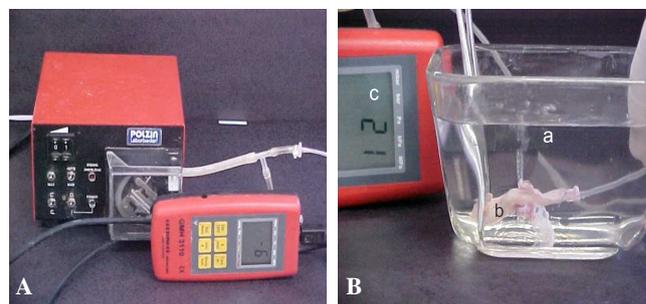


Figure 1 - A) Infusion pump, nelaton probe and electronic manometer; B) clear glass container containing running water (a), moment of the rupture of the colonic anastomosis evidenced by water bubbling (b); rupture pressure measured in mmHg (c).

and maximum tension underwent the Lilliefors normality test, and it was found that none showed a normal distribution. Therefore, these variables were evaluated in relation to the group effect and in relation to days within each group by Kruskal-Wallis analysis and Dunn's *post hoc* test. In histological variables (NAIR, grade, polymorphonuclear, mononuclear, edema, congestion, angiogenesis, fibrosis and collagen), the effect of the group within each day and the effect of the day in each group were evaluated by the nonparametric Kruskal-Wallis test and by the Dunn's *post hoc* test. The association of macroscopic evaluation variables (infection, dehiscence, abscess, fistula, and hematoma) and the location of the rupture with the groups were performed using the Pearson's chi-squared test. In all tests, the significance level (α) was 5%, that is, it was considered significant when $p < 0.05$.

RESULTS

The average weight of the rats in the control group was 279.89 ± 47.01 ; those of the babassu group, 286.11 ± 47.01 ; and those of the andiroba group, 260.94 ± 37.12 . There were no deaths in any of the animals as a result of anesthesia or surgical procedure, as well as due to the use of herbal medicines.

Macroscopic evaluation

No animal showed dehiscence or fistulas; however, the presence of abscess and infection in two animals from the andiroba group were verified, and one had hematoma. No complications in animals of the control and babassu groups were observed.

Regarding the grade of adhesion, the animals of the babassu group had a higher incidence of grade II adhesions, while in the control and andiroba groups grade I adhesions predominated. In the 21st day of the

postoperative period, the control and andiroba groups were similar; however, the babassu group had 100% of their animals with grade II adhesions, with a statistically significant difference (Table 1).

Tensiometric evaluation (resistance to atmospheric air insufflation test)

It was performed in all rats. The rupture of the anastomosis in rats evaluated on the 7th day was 83.3% in the control group, 33.3% in the babassu group and 66.6% in the andiroba group. On the 14th day, the andiroba group predominated (83.3%) and the control and babassu groups were equal (63.3%), while on the 21st day the results were similar. None of the evaluations had statistical significance.

It was found that the animals of the control group had the same number of animals with rupture of an organ distant from the suture and inside the suture area. In the babassu group, most animals had organ ruptures outside the suture lines in any of the evaluated days. On the other hand, in the andiroba group, most animals also had disruption of the organ outside the suture, but, on the 14th day, there was a higher number of animals when compared to other days. None of inter-group evaluations showed a significant difference.

It was observed that the andiroba group, on any of the days evaluated, presented a higher tension, highlighting the 14th day, with a tension of 157.7mmHg. In the babassu group, there was a higher tension on the 7th day, and in the next days the average of its pressures were lower than other groups.

Microscopic evaluation

On the 7th day, the angiogenesis, the mononuclear and polymorphonuclear were more intense in the andiroba, control and babassu group, respectively, a tendency towards significance only considering mononuclear. Regarding fibroblast proliferation, it was

Table 1 - Intergroup evaluation of adhesion grade according to NAIR score on the 7th, 14th and 21st postoperative day.

Group / Day	NAIR	Control	Babassu	Andiroba	p
7	I	3 (50.0)	3 (50.0)	3 (50.0)	0.590
	II	3 (50.0)	2 (33.3)	2 (33.3)	
	III	0 (0.0)	1 (16.70)	1 (16.70)	
14	I	1 (16.7)	2 (33.3)	1 (16.7)	0.308
	II	2 (33.3)	4 (66.7)	4 (66.7)	
	III	3 (50.0)	0 (0.0)	1 (16.7)	
21	0	1 (16.7)	0 (0.0)	1 (16.7)	0.024
	I	4 (66.7)	0 (0.0)	4 (66.7)	
	II	1 (16.7)	6 (100.0)	1 (16.7)	
GERAL	0	1 (5.6)	0 (0.0)	1 (5.6)	
	I	8 (44.4)	5 (27.8)	6 (33.3)	
	II	6 (33.3)	12 (66.7)	9 (50.0)	
	III	3 (16.7)	1 (5.6)	2 (11.1)	

higher in the andiroba group and smaller in the babassu group, with a statistically significant difference ($p=0.028$) (Table 2). HE staining, 400x, Andiroba Group 7 days

In animals on the 14th day, the variables related to acute inflammation and the presence of edema were similar among groups. Polymorphonuclear were less pronounced in the babassu group, with a statistically significant difference ($p=0.007$). The congestion was more pronounced in the control group, followed by the andiroba and babassu groups, with a significant difference between them ($p=0.003$). Fibroblastic proliferation was more intense in the control group, although with a statistical significance only for the babassu group ($p=0.043$). When comparing this variable to control and andiroba groups, no statistically significant difference was observed (Table 2). In the evaluation of the 21st day, none of the variables evaluated in any group showed a statistically significant difference.

Regarding collagenation in the evaluation of the 7th day, it was present in 100% of animals of the andiroba group. On the 14th day, it was more pronounced in the control group, while the babassu group had the lowest quantification. On the 21st day, similar results for the control and andiroba groups were observed.

DISCUSSION

The use of phytotherapies in order to verify its action on the healing of organs and tissues has been frequent, especially in experimental research and in those related to digestive system wound healing^{10,19,20}. In the literature, there are papers related to wound healing in colonic adopting 3, 7 days⁹ and 14, 21 days²⁰. These two herbal medicines are compared because they have common use in our society, with a great popular use and widely distribution in Maranhão.

The choice of monofilament synthetic and non-absorbable polypropylene thread was due to the fact that

non-absorbable materials, in the gastrointestinal tract, are better in promoting healing²¹.

In this study, the healing of the colon was analyzed from four main aspects: macroscopic, determining the mechanical resistance of the scar through atmospheric air insufflation test; histological study of tissue morphology; and the presence of collagen in the wound. Different days of death were used in order to verify changes resulting from the healing process, since each phase has peculiar characteristics.

In the macroscopic evaluation, the NAIR score was used to evaluate the adhesion of intra-abdominal organs, which, although sometimes being difficult and subjective, is a safe, practical and feasible method. In this study, there was no presence of grade IV adhesions in either group. On the 21st day, there was a predominance of grade II adhesions in the animals of the babassu group (100%); the andiroba and control groups had the same results (grade 0- 16.7%; grade I- 66.7%; grade II- 16.7%), with statistical significance. It was observed that the andiroba group showed abscess and infection in 11% of the animals, 5.5% had hematoma, but none showed dehiscence or fistula. However, in the Santos *et al.* paper, which compared the effect of babassu and andiroba in gastric healing, clinical signs of infection or dehiscence were not observed²².

Regarding the animals of the babassu group, there were no signs of infection or abscesses in any of them, as well as absence of fistulas, dehiscence or hematoma, a result better than that observed for Baldez, who found a mild surgical site infection and superficial skin dehiscence⁹.

There are two methods of scar tissue evaluation according to mechanical resistance: resistance of air or water insufflation and linear traction²³. In this study, was chosen to use resistance to air insufflation test because the organ under study is a hollow viscera. Such method is the most suited to the proposal as it is physiological when reproducing pressure vectors that usually are transmitted on the bowel wall resembling the real clinical situation; disruption will occur according to the distention, besides exerting pressure over the entire circumference of the intestinal wall,

Table 2 - Analysis of the presence of several variables among groups (inter-groups).

	Group	Day	Polymorphonuclear	Mononuclear	Edema	Congestion	Angiogenesis	Collagenation	Fibroblast proliferation
7 days	Control	7	Moderate /Severe a	Moderate / Severe a	Moderate	Moderate /Severe	Moderate	Mild	Mild
	Babassu	7	Severe a	Moderate	Moderate	Severe a	Moderate /Severe a	Absent	Absent /Mild
	Andiroba	7	Severe a	Severe a	Moderate	Severe a	Severe a	Mild / Moderate	Mild
14 days	Control	14	Moderate ab	Severe	Moderate	Severe	Moderate	Mild	Mild
	Babassu	14	Absent b	Mild / Moderate	Mild /Moderate	Mild c	Mild b	Absent	Absent
	Andiroba	14	Moderate b	Moderate b	Moderate	Moderate b	Mild / Moderate b	Mild	Mild
21 days	Control	21	Absent /Mild b	Moderate	Mild	Moderate	Mild / Moderate	Absent /Mild	Absent /Mild
	Babassu	21	Mild b	Moderate	Moderate	Moderate b	Mild b	Absent	Absent
	Andiroba	21	Mild /Moderate b	Moderate b	Mild	Moderate b	Mild b	Absent /Mild	Absent /Mild

Different letters mean $p<0.05$ by Dunn's test.

submitting it to seal proof²⁴. It was observed in this experiment, regarding the average of rupture forces, that in the 7th day there was more pressure on andiroba and babassu groups when compared with the control group, showing a better healing for babassu and andiroba groups, but without statistical significance. On the 14th day, there were no significant changes in rupture pressures of surgical wounds. On the 21st day, there was a substantial drop in pressure averages of the andiroba group, but without statistical significance. The resistance to atmospheric air insufflation test is a good and essential parameter for the evaluation of anastomotic integrity in the first days after surgery, while in the late postoperative period it is best evaluated by linear traction²⁵.

Regarding the site of the organ rupture, it was observed that on the 7th day, in the control group, only one animal had organ rupture outside the anastomosis; however, in andiroba and babassu groups, four animals had its colon ruptured distant from the anastomosis, a fact different from that reported by Thornton and Barbul²⁶, in which they posit that only from the second week resistance by anastomosis to the pressure may exceed that of the normal intestinal tissue, and the exhaust gas occurs distant from the anastomosis. On the 14th day, the control and andiroba groups had similar results, and on the 21st day, the results were the same for all groups, where four of the animals ruptured the colon outside the suture lines. Santos *et al.*, in their research on the analysis of atmospheric air insufflation test, the rupture of the stomach occurred in all anastomosis²². Likewise, Batista *et al.* when studying the effect of aqueous extract of babassu in stomach healing, in no animal, in which it was possible to conduct the tensiometric study, occurred air leakage outside the suture lines²⁷.

Inflammation is essential to healing, characterized by increased vascular permeability, chemotaxis of circulating cells and release of cytokines and growth factors. Neutrophils are the first cells to migrate to the injury, being responsible for the removal of foreign matter and dead tissue. Its maximum action occurs around the second day of healing. Polymorphonuclear, represented by macrophages, reach its highest concentration around the third day. The inflammatory phase extends from the occurrence of lesions to the sixth day of healing. In this study, the animals were put to death on the 7th day, as it represents the early wound healing phase - acute phase - characterized by the presence of edema, congestion and polymorphonuclear. The second phase, known as proliferative, begins around the second or third day, extending up to the 14th day. It is characterized by the presence of fibroblasts responsible for collagen production, a very important protein for the cell matrix. It is still possible

to find endothelial cells responsible for angiogenesis and myofibroblasts responsible for wound contraction. The third and final phase is characterized by the deposition of collagen in the wound, starting around the 8th day and extending up to a year and a half.

In attempting to evaluate chronic inflammation parameters (mononuclear cells, angiogenesis, fibroblast proliferation and collagenation), was opted for the death of the other group of animals at the 14th and 21st day after surgery, as this phase is best evaluated in late periods after postoperative.

When comparing acute inflammatory reaction among the groups, polymorphonuclear was higher in the babassu and andiroba groups in relation to the control group when they are compared on the 7th day, with a decrease in the last days of evaluation, but without statistical significance. This fact is explained because, in this time, the initial phase of wound healing occurs, also known as inflammatory phase. Andy Petroianu *et al.*, when evaluating the effect of vitamin C and hydrocortisone in the intestinal anastomotic healing, found that in animals subjected only to vitamin and in those who received vitamin and hydrocortisone on the 5th day after surgery there was the presence of inflammatory infiltrate consisting of polymorphonuclear and vascular congestion²⁸. On the 14th day, the signs of congestion were more evident in the control group, with a statistical significance.

The signs of chronic inflammation increase over days after injury in detriment of acute signs of inflammation. Mononuclear, representing chronic inflammation, were more pronounced on the 7th day, both in the babassu and andiroba groups, revealing a possible effect of the aqueous extract of babassu. Baldez, when studying the action of the aqueous extract of babassu in colon healing in rats, showed similar results⁹.

Experiments show a direct association between the healing efficiency and the number of fibroblasts and collagen fibers, the main structural component of granulation tissue²⁹. It was observed in this study that fibroblast proliferation, angiogenesis and collagenation were more pronounced on the 7th day after surgery in the babassu and andiroba groups when compared to the control group; there was a decrease in the 14th and the 21st day. Nunes Jr *et al.*³⁰ report that collagen synthesis reaches its peak on the 7th and 14th day, but from the 3rd day it is already possible to see fibroblasts and collagen in suture areas, fact proved by their experiment babassu using in the healing of the linea alba on the 3rd and 7th days.

In conclusion, the animals in babassu and andiroba groups showed better colorraphy healing when compared to the control group.

R E S U M O

Objetivo: avaliar o efeito cicatrizante do extrato aquoso do babaçu e do óleo de andiroba em feridas abertas no ceco de ratos. **Métodos:** cinquenta e quatro ratos Wistar foram divididos em três grupos de 18: 1) grupo babaçu, com aplicação do extrato aquoso de babaçu; 2) grupo andiroba, com aplicação do óleo; e 3) grupo controle, com aplicação de solução salina. Todos os procedimentos foram feitos por gavagem. Cada grupo foi dividido em três subgrupos de seis animais conforme o período de observação, aos 7, 14 ou 21 dias. De cada animal foi retirado fragmento do ceco com 1,5cm² de diâmetro. As áreas das lesões foram analisadas por macroscopia e os segmentos ressecados das feridas por microscopia ótica em colorações de hematoxilina-eosina e tricrômico de Masson. **Resultados:** foram verificados abscesso e infecção em dois animais do grupo andiroba, e um com hematoma. Quanto ao grau de aderências, o grupo babaçu teve maior incidência de aderências grau II enquanto que no grupo controle e andiroba predominaram aderências grau I. Na análise microscópica no sétimo dia a proliferação fibroblástica foi maior no grupo andiroba e menor no grupo babaçu ($p=0,028$). No 14º dia os polimorfonucleares foram menos acentuados no grupo babaçu ($p=0,007$). Quanto ao teste de resistência à insuflação de ar atmosférico observou-se que o grupo andiroba em qualquer dos dias avaliados apresentou maior tensão. Quanto à colagenização, no sétimo dia, ela esteve presente em 100% dos animais do grupo andiroba. No 14º dia foi mais acentuada no grupo controle e no 21º dia resultados semelhantes para o grupo controle e andiroba. **Conclusão:** os animais dos grupos babaçu e andiroba apresentaram melhor cicatrização do ceco em comparação ao grupo controle.

Descritores: Ratos. Cicatrização. Fitoterapia.

REFERENCES

- Campos ACL, Borges-Branco A, Groth AK. Cicatrização de feridas. ABCD, arq bras cir dig. 2007;20(1):51-8.
- Isaac C, Ladeira PRS, Rego FMP, Aldunate JCB, Ferreira MC. Processo de cura das feridas: cicatrização fisiológica. Rev Med. 2010;89(3/4):125-31.
- Mandelbaum SH, Di Santis EP. Cicatrização: conceitos atuais e recursos auxiliares: parte I. An Bras Dermatol. 2003;78(4):393-410.
- Silva MI, Ribas Filho JM, Malafaia O, Nassif PAN, Ribas MM, Varaschim M, et al. A utilização da *Pfaffia glomerata* no processo de cicatrização de feridas da pele. ABCD, arq bras cir dig. 2010;23(4):228-33.
- Palharin LHDC, Figueiredo Neto E, Camargo-Lopes MP, Bosquê GG. Efeitos fitoterápicos e homeopáticos da babosa. Rev Científ Eletrôn Agron. 2008;7(14).
- Brasil. Agência Nacional de Vigilância Sanitária. Resolução - RDC Nº 14, de 31 de março de 2010. Dispõe sobre os requisitos mínimos para o registro de medicamentos fitoterápicos. Diário Oficial da União, 5 abr 2010. [Citado 2014 17 nov]. Disponível em: <http://portal.anvisa.gov.br/wps/wcm/connect/321990042cf06e79b57dfafbcb188c8f/Resolu%C3%A7%C3%A3o+RDC+n%C2%BA+4+de+30+de+janeiro+de+2014.pdf?MOD=AJPERES>.
- Malafaia O, Campos ACL, Torres O, Goldenberg S. Os fitoterápicos e seu potencial na cicatrização. Acta Cir Bras. 2006;21(3):1.
- Coelho JM, Antonioli AB, Silva DN, Carvalho TMMB, Cury-Pontes ERJ, Odashiro AN. O efeito da sulfadiazina de prata, extrato de ipê roxo e extrato de barbatimão na cicatrização de feridas cutâneas em ratos. Rev Col Bras Cir. 2010;37(1):45-51.
- Baldez RN. Análise da cicatrização do cólon com uso do extrato aquoso da *Orbignya phalerata* (Babaçu) em ratos. Acta Cir Bras. 2006;21(2):31-8.
- Martins NLP, Malafaia O, Ribas Filho JM, Heibel M, Baldez RN, Vasconcelos PRL. Análise comparativa da cicatrização da pele com o uso intraperitôneo de extrato aquoso de *Orbignya phalerata* (babaçu): estudo controlado em ratos. Acta Cir Bras. 2006;21(3):66-75.
- Orellana BJP, Kobayashi ES, Lourenço GM. Terapia alternativa através do uso da andiroba. Lato & Sensu. 2004;5(1):136-41.
- Pereira MRNP, Tonini H. Fenologia da andiroba (*Carapaguianensis*, Aubl., meliaceae) no sul do estado de Roraima. Ciênc Florestal. 2012;22(1):47-58.
- Nayak BS, Kanhai J, Milne DM, Swanston WH, Mayers S, Eversley M. Investigation of the wound healing activity of *Carapa guianensis* L. (Meliaceae) bark extract in rats using excision, incision and dead space wound models. Larchmont. J Med Food. 2010;13(5).
- Brito NMB, Silva PRF, Silva GCF, Caselia SFM, Sampaio ARS, Carvalho RA. Avaliação macroscópica de feridas cutâneas abertas, em ratos, tratadas com óleo de andiroba. Rev para med. 2001;15(2):17-22.
- Lorenzi H. Árvores brasileiras: manual de identificação e cultivo de plantas arbóreas nativas do Brasil. São Paulo: Instituto Plantarum; 2002.
- Mendonça AP, Ferraz IDK. Óleo de andiroba: processo tradicional da extração, uso e aspectos sociais no estado do Amazonas, Brasil. Manaus. Rev Acta Amazon. 2007;37(3):353-64.
- White PF, Johnston RR, Eger EL. Determination of anesthetic requirement in rats. Anesthesiology. 1974;40(1):52-7.
- Nair SK, Bhat IK, Aurora AL. Role of proteolytic enzymes in prevention of postoperative intraperitoneal adhesions. Arch Surg. 1974;108:849-53.
- Garros IC, Campos ACL, Tâmbara EM, Tenório SB, Torres OJM, Agulham MA. Extrato de *Passiflora edulis* na cicatrização de feridas cutâneas abertas em ratos: estudo morfológico e histológico. Acta Cir Bras. 2006;21(3):55-65.
- Santos OJ, Barros Filho AKD, Malafaia O, Ribas Filho JM, Santos RHP, Santos RAP. *Schinus Terebinthifolius* Raddi (Anacardiaceae) no processo de cicatrização de gastrorrafias em ratos. ABCD, arq bras cir dig. 2012;25(3):140-6.
- Thornton FJ, Barbul A. Cicatrização no trato gastrointestinal. In: Barbul A. Cicatrização das feridas. Tradução de Giuseppe Taranto. Rio de Janeiro: Interlivros; 1977.
- Santos OJ, Malafaia O, Ribas Filho, Marcondes J, Czczeko NG, Santos RHP, et al. Efeito do *Schinus Terebinthifolius* Raddi (aroeira) e *Carapa guianensis* aublet (andiroba) na cicatrização de gastrorrafias. ABCD, arq bras cir dig. 2013;26(2):84-91.
- Nomura LM, Ribas Filho JM, Malafaia O, Dietz UA, Skare TL, Kume MH. Processo cicatricial de sutura em ceco com os fios polipropilene, poliglicaprone 25 e glicomer 60 em ratos. ABCD, arq bras cir dig. 2009;22(2):82-8.
- Ballantyne GH. Intestinal suturing: review of the experiment foundations for traditional doctrines. Dis Col Rect. 1983;26(12):836-43.
- Gottrup F. Healing of incisional wounds in stomach and duodenum: a biomechanical study. Am J Surg. 1990;140(2):296-301.

26. Thornton FJ, Barbul A. Healing in the gastrointestinal tract. *Surg Clin of North Am.* 1997;77(33):549-73.
27. Batista CP, Torres OJM, Matias JEF, Moreira ATR, Colman D, Lima JHF. Effect of extract of *Orbignya phalerata* (babassu) in the gastric healing in rats: morphologic and tensiometric study. *Acta Cir Bras.* 2006;21:26-32.
28. Petroianu A, Rocha CG, Alberti LR, Costa AMC. *Rev Col Bras Cir.* 2001;28(6):404-7.
29. Nitz AC, Ely JB, d'Acampora AJ, Tames DR, Corrêa BP. Estudo morfométrico no processo de cicatrização de feridas cutâneas em ratos, usando: *Coronopus didymus* e *Calendula officinalis*. *Arq Catarin Med.* 2006;35(4):74-9.
30. Nunes Junior JAT, Ribas Filho JM, Malafaia O, Czezko NG, Inácio CM, Negrão AW. Avaliação do efeito hidroalcoólico de *Schinusterebinthifolius Raddi* (aroeira) no processo de cicatrização da Línea Alba de ratos. *Acta Cir Bras.* 2006;21(3):8-15.

Received at: 15/03/2015

Accepted for publication: 18/05/2015

Conflict of interest: none.

Source of funding: none.

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Construction and validation of a surgical skills assessment tool for general surgery residency program

Construção e validação de um instrumento de avaliação de habilidades técnicas para programas de residência em cirurgia geral

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A B S T R A C T

Objective: To develop and validate an instrument for measuring the acquisition of technical skills in conducting operations of increasing difficulty for use in General Surgery Residency (GSR) programs. **Methods:** we built a surgical skills assessment tool containing 11 operations in increasing levels of difficulty. For instrument validation we used the face validity method. Through an electronic survey tool (Survey MonKey®) we sent a questionnaire to Full and Emeritus members of the Brazilian College of Surgeons – CBC – all bearers of the CBC Specialist Title. **Results:** Of the 307 questionnaires sent we received 100 responses. For the analysis of the data collected we used the Cronbach's alpha test. We observed that, in general, the overall alpha presented with values near or greater than 0.70, meaning good consistency to assess their points of interest. **Conclusion:** The evaluation instrument built was validated and can be used as a method of assessment of technical skill acquisition in the General Surgery Residency programs in Brazil.

Key words: Medical Residency. General surgery. Medical Education. Training programs.

INTRODUCTION

A good medical General Surgery Residency (GSR) program is one that forms skilled surgeons capable of providing the best possible medical care to the population, wherever they operate, in big cities or outside them. For that training to be appropriate and the results satisfactory, there needs to be a structured and balanced curriculum, with objectives defined at different stages of specialized training, which should include an extensive breakdown of theoretical knowledge and an equal opportunity for all residents to develop the technical skills essential to the surgeon¹, since "failure is not an option"².

Assessments should occur at the end of each period or year of training so that one knows if the resident can proceed to a more advanced training stage. At the end of the residency, a judicious assessment of technical skills should be mandatory so that certification can be granted to a competent professional, able to offer patients excellence in care and to independently exercise his/her duties³, pursuant to Specialist Title⁴ that will be granted by law at the end of the program in Brazil.

In 1872, in Germany, Theodore Billroth had already recognized the need of some form of more complete assessment to the general surgeon beyond the cognitive dimension, since even a great theoretical

knowledge is not warranty of technical skill⁵. Much has been published about evaluation. In the view of Satava et al., there is a deficiency in the field of evaluation of surgeons' performance and technical skill⁶. To Bhatti, there is no reliable and objective single test able to assess all the details involved in the competence of a surgeon³.

One can interpret the evaluation in various forms, and all its methods have strengths and weaknesses. The word comes from Latin *a + valere* and means to assign a value to the studied object. It implies to judge, to appraise. When it comes to students, residents in the case, assessment is almost synonymous with verification or measurement⁷. In one of his many ideas, to evaluate is to compare and to classify according to criteria defined by an evaluation instrument. When evaluating technical skills it is necessary to have a set standard⁸ (criterion-referenced assessment), whose outcome may be favorable or not to the performance of who is being evaluated⁹. The importance of the assessment certainly does not end in the result obtained; but when it comes to obtaining the Specialist Title, to meet the criteria for "certification" is the ultimate goal.

Most of the evaluation tests used today purports to the assessment of knowledge and for that, among others, multiple-choice tests are very good. When done carefully, with elaborate options, they are able to assess theoretical knowledge, but they do not evaluate the physician's ability

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to examine a patient (clinical competence) or perform an operation (surgical skills). Alone, they do not allow attesting the performance of a surgeon¹⁰.

So far there is no single test that includes the evaluation of all the requirements needed to test technical skills, allowing to conclude whether the surgeon is competent or not. Surgical performance can be assessed through direct observation in the operating room by means of a simulator, through videos, by OSATS (Objective Structured Assessment of Technical Skill)⁸, and even oral tests, by asking the resident to describe an operation¹¹. As positive points we can say that they are safe, have credibility and validity, but few are directed to specific aspects of the procedures, some are unaffordable for some hospitals, others require a long time to apply, and require a very large apparatus, such as video recordings, multiple testing stations or simulators.

Technical skill is the psychomotor domain of knowledge, is the "set of acquired practices, especially by demonstration, repetition and critical reworking, which provide the surgeons with expertise know-how along with the ability to make decisions and solve issues in their field", and includes accuracy and error prevention. These capabilities are very difficult to be measured¹². Ericsson et al. support the hypothesis that the specialist is developed by an intense and efficient training program¹³. The psychomotor domain development is achieved through movement repetition. This means that the greater the number of times the resident performs a given operation, the more he/she will develop manual dexterity, until automation is reached, when movements are performed without thinking about them.

Only in the last decade there has been a greater emphasis on evaluation of manual dexterity, motivated perhaps by the perception of educators that "innate talent", the quality that makes the resident need a lot fewer repetitions to achieve excellence, is a rare genetic peculiarity, and for those who lack it, rigorous training is key, with movements repetition in a greater number of times until the future surgeon can be considered competent, which is achieved with a large volume of operations¹⁴.

Bhatti and Cummings³, citing Miller, propose that the acquisition of surgical competence is based on four stages. For this demonstration, they used a pyramid with a wider base. At the bottom is the "knowing" that corresponds to knowledge (cognition), which is necessary to reach the next stage. In the fourth and final stage is what the individual "actually does", and is where the surgeon effectively demonstrates his/her performance. In surgery, it means practical performance, knowing how to perform the operation³.

In the regulation of GSR programs by the National Commission of Medical Residency (Brazil) there is no standard tool for technical skill assessment, either during or at the end of the programs⁴. In a thus formatted system, it is assumed that at the end of the program the resident

will be able to receive the Specialist Title, even if one is not aware of how many and what kind of operations the resident performed during the training period. There is no performance assessment that enables the identification of strengths and weaknesses of the training process so that the program can be improved, or which ratifies the decision not to certify the resident if he/she does not meet the predetermined standards.

Therefore, the aims of this study were to build a tool to assess the technical ability to GSR programs residents in conducting operations of increasing difficulty, and validate the instrument with General Surgery specialists, Full and Emeritus Members of the Brazilian College of Surgeons (CBC).

METHODS

Based on the most prevalent diseases in the context of daily General Surgery exercise, present in most hospitals that house GSR programs across the country, whether in universities or not, we developed an instrument including 11 operations at increasing levels of difficulty (Table 1), considered by the CBC General Surgery specialists as indispensable for those who will receive the General Surgery Specialist Title, and a questionnaire with four questions for each operation to assess the technical ability when performing them (Table 2). Among the eleven procedures proposed, three were considered of little difficulty, six of medium difficulty and two, great difficulty.

Validation consisted of two parts, the first related to the operations' degree of difficulty (Table 1), and the second, specific, considering particularities of each operation (Table 2). The questionnaire was constructed with closed answer questions, the options being: agree, when the experts were in agreement with the scale of the operations difficulty degrees and with the ability of the criteria to demonstrate skill when performing the operation; and disagree, when they thought otherwise.

We used face validation method, one in which a group of people connected to the area of interest of what is being validated judges whether that instrument is able to evaluate what it proposes. Through an electronic research tool (Survey MonKey®), we sent a questionnaire to Full and Emeritus members of CBC of all Brazilian states, all bearers of the CBC Specialist Title. The number of experts was based on a simple random sample, with sampling error not exceeding 5% according to proportional stratified sampling, where N = 1329 represented the total of Surgeons registered with the CBC as general surgeons and n = 307 showing the minimum number of surgeons to be consulted. We sent the emails in three distinct stages. Between the first and second delivery there was an interval of 30 days, and between the second and the third, the interval was 15 days.

For the analysis of the data collected, we used Cronbach's alpha to determine the internal consistency of responses or the average correlation of items in a survey instrument, to assess its reliability. We performed the analysis with the complete number of observations for each operation. For some procedures, we could not calculate the coefficient due to the almost absolute occurrence of concordant answers for the relevant questions (almost 100% agreement).

This work was presented to the Ethics in Research Committee at the Hospital Universitário Clementino Fraga Filho - UFRJ under the number 115,032 and was approved on October 4th, 2012.

RESULTS

Of the 307 questionnaires sent, we received 100 responses. We considered usable the responses that followed the alternatives: "agree" or "disagree". In some cases, it was necessary to eliminate the answer to a question because it did not meet the established criteria.

We observed that for almost all operations the global alpha coefficients presented with values near or greater than 0.70, a good expression of internal consistency to assess the matters of interest (Table 3). Only the procedure "colostomy" had an alpha below the 0.70 average, 0.62. We then withdrew the item considered inconsistent (Table 2), this operation retaining three assessment items, and the alpha coefficient increased to 0.69. Therefore, the test showed that all the operations-related questions were consistent and can be applied with reliability.

DISCUSSION

The changes taking place in general surgery practice, new technologies that require greater skills for

the domain, the social demands on patients safety and the legal prohibitions on animal training have required new behaviors when training and evaluating General Surgery residents.

In GSR the lack of an assessment tool of technical skill development can sometimes compromise the outcome of residents performance evaluations, since in most cases these refer only to knowledge (cognitive domain) and behavior (affective domain)³. The use of indicators such as hospital stay, postoperative complications, mortality, presence of foreign bodies left in patients, iatrogenic injuries and dehiscence are part of some competency assessment protocols, but are not suitable for technical skill assessment *per se*^{12,13}.

Building an instrument to assess gain in technical skills is not an easy task, and passes through several stages. Everyone involved in the education of future general surgeons may question what operations are essential to know how to perform, and in what number, for the resident to be considered a specialist.

In this work, the operations were arbitrarily chosen to be part of everyday life for all general surgeons practicing in urban centers or outside of them, and were judged by other specialists (members of the Brazilian College of Surgeons) as representing increasing levels of execution difficulty, and indispensable for those who receive a Specialist Title. The evaluation criteria for each of the procedures were also considered important, meaning the resident who performs them properly can be considered competent in carrying out that specific operation.

The most common form of data collection is the use of questionnaires. With the advent of computers, the electronic scientific research has increased enough to be a facilitating factor¹⁵. It offers many advantages, low cost, eliminates the embarrassment of a personal interview and favors a large sample. As disadvantages, there are the lack of understanding of those who read the questionnaire, the difficulties of internet access, and the main, the low response rate, as stated by several authors¹⁶⁻¹⁸. The literature states that these rates can vary between 13 and 35%¹⁵⁻¹⁸. In this work, the index was 32.6%, which is within the acceptable for this type of research.

To validate is to deem correct, true. There are different validation levels: face validity, content validity and criterion-related validity¹⁹⁻²¹. The face one was chosen, which, being simpler, is usually the first validation method to be used in a study²¹. Validation is a general measure, and although it is considered by many as weak evidence, does not make it incorrect. It is the kind in which a test is evaluated by a group of selected people involved in that study field, who state that that test is able to assess what it has set to assess. In other words, a test has face validity when it "seems" to measure what it is intended to measure. It can be used alone or as a first step to validation of an instrument, and researchers assume that the results are representative of reality. In our case, it means that the list

Table 1 - Operations proposed for evaluation, according to the degree of difficulty.

Degree Difficult	Operation
Small	Inguinal Herniorrhaphy Gastrostomy
Medium	Incisional Herniorrhaphy Colostomy Enterectomy Laparoscopic Cholecystectomy Biliodigestive derivation Partial gastrectomy Partial colectomy
Great	Simple Hepatectomy Distal Pancreatectomy

Table 2 - Specific content of the technical skills assessment tool.**Validation of specific criteria of performance evaluation for each procedure****Inguinal Herniorrhaphy**

- Correctly identifies the structures corresponding to the inguinal ligament, conjoint tendon, inguinal triangle?
- Properly identifies the anatomical relations with the femoral vessels?
- Properly handles the hernia sac?
- Properly Fixes the mesh?

Gastrostomy

- Properly incises the abdominal wall for Gastrostomy?
- Chooses a suitable gastric segment for positioning of the catheter?
- Properly fixes the catheter to the stomach?
- Properly fixes the catheter to the abdominal wall?

Incisional Herniorrhaphy

- Properly prepares the aponeurosis for fixing the mesh?
- Properly fixes the mesh? (adequate distance from the aponeurotic edges, adequate distance between stitches)
- Properly handles the contents of the hernia sac?
- Properly handles the hernia sac?(resection of excess, base ligation, possibility of use of the excess for abdominal cavity insulation)

Colostomy

- Chooses the correct abdominal wall spot for colostomy positioning?
- Exercises caution not to let the colon in tension?
- Incises the colon in proper extension?
- Adequately performs the lateral colostomy? (early maturation)*

Enterectomy

- Properly uses linear staplers for suture of small bowel resection?
- Properly uses intestinal clamps?
- Properly performs manual entero-enteric anastomosis?
- Observes the care required for the success of the anastomosis. (angles' stitches, vascularization, tension on suture line)

Laparoscopic Cholecystectomy

- Performs the first abdominal puncture with the due care?
- Recognizes the anatomical repairs for surgical safety? (dissection along the gallbladder, Calot's Triangle exposure, exposure of junction of cystic duct and choledocus)
- Properly dissects the gallbladder pedicle (cystic duct, choledocus, cystic artery)
- Uses cautery with the required caution? (low current, away from the main biliary tree area)

Biliodigestive derivation with jejunum

- Appropriately chooses the bowel segment for anastomosis? (proper distance to excluded loop)
- Properly incises biliary tree and bowel loop?
- Properly performs the anastomosis? (no tension)
- Appropriately positions the cavity drain?

Partial Gastrectomy

- Recognizes stomach's vascular pedicles? (left gastric and celiac trunk; right gastric, left and right gastroepiploic, short vessels)
- Recognize stomach's anatomical divisions?
- Adequately performs vascular ligatures? (type of suture, type of ligature)
- Adequately performs the reconstruction of transit? (Roux-en-Y, B I or B II, submucosal hemostasis, equal distance from the edges).

Partial Colectomy

- Recognizes anatomical landmarks and vascular pedicle of segment to be resected.
- Adequately performs vascular ligatures?
- Properly uses linear and circular staplers?
- Adequately performs anastomosis for the reconstruction of the transit? (repairs in the angles, extramucosal suture, mesenterium position, absence of tension)

Simple Hepatectomy

- Correctly recognizes the liver vascularization landmarks?
- Adequately performs digitoclasis, ligatures and resection?
- Recognizes the intrahepatic ducts and ligates them separately?
- Adequately uses the different methods for hemostasis? (monopolar current, ultrasonic, argon scalpel, biological glues, etc.)

Distal Pancreatectomy

- Properly recognizes and dissects planes for access to the pancreas?
- Properly identifies splenic artery and vein?
- Adequately performs parenchymal suture?
- Adequately treats the pancreatic duct?

* Item withdrawn from the questionnaire after validation by experts.

Table 3 - Cronbach's alpha coefficients for each of the 11 operations evaluated.

Operation	Number of responses	Cronbach's alpha coefficient
Inguinal Herniorrhaphy	99	0.69
Gastrostomy	98	NP
Incisional Herniorrhaphy	97	0.85
Colostomy	97	* 0.62
Enterectomy	98	0.89
Laparoscopic Cholecystectomy	97	0.76
Biliodigestive derivation	94	NP
Partial gastrectomy	96	0.67
Partial colectomy	97	NP
Simple Hepatectomy	96	0.93
Distal Pancreatectomy	98	0.98

* After exclusion of the fourth evaluation item of this operation, the alpha coefficient went on to 0.69.

NP: not processed due to absolute agreement of answers.

of chosen operations is representative of the increasing levels of complexity, and that the questions on them may indicate the technical skill of the evaluated resident when performing them¹⁹⁻²¹.

The use of this questionnaire was considered practical and objective by addressing specific aspects of the procedures. Another advantage is that there was no high cost involved in its application.

In conclusion, to certify a Specialist in General Surgery is a big responsibility. We believe that improving evaluation methods translates commitment to improving

the care provided and to provide the population with the quality care it deserves. The built assessment tool was validated and can be used as a method of evaluation of technical skill gain in the Medical Residency Program in General Surgery in Brazil.

Acknowledgments

Our thanks to the Brazilian College of Surgeons for providing the National list of Full and Emeritus Members, and to the Specialists who responded to the questionnaire.

R E S U M O

Objetivo: construir e validar um instrumento para aferir a aquisição de habilidades técnicas na realização de operações de graus crescentes de dificuldade para ser utilizado na Residência Médica em Cirurgia Geral (RMCG). **Métodos:** foi construído um instrumento de avaliação de habilidades cirúrgicas contendo 11 operações em níveis crescentes de dificuldade. Para a validação do instrumento foi usado o método de validação de face. Por meio de uma ferramenta de pesquisa eletrônica (Survey MonKey®) um questionário foi enviado para membros Titulares e Eméritos do CBC de todos os estados brasileiros, portadores de Título de Especialista pelo CBC. **Resultados:** Dos 307 questionários enviados foram recebidas 100 respostas. Para a análise dos dados coletados foi utilizado o teste alfa de Cronbach. Observou-se, de uma forma geral, que os alfas globais se apresentaram com valores próximos ou superiores a 0,70, expressando uma boa consistência interna das perguntas para avaliar os respectivos aspectos de interesse. **Conclusão:** O instrumento de avaliação construído foi validado e pode ser usado como um método de avaliação da aquisição de habilidade técnica na Residência Médica em Cirurgia Geral no Brasil.

Descritores: Residência Médica. Cirurgia Geral. Educação Médica. Programas de Treinamento.

REFERENCES

1. Grantcharov TP, Bardram L, Funch-Jensen P, Rosemberg J. Assessment of technical surgical skills. *Eur J Surg.* 2002;168(3):139-44.
2. Panait L, Larios JM, Brenes RA, Fancher TT, Ajemian MS, Dudrick SJ, et al. Surgical skills assessment of applicants to general surgery residency. *J Surg Res.* 2011;170(2):189-94.
3. Bhatti NI, Cummings CW. Competency in surgical residency training: defining and raising the bar. *Acad Med.* 2007;82(6):569-73.
4. Brasil. Ministério da Educação [homepage na Internet]. Regulação da Residência Médica [acesso em jul 2014]. Disponível em <http://www.mec.gov.br>.
5. O'Shea JS. Becoming a surgeon in the early 20th century: parallels to the present. *J Surg Edu.* 2008;65(3):236-41.
6. Satava RM, Gallagher AG, Pellegrini CA. Surgical competence and surgical proficiency: definitions, taxonomy and metrics. *J Am Coll Surg.* 2003;196(6):933-7.
7. Luckesi CC. Avaliação da aprendizagem escolar: estudos e proposições. 19ª ed. São Paulo: Cortez; 2008.
8. Martin JA, Regehr G, Reznick R, MacRae H, Murnaghan J, Hutchison C, et al. Objective structured assessment of technical skill (OSATS) for surgical residents. *Br J Surg.* 1997;84(2):273-8.
9. Fried GM, Feldman LS. Objective assessment of technical performance. *World J Surg.* 2008;32(2):156-60.
10. Cheung MT, Yau KK. Objective assessment of a surgical trainee. *ANZ J Surg.* 2002;72(5):325-30.
11. Faurie C, Khadra M. Technical competence in surgeons. *ANZ J Surg.* 2012;82(10):682-90.
12. Mendes OM. Avaliação formativa no ensino superior: reflexões e alternativas possíveis [acesso em jul 2013]. Disponível em: http://www.proiac.uff.br/sites/default/files/avaliacao_formativa_olenir.pdf
13. Ericsson KA, Nandagopal K, Roring RW. Toward a science of exceptional achievement: attaining superior performance through deliberate practice. *Ann N Y Acad Sci.* 2009;1772:199-217.
14. Sooriakumaran P. Is UK surgical training in crisis? A trainee's perspective. *Int J Surg.* 2004;2(2):127; discussion 128-9.
15. Coleman JJ, Esposito TJ, Rozycki GS, Feliciano DV. Early subspecialization and perceived competence in surgical training: are residents ready? *J Am Coll Surg.* 2013;216(4):764-71; discussion 771-3.
16. Barbosa EF. Instrumentos de coleta de dados em pesquisas educacionais [acesso em jul 2014]. Disponível em: http://www.tecnologiadeprojetos.com.br/banco_objetos/%7B363E5BFD-17F5-433A-91A0-2F91727168E3%7D_instrumentos%20de%20coleta.pdf
17. Vieira HC, Castro AE, Schuch Júnior VF. O uso de questionários via e-mails em pesquisas acadêmicas sob a ótica dos respondentes. XIII SEMEAS Seminários em administração. 2010. [acesso em mai 2012]. Disponível em: <http://www.ead.fea.usp.br/semead//13semead/resultado/trabalhosPDF/612.pdf>.
18. Vasconcelos L, Guedes LFA. E-surveys: vantagens e limitações dos questionários eletrônicos via internet no contexto da pesquisa científica. X SEMEAS, FEA-USP. 2007. [Acesso em jul 2014]. Disponível em: http://www.ead.fea.usp.br/Semead/10semead/sistema/resultado/an_resumo.asp?cod_trabalho=420.
19. Bright E, Vine S, Wilson MR, Masters RS, McGrath JS. Face validity, construct validity and training benefits of a virtual reality TURP simulator. *Int J Surg.* 2012;10(3):163-6.
20. Shuttleworth M. Face validity. [acesso em set 2014]. Disponível em: <https://www.explorable.com/face-validity>.
21. Trochim WMK. Measurement validity types. [acesso em jul 2014]. Disponível em: <http://www.socialresearchmethods.net/kb/measval.php>.

Received at: 30/05/2015

Accepted for publication: 25/07/2015

Conflict of interest: none.

Source of funding: none.

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System to outline the graduate students

Sistema de mapeamento dos egressos

ALBERTO SCHANAIDER¹

A B S T R A C T

Objective: to evaluate the system to outline the graduate students from the Post-Graduate Programs of CAPES Medicine III area. **Method:** it was analyzed the book of indicators and the Document of Area of the Post-Graduate Programs of Surgery, also checking the literature about this issue. **Results:** there was a paucity of data from most of the programs, as regards to the methods for evaluation of graduate students. The current system lacks a standard and an institutional support to outline the graduate students. In the public system there is a concentration of postgraduate students in Medicine; however, they represent a small part of those Brazilians students who finished their graduation courses in Medicine. In the current context, the quest for the post graduate courses and consequently for a research field or even a teaching career, has been replaced by the private sector jobs and the labor market, both in non-academic assistance activities. **Conclusion:** it is imperative to establish not only science and technology innovation policies but also educational and health policies acting harmoniously and stimulating the qualification and the teaching career, improving the post-graduate courses. It is necessary to develop a single form under the institutional guidance of CAPES with the conception of a National Program for Graduate Student in order to consolidate guidelines to mapping the graduate students of post-graduate programs in surgery, in our country.

Key words: Education, Graduate. Educational Measurement. Health Sciences. Students.

INTRODUCTION

In the Brazilian educational system it is necessary to evaluate the profile of student egress of postgraduate programs. It must be know and validate the teaching-learning process considering, primarily, that the impact on teacher and researcher training. The public university is the main responsible for the existing programs in the country and therefore we emphasize its primary commitment on excellence training and qualified teachers. However, in the egress profile must be analyzed the influences inherent to the labor market, although this is not the mister of public universities.

Then, to map the egresses is not limited to the mere accountability. Has the scope of legitimation of knowledge, sanctioned by official and institutional recognition (CAPES / MEC) and is essential to support policy decisions aimed at the quality of training in graduate school, according to the nation's needs. It should be noted that the mapping of the egresses is inserted in the evaluation of Medicine III area programs and is one of the relevant indicators in Sucupira Platform, formerly existing in the CAPES Coleta System. This information is linked to the larger environment, the law that created the National System of Higher Education Evaluation (SINAES)¹.

Thus, in general, the objective of evaluation is: improve the quality of higher education; guide the expansion of its offer; increase in ongoing basis, institutional academic and social effectiveness; deepen commitments and social responsibilities of higher education institutions, through the enhancement of their public mission and promote democratic values, respect for differences and diversities, affirmation of autonomy and institutional identity¹. Understanding this mission means taking responsibility that must be shared by all actors committed to the educational goals for the post-graduate in Brazil.

METHODS

Was analyzed the evaluation form of the Medicine III Area Document looking for the inclusion of the term egress/alumni/graduates in several items/questions/indicators², namely:

Question: Proposal of the program

Item 1.2. Program planning with a view to his future development addressing international challenges of the area in the production of knowledge, its purpose in the best training of their students, their goals as the richest social integration of its egresses, as the area parameters.

1. Professor Titular, Coordenador do Programa de Pós-Graduação em Ciências Cirúrgicas e Chefe do Centro de Cirurgia Experimental do Departamento de Cirurgia da Faculdade de Medicina da UFRJ.

Question: Student body, theses and dissertations

Item 3.3. Quality of theses and dissertations and production of students-authorship graduate and undergraduate (for IES with a graduation in the area) in the scientific production of the program, as measured by publications and other relevant indicators to the area.

Definitions and comment on the Question/Item: is measured primarily by the full articles published by students and program graduates, related to theses and dissertations completed. Indicator 1 - Assess publications involving students or egresses authors (last three years) in the number of graduates (sum of products with student authored the three years/number of postgraduate students in the triennium): $G > 0.6$, $G = 0.40$ to 0.59 , $F = 0.2$ to 0.39 , $P = .10$ -.19, $D < 0.10$ ($G =$ Great, $G =$ Good, $F =$ Fair, $P =$ Poor).

Question: Intellectual production

Item 4.1. Publications of the program by qualified permanent teaching.

Definitions and comment on the Question/Item: takes into account the overall production of the program, ie, the total number of complete articles published in scientific journals by the set of permanent faculty, students and egresses. The quality of the publications parameter is the WebQualis Journal.

VI. Considerations and definitions to notes 6 and 7 - international insertion

1. Skill level, production and performance equivalent to international centers of excellence in human resource training, and the expression of scientific production of the student body.

In relation to the international context of the program, the following international production indicators of teachers will be computed: conducting post-doctoral training of egresses and teachers abroad, preferably with support from funding agencies.

2. Consolidation and national leadership program as a trainer of human resources for research and graduate education.

In this section, the performance of the program in the training of human resources and nucleation of new research groups in other states and regions of the country will be evaluated, and considered the current situation and the history of the program as a trainer of human resources, considering the integration of students and egresses in the research system and graduate.

Thus, in the analysis of expected interest focuses on the evaluation form, by CAPES Indicators Book and the guidelines issued by the MEC/INEP³, stand some priority parameters in the evaluation of the egresses of postgraduate Medicine III area programs¹⁻⁴: intellectual production (technical and quality of research output); social inclusion;

internationalization; training and qualification of the student body; and occupational performance.

RESULTS

In 2008, at the Second National Meeting of Post-Graduate Programs in Health Sciences in Águas de São Pedro, Brazil, Professor Nestor Schor, referencing Velloso⁵ presented egresses destination trained in post-graduate programs in the 90s. The vast majority of doctors (77%) was linked to universities and research institutes, whereas this percentage was reduced to approximately 40% compared to the masters.

The Post-Graduate Program in Surgical Sciences, Department of Surgery, Faculty of Medicine, Federal University of Rio de Janeiro (UFRJ) - the authorization for the operation of the master's and doctoral occurred respectively in the first and second half of 2009 - analyzed their data to the first half of 2014⁴. It was observed that both the teachers and doctors held high concentration of links with the public service (almost 90%), reserving small portion for exclusive private activity (Figure 1). Of that program, about 45% of the doctors exerted teaching activities in medical schools and all had at least a link to the public service.

It is observed that 87% of teachers and 88% of doctors had liaison to public institutions. Among doctors 44% had activities in university teaching, but with double bond (professor and doctor of public service, teaching or private institution and doctor of public service)

The Federal Council of Medicine, in a magnificent study published in 2004⁶, evaluated 8980 questionnaires answered by doctors of all states. It was found that 14% had a master's degree, 6.8% doctor's and 1.3% post-doctor's. The titles were obtained largely in public institutions, predominantly student's in post-doc training overseas (about 60%). Almost 50% of master's students defended their dissertations within 24 months and about 60% of doctoral candidates did it in range between 25 and 48 months. There was dispersion among specialties, and in anyone the choice was greater than 10%. In the three levels (master's, doctoral and postdoctoral) preferences were for General Surgery/Digestive System, Urology and Gynecology/Obstetrics (Figure 2).

DISCUSSION

The search for an effective evaluation system requires constant improvement and adjustment to changes in the contemporary world. Earlier this decade, the INEP³ already advocated that the evaluation process should be a system that allows the integration of the various dimensions of the evaluated reality, ensuring the conceptual coherence, epistemological and practices as

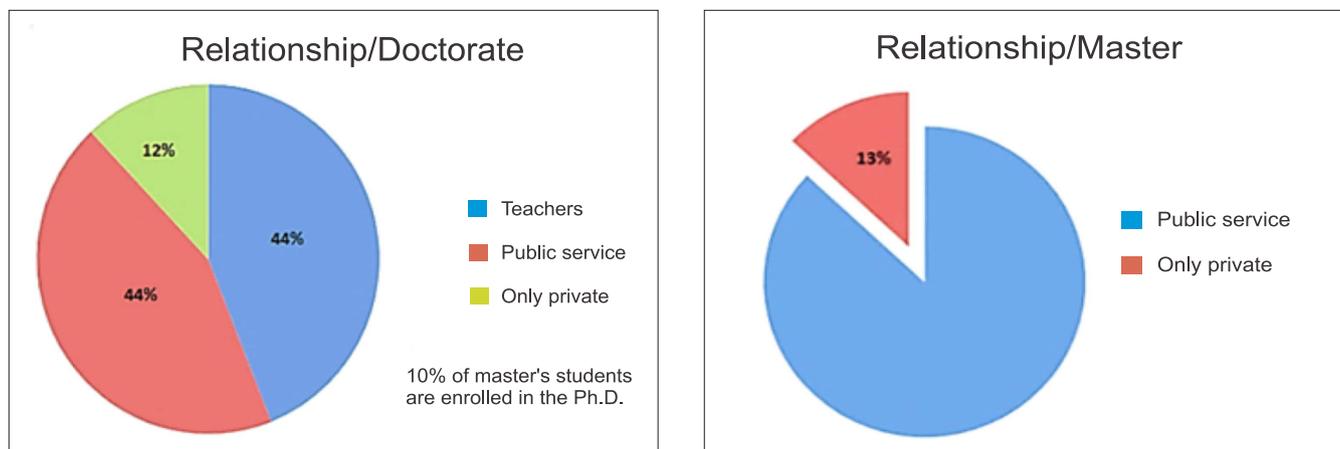


Figure 1 - Distribution of students of the Post-Graduate Program in Surgical Sciences, Federal University of Rio de Janeiro - UFRJ, Rio de Janeiro, RJ, Brazil.

well as achieving the objectives of the various instruments and modalities.

Some considerations are in order regarding the results. Most students who have committed themselves to the doctorate in stricto sensu graduate had teaching vocation. However, competitions for entry into university teaching in public universities are largely absent. Thus, there is migration of several of these graduates to private institutions whose activities are primarily care, where research is poorly developed or inexistent⁷.

It is noteworthy that, a doctoral student enrolled in a graduate program in the medical field usually has around 30 years or more, and has already taken consolidated employment contracts. The lack of policy on higher education to absorb the trained and polished values in public institutions undermines the intention of attending graduate school. In this obstacle add to the absence of incentives characterized by small change of scholarships,

the low pay in the public teaching career and/or browser activity.

In the analyzes of egresses of postgraduate programs is necessary to consider the large volume of medical students of about 250 medical schools in Brazil. Surprises the number of students finishing medical school more concerned with the financial return that comes from the labor market than with continuing education, essential to quality of their training. These results not only for survival issues, but for contingencies of this hot market, with many opportunities for job positions in non-academic assistance activities in the private or public sector, and have seductive remuneration.

It is attested paradigm shift in this third millennium, in which contracts for professional practice, usually in private institutions, have been signed with new graduates without residency. They are not worried about learning new skills that enable them to solve increasingly

Table 1 - Analytical chart in the various postgraduate levels.

	Master	Doctorate	Pos-Doctorate
Degree	14%	6.8%	1.3%
Public (exterior)	89.6% (3.4%)	94.6% (6.0%)	72.7% (61%)
Time			
Till 24 months (m)	46.1%	19.2%	82.7% (34% 1 year)
25 e 36 m	34.2%	25.4%	17.3%
37 e 48 m	13%	37.7%	
More than 49 m	6.6%	17.7%	
Areas (the 10 more. all of them with less than 10%)	General Surgery-6.2% Gyneco/Obstetrics-5.2% Urology-3.6%	General Surgery-5.6% Urology-5.5% Gyneco/Obstetrics-5.1% Otorhino-3.1%	Urology-9.2% Gyneco/Obstetrics-3.8% Digestive System-2.7% Ophthalmo-2.7%

Source: Federal Council of Medicine - CFM data compilation, 2004.

complex problems, in an autonomous, critical and efficient way improving the quality of care⁷. These surgeons are limited to developing technical skills. They use repetitive, nondescript, utilitarian process with emphasis on marketing, aiming projection among peers in highly competitive market, in which ethics and social interface components are less relevant⁷⁻⁸. The lack of better training - which could be supplied by graduate - unfortunately fades. This context results in the limited field of scientific knowledge applied without distinction to the various scenarios of practice and consequential, including the quality of the care service. It is a challenge to be faced by managers of higher public administration in formulating appropriate policies to the training process.

Dias Sobrinho⁹ mentions the necessity to establish the evaluation criteria. Arises therefore the need to deepen the understanding of the profile of egresses, through the development and implementation of research and analysis parameters after discussion with coordinators of the area programs.

Thus, the development of online questionnaire (linked database) in specific worksheet would be very useful tool for programs. However, it has costs and would be recommended institutional financial support in its planning and execution. In addition to the identification data and geographic distribution, the content of this future questionnaire cannot forget information about linking employment (academic or non-academic), the identification of scientific production and regularity of publications and involvement with the research. Such data will be useful to set overview of the training of leaders and nucleation in the country. Thus, the items of a questionnaire could cover more of the following considerations: name; sex; degree obtained in graduate school; current titration; city/state; city/state in which you currently practice professional activities; name and type of institution where currently work, professional activities (public - municipal, state or federal, private, philanthropic); activity (underline): teacher (category), healthcare (specialty), research, administrative, business/industry, office, no linked to the training area, disabled by illness or another important reason, another (to detail); contact the supervisor after the defense (yes or no); publication of the dissertation or thesis (report journal/Qualis); intellectual production after post-graduate with articles indexed in national journal (yes or no) or in international journal (yes or no), patents (yes or no); Lattes update (yes or no); name two most relevant disciplines during the course; assign concept to the work of faculty: Great, Good, Fair, Poor; express opinions about graduate's contribution to the career; number of unanswered forms.

Of course, the contact with the egress will require permanent action of the programs. It should be considered that the Lattes is usually outdated after titration.

Also, it is necessary to remember that any acquisition or data publication should be preceded by the

signing of Informed Consent, according to the ethical principles applicable to voluntary participation, with the right to privacy.

Therefore, the strategy for the successful mapping of the egresses could, briefly, include: registration of egresses and update data for e-mail; periodic Lattes search; national survey of development (or area) online available on the program page, in Sucupira platform, in the form of a database with institutional financial support; national program for egresses done by CAPES.

The evaluation process itself is constantly evolving, *mutatis mutandis*. However, most of the programs have no standardized system for evaluation of alumni, according to the survey of the Indicators Program Book. The development of questionnaires or forms for mapping egresses of postgraduate programs transcends mere verification of data. The clearance of the results, with the necessary self-criticism, will consider values and, above all, assess the actual post-graduate course in Brazil.

Therefore, it is appropriate to generate reflections with our peers, managers, scientific community to have a better result, understanding and contextualization of educational guidelines for our egresses, adding some questions: how many egresses have published their theses and dissertations? There are self-evaluation of program/supervisors of alumni? What is the quality of teachers and doctors trained in post-graduate studies, including professional master degree? In which sectors the professional master competes with academic? What is the total expenditure of resources to form a master, a doctor, or a post-doctor in Brazil? How many egresses exerts only private activities? In these cases, it would be reasonable to establish social retribution, in the face of public spending in this training? How many teachers have chosen not to attend the doctorate and why? How many doctors continued to do research and publish? How many teachers and doctors followed the teaching career? It is necessary educational policy for the absorption of masters and doctors in public university teaching?

In conclusion, know the reality of alumni, in methodical and detailed way, is crucial step for the programs in surgery consolidation. The mapping of the egresses of Medicine III area will require ongoing assessment aligned to dialogue among peers and the strong institutional support. A national program under the aegis of CAPES, responsible for the development of a public domain software, containing assessment questionnaire of egresses, with uniform and systematic criteria, providing mechanism to find the today missing data, is a prerequisite for realization of this goal

There is a need for adoption public health policies, education combined with science, technology and innovation, to reach the egress student and encourage him to entry into the teaching profession - that needs to be valued - adding also strong stimulation for development of scientific research.

R E S U M O

Objetivo: avaliar o sistema de mapeamento dos egressos dos Programas de Pós-Graduação da área Medicina III da CAPES. **Métodos:** compôs-se da análise dos Cadernos de indicadores e do Documento de área dos Programas de Pós-Graduação em Cirurgia e da consulta à literatura sobre o tema. **Resultados:** Constatou-se uma escassez de dados no que tange a avaliação dos egressos, junto a maior parte dos Programas. O sistema vigente para mapeamento de egressos carece de padronização e suporte institucional. Há uma concentração de pós-graduados médicos no sistema público, no entanto, estes representam uma pequena parcela dos alunos formados pelos Cursos de Graduação em Medicina no Brasil. No contexto atual, a procura pela Pós-Graduação e, conseqüentemente, pela pesquisa e carreira docente vem cedendo espaço para as atividades assistenciais não acadêmicas, na iniciativa privada e no mercado de trabalho. **Conclusão:** urge instituir não políticas de Ciência, Tecnologia e Inovação, mas de Educação e Saúde que atuem harmonicamente, estimulem a qualificação e a carreira docente e aprimorem a Pós-Graduação. Faz-se necessária a elaboração de um formulário único, sob a égide institucional da CAPES, por meio da criação de um Programa Nacional de Egressos, objetivando consolidar diretrizes para o mapeamento dos egressos dos Programas de Pós-Graduação em Cirurgia no país.

Descritores: Educação de Pós-Graduação. Avaliação Educacional. Ciências da Saúde. Estudantes.

REFERENCES

- 1) Brasil. Lei nº 10.861, de 14 de abril de 2004. Acessado em: jan 2015. Disponível em: http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/l10.861.htm
- 2) Documento de área 2013. CAPES. Área de avaliação: Medicina III. Acessado em: jan 2015. Disponível em: http://www.capes.gov.br/images/stories/download/avaliacaotrienal/Docs_de_area/Medicina_III_doc_area_e_comiss%C3%A3o_att08deoutubro.pdf
- 3) Brasil. INEP – Avaliação das Instituições de Educação Superior. Acessado em: jan 2015. Disponível em: http://portal.inep.gov.br/superior-avaliacao_institucional.
- 4) Relatório de Avaliação 2010-2012 - Trienal 2013. Área de avaliação: Medicina III. Acessado em: jan 2015. Disponível em: http://conteudoweb.capes.gov.br/conteudoweb/CadernoAvaliacaoServlet?acao=filtroArquivo&ano=2012&codigo_ies=&area=17
- 5) Velloso, J. Mestres e doutores no país: destinos profissionais e política de pós-graduação. Cadernos de Pesquisa. 2004;34(123):583-611.
- 6) Carneiro MB, Gouveia VV. O médico e o seu trabalho: aspectos metodológicos e resultados do Brasil. Brasília: Conselho Federal de Medicina; 2004.
- 7) Schanaider A. O Cirurgião e a atual conjuntura. Rev Col Bras Cir. 2008;35(3):207-9.
- 8) Schanaider A. Exercício da atividade médica. Administração do tempo útil e relação com o trabalho. In: Médico. Profissional diferente. Belo Horizonte: Folium; 2012, v.1, p. 415-24.
- 9) Dias Sobrinho J, Ristoff DI. Universidade desconstruída: avaliação institucional e resistência. Florianópolis: Insular; 2000.

Received at: 18/04/2015

Accepted for publication: 20/05/2015

Conflict of interest: none.

Source of funding: none.

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Device model for training of laparoscopic surgical skills

Modelo de dispositivo para treinamento de habilidades operatórias em laparoscopia

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A B S T R A C T

The authors present a especially constructed, lightweight, collapsible, portable and low cost model device for skills training in laparoscopic.

Key words: Education, Medical. Training/education. Teaching Materials.

INTRODUCTION

The surgeon's skill is fundamentally acquired through continuous practice. The knowledge and the proper training of the surgical technique cannot only improve the experience but also avoid complications in surgical procedures¹.

Despite new surgical techniques such as laparoscopy and robotic surgery, which are important milestones in the history of medicine and surgery, the critical surgical times – dieresis, hemostasis and synthesis – remain unchanged and need to be taught^{2,3}. However, despite the existence of non-organic models, such as virtual simulators and black boxes, these resources are not available to most physicians, training traditionally following an apprenticeship-based model in the operating room, an approach that can be time consuming, costly^{4,5} and unethical due to the potential harm to the patient resulting from the training surgeon's inexperience⁶.

Moreover, the Brazilian surgery training centers, mostly institutions of the public health system, lack funds for investment in educational technologies.

Therefore, based on the importance of surgical technique practical learning, and to facilitate the initial training in developing laparoscopy skills, we created a device model.

DESCRIPTION OF THE DEVICE

This is a device for simulating situations similar to those found in surgery, such as gripping structures, dissection, ligatures and tissues suturing.

The model was built in white acrylic and consists of three faces: front face (1), left lateral face (2) and right lateral face (3), all put together by a set nuts and bolts (4) for ease of transport and portability (Figure 1). All faces have holes (5) for the passage of laparoscopic instruments (Figure 1).

On the front side there are a rectangular opening (6) and a perpendicular support (7) for accommodating tablets and the like, to capture images and indirect

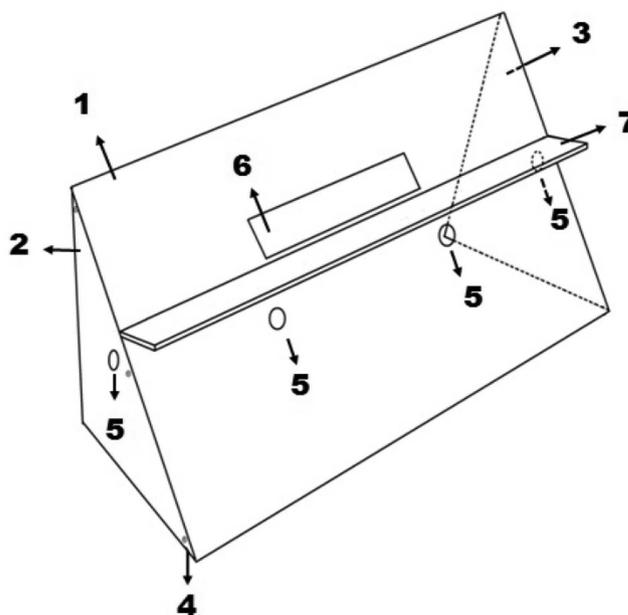


Figure 1 - Training model of laparoscopic skills in perspective.

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visualization of the movements by the practitioner, as occurs in real surgical procedures (Figure 2).

DISCUSSION

The black boxes traditionally known consist of closed or half open containers of wood or plastic, with holes for insertion of instruments and fixed or mobile micro cameras for visual control of the tasks performed with the instruments⁷.

Although there are other inexpensive devices as an alternative to more sophisticated simulators used in large training centers⁸⁻¹¹, we believe such devices have some limitations: they are usually made as heavy containers with large size, rendering transport and mobility difficult; they often require an interior light source, generated by another device or an external light nearby, hampering portability; furthermore, in most cases they require the use of trocars for manipulation of laparoscopic instruments.

Aimed at solving these limitations, we developed the model. Despite lacking its own lighting apparatuses, it requires no exclusive light sources for use, only needing ambient lighting. The traditionally used microcamera follows as an alternative however, it was essentially replaced by the camera of tablets, mobile phones and the like, which, aided by free applications available, even allow one to wirelessly send the images captured in real time to monitors or TV sets, further contributing to the portability and providing vision similar to the actual procedure. As for the holes for insertion of laparoscopic forceps, we found an excellent correlation in their dimensions, capable of avoiding the variation of unwanted linear motion of the instruments shaft caused by the lack of a fixed support point in large holes in relation to the diameter of the forceps and the

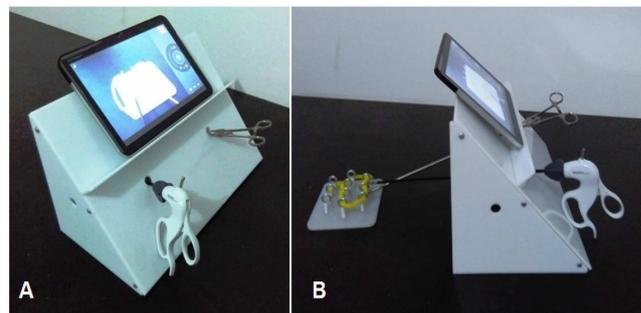


Figure 2 - Representation of the model for training of laparoscopic skills in use. A) model in perspective. B) model in profile.

very limited angular movement in just orifices in relation to the diameter of the instrument. Consequently, we avoided the need of rubber membranes and / or use of trocars, which increase production costs.

The formation of a surgeon is complex, since it requires knowledge of the natural history of the disease, clinical diagnosis, additional exams, the choice of treatment and opportunity of its application, besides mastering the surgical technique to be employed to achieve the ultimate goal, the patient's healing¹².

The creation of the presented model, of low production cost, showed a viable option for purchase by institutions and individuals, proving to be of great value to education and training for those interested in minimally invasive surgery.

Acknowledgements

We thank the Professor José Eduardo Ferreira Manso, for all the support and encouragement with invaluable contribution.

RESUMO

Os autores apresentam um modelo de dispositivo para treinamento de habilidades em laparoscopia de original construção, leve, desmontável, portátil e de baixo custo.

Descritores: Educação Médica. Capacitação/educação. Materiais de Ensino.

REFERENCES

1. Townsend CM, Beauchamp RD, Evers BM, Mattox KL. Sabiston – Tratado de Cirurgia: As bases biológicas da prática cirúrgica moderna. 18ª ed. Rio de Janeiro: Elsevier; 2009.
2. Goffi FS, Tolosa EMC. Operações fundamentais. In: Goffi FS. Técnica cirúrgica: bases anatômicas e fisiopatológicas e técnicas de cirurgia. 4ª ed. São Paulo: Atheneu; 1996. p.52-3.
3. Ethicon n/d. Knot tying manual. New Jersey: Ethicon; 2005.
4. Harrington DT, Roye GD, Ryder BA, Miner TJ, Richardson P, Cioffi WG. A time-cost analysis of teaching a laparoscopic entero-enterostomy. J Surg Educ. 2007;64(6):342-5.
5. Bridges M, Diamond DL. The financial impact of teaching surgical resident in the operating room. Am J Surg. 1999;177(1):28-32.
6. Kohn LT, Corrigan JM, Donaldson MS. To err is human: building a safer health system. Washington, DC: Institute of Medicine; 2000.
7. Undre S, Darzi A. Laparoscopy simulators. J Endourol. 2007;21(3):274-9.
8. Beatty JD. How to build an inexpensive laparoscopic webcam-based trainer. BJU Int. 2005;96(4):679-82.
9. Batista EFN, Batista GAP. Treinamento em videocirurgia - atualização de modelo de "caixa preta" para uso com microcâmera. Rev Bras Videocir. 2006;4(1):21-5.

10. Batista DM, Felzemburgh VA, Matos EP. New experimental model for training in videosurgery. *Acta Cir Bras.* 2012;27(10):741-5.
11. Martins JMP, Ribeiro RVP, Cavazzola LT. White box: caixa para treinamento laparoscópico de baixo custo. *ABCD, arq bras cir dig.* 2015;28(3):204-6.
12. Ebram Neto J, De Paula PR, Celano RMG, Hirose K, Cauduro AB, Speranzini MB. Modelo de dispositivo para treinamento e avaliação das habilidades em técnica operatória. *Acta Cir Bras.* 1998;13(1):58-60.

Received at: 07/07/2015
Accepted for publication: 09/08/2015
Conflict of interest: none.
Source of funding: none.

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Obtention of injectable platelets rich-fibrin (i-PRF) and its polymerization with bone graft: technical note

Obtenção da fibrina rica em plaquetas injetável (i-PRF) e sua polimerização com enxerto ósseo: nota técnica

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A B S T R A C T

The use of autologous platelet concentrates, represent a promising and innovator tools in the medicine and dentistry today. The goal is to accelerate hard and soft tissue healing. Among them, the platelet-rich plasma (PRP) is the main alternative for use in liquid form (injectable). These injectable form of platelet concentrates are often used in regenerative procedures and demonstrate good results. The aim of this study is to present an alternative to these platelet concentrates using the platelet-rich fibrin in liquid form (injectable) and its use with particulated bone graft materials in the polymerized form.

Key words: Platelet-Rich Plasma. Fibrin. Blood Cells. Alveolar Bone Loss.

INTRODUCTION

The search for ways to accelerate new bone formation is a constant in the medical and dental areas. Thus, there has been researched on the influence of blood cells on biomaterials applied in the human body. This evolution stems from the late 1990s in the last century, with the release of platelet-rich plasma (PRP)¹, followed by the second generation of platelet aggregates, platelet-rich fibrin (PRF)², until the recent advanced platelet-rich fibrin clot (a-PRF)³.

These platelet concentrates propose an acceleration in healing of soft and hard tissues by increasing the concentration of growth factors such as transforming growth factor- β (TGF- β), insulin-like growth factor-1 (IGF-1), platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), fibroblast growth factor (FGF), epidermal growth factor (EGF) and platelet-derived epidermal growth factor (PDEGF)⁴⁻⁶.

The use of platelet aggregates in injectable form is widespread, especially in orthopedics⁶ and in plastic surgery⁷, where it was possible to obtain favorable results, but these concentrates use venous blood collection tubes with anticoagulants or separating gel. However, the tubes used in the technique to be presented in this work have no additives that interfere in the process.

Thus, the objective of this technical note is to present a platelet-rich fibrin production alternative for use in liquid (injectable) or polymerized (clot) forms.

I-PRF OBTAINING METHOD

To obtain the i-PRF, blood collection was performed using 9 ml tubes without any additive (Dry Vacutube, Biocon®, Brazil). The blood used for making the i-PRF was donated by the researchers themselves. After collecting three tubes, they were placed in the horizontal centrifuge (B-40, RDE®, Brazil), with a tube filled with water in order to maintain the balance during centrifuging for two minutes at 3300 rpm. Upon termination of this process, it is possible to observe an orange color area in the tube (i-PRF) and the remaining blood materials below (Figure 1). Then, the tubes were opened carefully, to avoid homogenization of the material. We collected 5 ml of i-PRF (Figure 3) from the tubes (Figure 2) using a 20ml syringe (Injex®, Brazil) with a 18G hypodermic needle (Injex®, Brazil).

I-PRF AGGLUTINATION WITH BONE GRAFT

To demonstrate the i-PRF agglutination and to quantify its polymerization time we employed a hydroxyapatite particulate bone graft (Alobone, Osseocon®, Brazil). To prepare this mixture, we used a metal tank for arranging the i-PRF (Figure 4). After five minutes we gradually added bone graft particles (Figure 5). Within 15

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Figure 1 - *i-PRF* obtained after centrifugation.



Figure 2 - *i-PRF* collection in the tube.



Figure 3 - Five milliliters of *i-PRF* obtained after collecting from the tubes.

minutes, it is possible to observe the start of polymerization, the material being ready for use in total time of 20 minutes, and can be removed to perform the bone grafting (Figure 6).

DISCUSSION

Obtaining *i-PRF* was only possible by use of tubes for blood collection without additives, different from the

tubes with clot activators commonly used for the analysis of blood chemistry and in making the PRF⁸. Prior to completion of the technique, tests were conducted with this tube, which contains silica in its walls (clot activator), its presence having been already analyzed, showing no



Figure 4 - *i-PRF* dispensed in the metal tank.



Figure 5 - Slow application of bone graft.



Figure 6 - *i-PRF* polymerized with the bone graft.

cytotoxic effect⁹. With this test, we obtained a fibrin clot in a short centrifugation time, only one minute, using the same spin speed used in the presented method. The blood collection tubes used to obtain i-PRF corroborate the same as described in other studies^{2,3,7,8}, not using anticoagulants, present in other techniques for making platelet aggregates^{1,10}.

The i-PRF is a new alternative to the platelet aggregate to different areas of Medicine and Dentistry, enabling experts to further research this product. Because it is autogenous, it decreases the chances of adverse reactions to the implanted material, especially immune-mediated ones, as with other types of

grafting¹¹, which qualifies it as a viable option in regenerative procedures.

The possibility of bonding of i-PRF with biomaterials for bone grafting creates an alternative to PRP as a platelet aggregate for bone regeneration. PRP is used in regenerative procedures because of the possibility to optimize bone formation¹². The technique presented in this study permits incorporation of the graft without the use of anticoagulants or other additives, thereby forming a well-agglutinated "steak for bone grafting", as shown.

We believe that, with this technique, physicians and dentists may carry out different studies, quickly and simply providing i-PRF for use in liquid or polymerized form.

R E S U M O

A utilização dos agregados plaquetários autólogos é uma realidade inovadora nos procedimentos médicos e odontológicos atualmente. O objetivo deles é promover uma melhor cicatrização dos tecidos moles e duros. Dentre eles, o plasma rico em plaquetas (PRP), é a principal alternativa para a utilização na forma líquida (injetável). Estes agregados plaquetários na forma injetável são frequentemente empregados em procedimentos regenerativos, apresentando bons resultados quando usados. O objetivo deste trabalho é apresentar uma alternativa para estes agregados, através da produção de fibrina rica em plaquetas na sua forma líquida (injetável), e possibilitar sua utilização com materiais particulados para enxertos ósseos na sua forma polimerizada.

Descritores: Plasma Rico em Plaquetas. Fibrina. Células Sanguíneas. Perda do Osso Alveolar.

REFERENCES

- Marx RE, Carlson ER, Eichstaedt RM, Schimmele SR, Strauss JE, Georgeff KR. Platelet-rich plasma: growth factor enhancement for bone grafts. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1998;85(6):638-46.
- Choukroun J, Adda F, Schoeffler C, Vervelle A. Une opportunité en paro-implantologie: Le PRF. *Implantodontie.* 2001;42:55-62.
- Ghanaati S, Booms P, Orlowska A, Kubesch A, Lorenz J, Rutkowski J, et al. Advanced platelet-rich fibrin: a new concept for cell-based tissue engineering by means of inflammatory cells. *J Oral Implantol.* 2014;40(6):679-89.
- Soffer E, Ouhayoun JP, Anagnostou F. Fibrin sealants and platelet preparations in bone and periodontal healing. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2003;95(5):521-8.
- He L, Lin Y, Hu X, Zhang Y, Wu H. A comparative study of platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) on the effect of proliferation and differentiation of rat osteoblasts in vitro. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2009;108(5):707-13.
- Kon E, Filardo G, Di Martino A, Marcacci M. Platelet-rich plasma (PRP) to treat sports injuries: evidence to support its use. *Knee Surg Sports Traumatol Arthrosc.* 2011;19(4):516-27.
- Sclafani AP, Saman M. Platelet-rich fibrin matrix for facial plastic surgery. *Facial Plast Surg Clin North Am.* 2012;20(2):177-86.
- Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part I: technological concepts and evolution. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006;101(3):e37-44.
- O'Connell SM. Safety issues associated with platelet-rich fibrin method. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2007;103(5):587-93.
- Anitua E. Plasma rich in growth factors: preliminary results of use in the preparation of future sites for implants. *Int J Oral Maxillofac Implants.* 1999;14(4):529-35.
- Alijotas-Reig J, Fernández-Figueras MT, Puig L. Inflammatory, immune-mediated adverse reactions related to soft tissue dermal fillers. *Semin Arthritis Rheum.* 2013;43(2):241-58.
- Chen TL, Lu HJ, Liu GQ, Tang DH, Zhang XH, Pan ZL, et al. Effect of autologous platelet-rich plasma in combination with bovine porous bone mineral and bio-guide membrane on bone regeneration in mandible bicortical bony defects. *J Craniofac Surg.* 2014;25(1):215-23.

Received at: 08/05/2015

Accepted for publication: 08/06/2015

Conflict of interest: none.

Source of funding: none.

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