ISSN 0100-6991
ISSN ONLINE: 1809-4546

QUALIS B1 CAPES

CBC

Revista do Colégio Brasileiro de Cirurgiões

Journal of the Brazilian College of Surgeons

Orgão Oficial

COLÉGIO BRASILEIRO DE CIRURGIÕES

Sociedade Brasileira de Hérnia e Parede Abdominal

ENGLISH

Volume 43 • Nº 5
Setembro / Outubro de 2016

www.cbc.org.br

Indexado

DOAJ LILACS PubMed SciELO SJR SCImago Journal & Country Rank SCOPUS

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Revista do Colégio Brasileiro de
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Órgão Oficial do Colégio Brasileiro de Cirurgiões

THE JOURNAL OF THE BRAZILIAN COLLEGE OF SURGEONS is indexed in Latindex, Lilacs and Scielo, Scopus, Medline / PubMed, DOAJ, Free Medical Journals, and sent every two months to all members of the CBC, to its subscribers, to medical institutions, libraries, hospitals and study centers, to publications with which it keeps exchange and to its advertisers.

PUBLISHING, SUBSCRIPTIONS and ADMINISTRATION

Rua Visconde de Silva, 52 - 3º andar - Botafogo - 22271-092 - Rio de Janeiro - RJ - Brasil
Tel.: + 55 21 2138-0659; Fax: + 55 21 2286-2595; E-mail: revistacbc@cbc.org.br
http//www.cbc.org.br

Annual subscription price: R$ 150.00 on spot
or three installments of R$ 60.00
Single/late issues: R$ 40.00
Foreign subscription price: US$ 248.00
Print run: 5,000 copies

International Standard Serial Number
ISSN 0100-6991

ADVERTISING

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

PRINTING AND FINISHING
Gráfica e Editora Prensa Ltda
Rua João Alvares, 27
Saúde - Rio de Janeiro - RJ
Tel.: (21) 2253-8343

GRAPHIC DESIGN
Artur Farias

GRAPHIC DESIGN – COVER
Libertta Comunicação

JOURNAL OF THE BRAZILIAN COLLEGE OF SURGEONS

Indexed in Latindex, Lilacs and Scielo, Scopus, Medline/PubMed, DOAJ and Free Medical Journals

DOI: 10.1590/0100-69912016005001

Visceral artery aneurysms

Aneurismas viscerais

Sergio Silveira Leal Meirelles, TCBC-RJ[1].

The Visceral Artery Aneurysms (VAA), although considered rare for a long time, actually are not so unusual. Their incidence ranges from 1.5 to 3% in the literature and consists of segmental dilatation of the visceral branches of the abdominal aorta. By not presenting with specific characteristic symptoms, they have great clinical importance,since about 22% of them will manifest as a surgical emergency.

Classically, their diagnoses were made during laparotomy for treatment of hemorrhagic acute abdomen. Presently, modern imaging tests allow early diagnosis of visceral aneurysms.

This issue of the Journal of the Brazilian College of Surgeons (CBC) brings three such cases. The splenic artery aneurysm is the most prevalent and may be present in up to 10.4% of autopsies in patients over 60 years. It is most often asymptomatic, and rupture may be the first symptom. Especially prone to rupture are the aneurysms in pregnant women in the 3rd trimester. In the report, the aneurysm is diagnosed during a magnetic resonance angiography of the abdominal aorta, during the investigation of cervical lymphadenopathy in a 51-year-old patient. Although asymptomatic, surgery was indicated since the aneurysm had a diameter of 2.5cm. It was possible to deal with that case with an elective splenectomy.

The hepatic artery aneurysm is the third in frequency among visceral aneurysms. The location is extrahepatic in 80% of cases and intrahepatic in the remaining 20%. Most display a saccular form. The common hepatic artery is the most affected, followed by its right branch, which is the site of the reported aneurysm. In this report, the patient was symptomatic, with abdominal pain and anemia, which made the casemore complex. The diagnosis was only possible with an abdominal computed tomography (CT) and surgery consisted in the ligation of the right hepatic artery. In high-risk patients, as reported, the surgeon would also have the option of using an endovascular technique for selective embolization of that artery.

The third case is of a celiac artery aneurysm rupture caused by Behçet's disease, actually an extremely rare case. Celiac trunk aneurysms account for 4% of visceral aneurysms, the vast majority of patients being asymptomatic. Many are detected on imaging studies performed to investigate other diseases. In such cases, as the authors point out, open surgery with resection of the aneurysm and vascular reconstruction is a good option. One can also employ endovascular treatment with stent implantation or coil embolization. In this case, due to theemergency, it was decided to resect theaneurysm and suture the aorta, which proved to be a good option when facing such a challenge, the patient presenting with a successful recovery after 40 days of hospitalization.

Currently, most VAA can be treated by endovascular methods. The indications are the same as surgery: saccular form, symptoms of expansion or rupture. All pseudoaneurysms should be treated. According to Arno von Ristow, although there are authors who recommend the treatment of asymptomatic truncal VAA from 15mm diameter on, 20mm is the accepted limit;andit is a consensus that non-saccular asymptomatic saccular VAA that have three times the original diameter of the normal native artery require treatment.

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DOI: 10.1590/0100-69912016005014

Reflections on the open abdomen

Reflexões sobre o abdome aberto

Domingos André Fernandes Drumond, TCBC-MG[1].

The Damage Control Surgery required from the surgeon a paradigm shift, which previously aimed at the definitive treatment of injuries and closure of the abdominal cavity at all costs.The abdominal compartment syndrome, unappreciated and belatedly recognized until then, was certainly the catalyst factor of bad evolution of many trauma patients. Leaving the abdomen open in damage control surgery reignited the importance of the compartment syndrome and softened the impact of this occurrence. It is the good side of the story.

The damage control, a good expression coined by Rotondo *et al*.[1], in 1993, and borrowed from the US Navy, was seen as a simple resource, performed by any surgeon at any hospital. From the results and documented experience, we see that it is not so. Damage control and open abdomen are not as simple as they look decision. We enter the mature phase of performing these procedures, but there is a lot of learning ahead.

There is no denying the importance of liver bleeding control through liver packing. It is also understandable to be fast to control bleeding and contamination of the agonized patient. The benefit of scheduled laparotomies also seems clear in unstable patients with multiple injuries and too prolonged surgical time to definitely correct all injuries.

Unfortunately, the range of indications of scheduled surgery and open abdomen has increased. For reasons previously not seen, one interrupts the operation to finish it later. It is not easy to follow the protocol of damage control / laparostomy: there is too much subjectivity in the procedure's indication. Laboratory documentation and monitoring are often insufficient. The surgeon decides to suspend the procedure not because he/she cannot execute it, but for often inconsistent reasons.

Damage control / laparostomy is not an easy decision strategy. Besides the severity of cases, treatment success depends on the performance of the surgical team and on the involvement of anesthesiologists and intensivists. It also depends on material resources and, as an orchestra, there is a system involving professionals imbued with the purpose of masterly performing a complex symphony.

These patients do not tolerate misconceptions and improvisations. The window for the definitive treatment, when opened, is short. Otherwise, the inflammatory response takes control of the scene and compromises the final surgical outcome.When the conventional abdomen closure is not possible in the fourth stage of the damage control procedure (definitive surgery), a difficult and painful task begins, consisting in keeping under protection the viscera and the very abdominal wall, through resources not always the most suitable.

The Bogota bag should not be the unique resource for the open abdomen. It provides for alternative closing between the second and fourth stages. Thereafter, should the abdomen remain without the permanent closure, one should employ dressing with negative pressure whenever possible. It is more reasonable.

The entero-atmospheric fistula is a serious complication of laparostomy. Treatment is difficult, sometimes challenging. Bowel loops without the natural protection of the abdominal wall are vulnerable to perforation for a number of reasons and the Bogota bag is the one with higher fistula incidence. No less difficult to deal with are the other complications of the open abdomen: bowel obstruction, abscesses, intestinal fistulas, incisional hernias.

Accordingly, morbidity and mortality are significant in patients with multiple injuries admitted in critical condition. What concerns, in fact, it is the trivialization of the operative strategy and the interruption

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of the abdominal surgery without proper assessment of the consequences of that decision.

Are we facing a new iatrogeny in trauma?

In trauma services, it seems appropriate to review protocols on abbreviated laparotomy and warn surgeons that we still do not know everything about the open abdomen.

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DOI: 10.1590/0100-69912016005003

Burnout Syndrome prevalence of on-call surgeons in a trauma reference hospital and its correlation with weekly workload: cross-sectional study

Prevalência da Síndrome de Burnout em cirurgiões plantonistas de um hospital de referência para trauma e sua correlação com carga horária semanal de trabalho: estudo transversal

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ABSTRACT

Objective: *to determine the prevalence of Burnout Syndrome (BS) for surgeons working in referral hospital for trauma in Maceio and to evaluate the possible correlation between BS and weekly workload.* **Methods:** *cross-sectional study with 43 on-call surgeons at Professor Osvaldo Brandão Vilela General State Hospital, Maceió, between July and December, 2015. A self-administered form was used to evaluate BS through the Maslach Burnout Inventory (MBI) and socio-demographic characteristics among participants. Spearman's S test was used to compare BS and weekly workload. Significant level was 5%.* **Results:** *among the surgeons studied, 95.35% were male and the mean age was 43.9 ± 8.95 years. The mean weekly workload on call in trauma was 33.90 ± 16.82 hours. The frequency of high scores in at least one of the three dimensions of MBI was 46.5%. Professional achievement was correlated with weekly workload (P = 0.020).* **Conclusion:** *the prevalence of Burnout Syndrome among on-call surgeons in referral hospital for trauma was 46.5%. In this sample there was correlation between weekly workload and the Burnout Syndrome.*

Keywords: *Job Satisfaction. Burnout, Professional. Observational Studies as Topic. Surgeons.*

INTRODUCTION

The Burnout Syndrome (BS) is as a state of exhaustion caused by the working activity[1,2]. It is a medical condition classically characterized by three dimensions: emotional exhaustion, depersonalization and low personal accomplishment[3]. The main cause of emotional exhaustion is usually prolonged exposure to stress that manifests itself through the loss of enthusiasm for work and feelings of imprisonment and impotence[3]. The depersonalization features indifference in interpersonal treatment, the professional coming to consider colleagues and patients as objects[4]. The reduction injob satisfaction is characterized by negative personal assessments or feelings of incompetence associated with job dissatisfaction[4].

Individuals who are more prone to BS are generally those that have a high degree of perfectionism and often have the feeling of guilt for not having met their own expectations[5]. The first indication that emotional trauma is already present in the professional are the stress reactions[5]. These are conscious or unconscious, behavioral, emotional and cognitive reactions that the BS bearer displays to cope with the stressor agent[5].

The most used diagnostic tool is the Maslach Burnout Inventory (MBI) questionnaire, which includes 22 items that measure three dimensions of BS[3]. The MBI is the gold standard for the identification of BS in clinical research[3].

The prevalence of BS varies between surveys and depends on the analyzed population. International research has shown that the prevalence among physicians working in intensive care units may vary between 0 and 70%[4-6]. Prevalence among surgeons in Brazil is not yet established and it remains unclear if the excess weekly working hours can positively contribute to BS emergence.

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The objective of this research was to determine the prevalence of BS in medical surgeons working in a trauma reference hospital in Maceió and to evaluate the possible correlation between BS and the weekly working hours. The hypothesis tested in this study is that the correlation between BS and the weekly workload among surgeons in a trauma reference hospital in Maceió is 0.3. The correlation coefficient evaluates the relationship between variables. Its values serve to identify the intensity of the relationship. Values between 0.1 and 0.29 are mild, between 0.3 and 0.49 are moderate, and between 0.5 and 1, intense. There are no studies evaluating this issue among surgeons in Brazil, so we considered the reference value of 0.3 to be clinically relevant for this research's hypothesis.

METHODS

This was a transversal study of analytical character. We collected data in trauma reference hospital in Maceió. The research was submitted to the *Plataforma Brasil* and approved under protocol 560,965. We carried out the research between June and December 2014. We used an informed consent form.

The survey included physicians working as on duty surgeons on shifts at the trauma hospital in the city of Maceio. We excluded physicians who did not properly answer the data collection form in the part containing the instrument whose purpose was to assess the presence of professional Burnout, MBI, or the question about the weekly working hours. This study made no restriction on the size of the sample in terms of age, gender, color, ethnic or social group.

We created a list of identification numbers for doctors who met the inclusion criteria of this research. We asked the physicians to participate after a draw. We addressed the participants during their shifts in the institution where they worked. We obtained dataon lifestyle, workplaces, health status, and stressors among those who were diagnosed as having the BS. The participants signed the consent form at the same time they filled the data collection form.

The data collection form was a self-administered instrument. The information used were those provided by the participants. The researchers did not interfere in the filling or to clarify doubts regarding the instrument questions. This form contained four blocks of questions: first, general identification of the participants with optional name identification, whose goal was to collect data on gender, marital status, age, expertise, lifestyle, total weekly workinghours and other data to characterize the sample; the second, assessment of professional stress through the MBI; the third, containing questions about health symptoms and problems; and the fourth, containing questions related to stress in the workplace.

The MBI was validated for Portuguese and has 22 questions with five options each, according to the 1-5 Likert scale, to assess the three dimensions of BS[7]. The three dimensions have been independently described as follows: emotional exhaustion is evaluated innine items, depersonalization in fiveitems, and job satisfaction in eight[7].

The MBI allows to classify participants into levels: high, moderate or low. The rating levels for the MBI dimensions are based on the sum of items in each dimension, as follows: emotional exhaustion, high when greater than or equal to 27 points, moderate between 19 and 26 points,low when and less than 19 points; depersonalization, high when greater than or equal to 10 points, moderate between 6 and 9 points, and low when less than 6 points; and job satisfaction, high between 0 and 33 points, moderate between 34 and 39 points, and low when greater than 40[7]. Job satisfactionis ina direction opposite to the other MBI domains. We considered as having BS the participants who had high level in at least one of the MBI domains[8].

The primary variables were: prevalence of BS and correlation between BS and weekly working hours. The secondary variables were: signs, symptoms and disorders associated with BS, psychological and behavioral symptoms, weekly working hoursin the trauma hospital, physical activity, smoking, drinking habits, leisure hours and chronic diseases.

The signs, symptoms and disorders associated with BS are characterized by progressive and constant fatigue, sleep disturbances, muscle or muscle-skeletal pain, headache, migraine, gastrointestinal disorders, cardiovascular disorders, respiratory disorders, and sexual dysfunction.

Psychological and behavioral symptoms were characterized as lack of attention and concentration, memory changes, slowness of thought, impatience, emotional instability, asthenia, anorexia, depression, irritability, aggressiveness, difficulty in accepting changes, loss of initiative, use of illegal substances, tendency to isolation, feelings of omnipotence, loss of interest in work, absenteeism, irony and cynicism.

Considering a correlation between the BS score and the weekly working hours of 0.3, the sample required 43 participants for a significance level of 5% and a statistical power of 80%. We describe continuous variables as mean and standard deviation, and categorical variables by simple frequency. We used The Shapiro-Wilk test to verify the symmetry of data distribution. We applied the Spearman's S test for statistical correlation. The level of significance of this research was 5%, with two-tailed test. We used the BioEstat 5.0 computer application to perform the statistical and sample size calculations[9].

RESULTS

The research was carried out as planned. We analyzed the responses of 43 participants. Among the participants, two (4.65%) were women and 41 (95.35%) men. The average age was 45.53±8.35 years. The marital status of participants was distributed as follows: two (4.65%) single, two (4.65%) divorced and 39 (90.70%) married. Of the participants, 36 (83.72%) had children, with a mean of 2.41±1.16 children per participant.

Regarding professional activity as a surgeon, 38 (88.37%) participants had specialization in surgery. The average work as a surgeon was 17.60±9.06 years. The type of establishments in which the they worked were: 41 (95.35%) participants in public and private institutions and two (4.65%) participants only in public institutions. Regarding the monthly wage income, 41 (95.34%) participants reported more than 13 minimum wages, one (2.33%) participant, between ten and 13 minimum wages, and one (2.33%) participant, less than ten minimum wages. Personal satisfaction with the monthly income was classified as satisfactory by 31 (72.74%) participants, dissatisfactory by eight (18.6%) participants, three (6.98%) participants did not score it and one (2.33%) did not wish to answer.

The average weekly working hours as a doctor on duty in the trauma service was 33.90±16.82 hours. The average uninterrupted shift time in the trauma service was 29.39±17.72 hours. The average weekly working hours out of the trauma service was 28.96±17.94 hours.

Regarding weekly hours devoted to leisure activities, we observed an average of 36.43±18.38 hours. Aerobic physical activity, walking or running were reported by 31 (72.09%) participants, with the weekly average of 6.63±3.99 hours.

As for general health and lifestyle, ten (23.26%) reported suffering from chronic diseases, consisting mainly of hypertension, diabetes and gastrointestinal disorders. Among the participants, 40 (93.02%) reported to be non-smokers. Alcohol use was reported by 30 (69.77%) individuals.

The score of the participants for the MBI questions according to each domain were: 20.98±5.64 for emotional exhaustion, 8.46±2.27 for depersonalization and 35.40±3.62 for job satisfaction. We identified BS in 20 (46.5%) participants. The correlation between the weekly working hours and the three dimensions of BS were +0.16 for emotional exhaustion (p=0.497), +0.13 for depersonalization (p=0.565) and -0.51 for job satisfaction (p=0.020).

Participants reported the signs, symptoms and disorders associated with BS as follows: seven (35%) subjects had no symptoms, five (25%) reported steady and progressive fatigue, three (15%) had headache, three (15%) participants displayed muscular and osteoarticular pain, and two (10%) showed cardiovascular disorders.

Individuals reported psychological and behavioral symptoms as follows: one (5%) participants had no symptoms, eight (40%) participants reported impatience, five (25%) had inability to relax, two (10%) displayed memorychanges, two (10%) participants had dismay, one (5%) participant had irritability, and one (5%) had difficulty in accepting the changes.

Participants marked more than one alternative in item existing factors at work that were considered stressful or harmful to health. The answers were: one (5%) participants did not score any of the factors, eight (40%) marked the possibility of complications, 12 (60%),the lack of resources, 11 (55%) participants chose administrative problems, six, excessive noise (30%), six (30%) participants marked the amount of patients per doctor, four (20%) participants, the obligation to deal with various issues, three (15%) marked dealing with suffering and death, three (15%) chose team commitment, three (15%) participants marked accelerated pace of work, two (10%) participants chose the care for patients at risk of death, one (5%) marked the difficulty for sleeping in shifts, one (5%), the relationship with the team, and one (5%) participant scored working in the operating room and in the emergency room.

Participants marked more than one alternative in item feeling in the workplace during night shifts. The answers were: 14 (70%) participants did not score any alternative, two (10%) stated that they felt prevented from acting according to their principles at work, two (10%) participants marked that they felt their work hampered by quality of the relationships in the workplace, one (5%) chose the difficulty in communicating with the shift organizers, and one (5%) stated to feel uncomfortable with frequent rule changes.

DISCUSSION

We obtained the answer to this research's question. The results can be briefly described as follows: the prevalence of BS among attending physicians in a trauma reference hospital in Maceió was 46.5% and we identified a correlation between the weekly working hours and the BS.

The research was classified as a cross-sectional study using a self-administered questionnaire. The cross-sectional study does not allow inferences related to causation[4]. The objective of this research did not involve the analysis of the BS's causes. The questionnaire is a research instrument already well-established by the literature, which is used in clinical research involving the need to assess the subjectivity of the research subject. The instrument most commonly used in this research topic is the MBI, however there are other instruments to analyze BS regardless of the analysis of the domains that characterize BS[7,8]. The researchers chose to use an existing Portuguese version of the MBI since it had already been validated[10].

The limitations of this study deserve comment, such as: incomplete filling of the questionnaire form and the need for more than one answer on some items. The fact that some answers were not answered do not undermine the objectives of this research though, since the items on the weekly working hours and the MBI have been completely answered. The forms analysis revealed that only two participants filled out the form incompletely. The items symptoms, signs and disorders associated with BS or behavioral and psychological symptoms were scored by the participants only once, as oriented by the form itself. The frequency of these results could have been greater, since the BS bearers could display of more than one symptom or sign. The way these items were answered may have limited results, but did not invalidate the execution of the research and the dissemination of results.

The research showed a predominance of male participants. The analysis of other studies shows that the female gender is more prone to the development of BS, since despite having the same exposure to stressors, women still have greater involvement with the household duties and family[7]. The predominance of males in the survey can also be seen in the service where the study was performed. The average age of participants was 45 years, and of working as a surgeon, 17 years, indicating the pos-

sibility of long exposure to stressors. A study presented prevalence with different values considering the professional working environment: 14.5% in the intensive care unit, 21.9% in the oncology department, 17.5% in the operating room and 17.2% in the department of surgery[11]. The places where the surgeon performs his/her labor activity may display more or less potential for the development of BS. The analysis that takes into account different age groups and working time was not planned for this research.

Most participants were married and had children. One survey reported that these are protective factors for BS due to the ability that this group of people have to face problems[7].

The prevalence of BS was high in this study. The medical literature shows no consensus regarding the diagnosis of BS. One possible way is to diagnose individuals as BS bearers if they have scores for three MBI domains[11]. This research was in accordance with other studies that used a high score in at least one domain to diagnose BS[6,8,12]. The lack of consensus in the literature and the way this research was performed may explain the high prevalence of BS. The high prevalence of BS in professionals evaluated in other studies was also high, similar to our results[6,8,12]. There are other researchers trying to validate new tools to diagnose BS[10]. The new instruments need to be validated in different professional populations to gain more acceptance and use in clinical research.

The analysis of the correlation between the BS and the weekly working hours showed statistical significance when considering the job satisfaction domain. A research performed in the United States and Puerto Rico found similar results[13]. A survey assessed the impact of the reduction of weekly working hours on the incidence of BS for surgeons, however the reduction in the number of working hours alone was not accompanied by a reduction in BS incidence[14]. It would be essential to know what were the motivations for each professional to choose the medical specialty, as well as what their strategies to deal with stress fulsituations of their daily work, to elucidate aspects involving job satisfaction. The Stress Vulnerability Questionnaire may help to elucidate these issues in future research. The method used in this research allowed no detail to clarify the situation. The research in question noted that the increase in weekly working hours is related to BS.

The analysis of behavioral and psychological symptoms and signs serves to identify which domain is affected in BS. The MBI results showed that there were diagnoses given by high scores in all three domains. Emotional exhaustion is usually the first area to be committed in BS[5]. We observed fewer BS diagnoses in this area than in others. The job satisfaction is usually the last dimension to be committed in BS[5]. There is a predominance of feelings of inefficiency and poor self-confidence[5]. It is important to note that, in this research, this last dimension of BS was the one correlated with the weekly workload.

The implication of this research's results to clinical practice is the suggestion that strategies be developed to treat or even prevent the onset of BS. The Maslach model shows that BS is a process that begins with the emotional exhaustion, being followed by depersonalization, and finally the lack of job satisfaction. However, in our research the score of the latter domain in the MBI was striking and also correlated with the weekly hours workload, suggesting that this may be the main focus of the strategies to be implemented to treat or prevent BS.

Future research needs to determine the prevalence of BS in surgeons working in trauma hospitals in Brazil to confirm the results of this research, as well as to carefully assess specific conditions that may be causing the trauma surgeon to be not fully realized professionally. An important contribution in future research will be to assess whether the reduction of weekly working hours may have some influence on professionals already diagnosed with BS. It is possible that in other studies one can analyze BS together with the time of exposure to stressors.

In conclusion, the prevalence of Burnout Syndrome among surgeons in a trauma reference hospital was 46.5%.There was correlation between the weekly working hours and the Burnout Syndrome.

R E S U M O

Objetivo: determinar a prevalência da Síndrome de Burnout (SB) em médicos cirurgiões que trabalham em hospital de referência para o trauma em Maceió e avaliar a possível correlação entre SB e a carga horária semanal de trabalho. **Métodos:** estudo transversal com 43 cirurgiões de plantão do Hospital Geral do Estado Professor Osvaldo Brandão Vilela, Maceió, entre julho e dezembro de 2015. Um formulário autoadministrado foi utilizado para avaliar SB por meio do *Maslach Burnout Inventory* (MBI) e as características sociodemográficas entre os participantes. Foi utilizado o teste de Spearman S para comparar SB e carga horária semanal. O nível de significância foi 5%. **Resultados:** entre os cirurgiões estudados, 95,35% eram do sexo masculino e a média de idade foi 43,9±8,95 anos. A média da carga horária semanal de plantão no trauma foi 33,90±16,82 horas. A frequência de pontuações elevadas em pelo menos uma das três dimensões do MBI foi 46,5%. Realização profissional foi correlacionada com a carga de trabalho semanal (P=0,020). **Conclusão:** a prevalência da Síndrome de Burnout entre cirurgiões plantonistas em hospital de referência para o trauma foi 46,5%. Nesta amostra houve correlação entre a carga horária semanal de trabalho e a Síndrome de Burnout.

Descritores: Satisfação no Emprego. Esgotamento Profissional. Estudo Observacional como Assunto. Cirurgiões.

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Received in: 17/05/2016
Accepted for publication: 12/07/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005004

Pediatric vascular trauma in Manaus, Amazon – Brazil

Traumatismos vasculares pediátricos na cidade de Manaus, Amazonas – Brasil

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ABSTRACT

Objective: *to assess the incidence of pediatric vascular injuries in patients treated at the Emergency Room of the Eastern Children's Hospital, in Manaus.* **Methods**: *we conducted a retrospective study of pediatric patients who suffered vascular injuries treated between February 2001 to February 2012.* **Results**: *we studied 71 patients, predominantly male (78.87%), with a mean age of 7.63 years. The predominant mechanism of injury was stab wound in 27 patients (38.03%). The average hospital stay was 10.18 days; 16 patients required care in intensive care unit, with average stay of 8.81 days. The main injuries occurred in the extremities, the upper limb being the most affected, with lesions of the ulnar artery in 13 (15.66%) and radial in 10 (12.04%). The mostly applied procedure was vascular exploration 35 (32.4%). Complications occurred in nine patients (12.68%). Mortality was 1.4%, in one patient with a lesion of the common iliac vein and the inferior vena cava due fall from height.* **Conclusion**: *pediatric vascular injury occurred predominantly in the extremities. The dimensions of the injured vessels made surgical correction more complex and increased complication rates, particularly amputations.*

Keywords: *Trauma, Vascular. Child. Adolescent.*

INTRODUCTION

In Brazil, as in most developing countries, violence is the leading cause of trauma, reaping many lives in the productive phase and generating billions of reais in expenses for hospitalization, temporary or permanent incapacitation and rehabilitation[1,2].

Trauma sequelae incapacitate an even greater number of people, not counting the psychological and emotional aspects, which in children can lead to a regressive behavior in the presence of stress related to the event[1]. In the pediatric population, in which multisystem injuries are more frequent, mainly due to the greater absorption of energy per unit area generated by the lower body mass, trauma is a major cause of death and disability[1,3-7]. Vascular injury is a segment with unique features and difficult to analyze, mainly due to the small number of reported cases and technical challenges involved[3,4,8-10].

The knowledge on vascular trauma evolved mainly by the accumulated military experience in the first and second world wars, the Korean War and Vietnam one. It is right to say that among the different age groups affected by vascular lesions, the adult population was the most benefitted from this accumulated knowledge, ie, vascular lesions in adult patients have been well documented[11-14]. Contemporary conflicts, such as in Iraq and Afghanistan, have contributed to increase the knowledge of vascular trauma in children also[15].

Severe vascular lesions occur with relatively low incidence in the pediatric population, but are associated with significant mortality and severe complications. They can be caused by penetrating wounds, closed ones or iatrogenic trauma. Vascular injury in this age group have been described in five major series totaling 204 cases, with an average of 3.3 cases per year[5,13,14,16,17].

In adults, vascular lesions are adequately treated by surgeons, with their diagnosis and surgical indication well established. However, in children, the small caliber of the blood vessels, intense vasospasm and the inability of some very young patients reporting symptoms to the medical staff, in addition to factors related to the

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immaturity of their anatomical structures and their physiological responses[1,2,8,9,18-20], compromise surgical repair or can lead to a false sense of absence of vascular injury, making this type of injury peculiar[3,9,21,22].

This study evaluated pediatric vascular injuries in patients treated at the Emergency Room of the Eastern Children's Hospital (HPSC Zona Leste), in Manaus, a reference unit for this type of trauma.

METHODS

This is a non-randomized, retrospective study, whose data were obtained by collecting data from pediatric patients medical records, children and adolescents (zero to 14), in whom vascular injuries were identified in any body region, seen in the period from February 2001 to February 2012.

We developed a form to collect data from medical records of patients in the study. We conducted the analysis of the information contained in the medical records of these patients, followed by descriptive analysis of epidemiological information, with age, gender, type of injury, injury time, etiology, treatment period, type of surgery and evolution and possible complications.

This study was approved by the Ethics in Research Committee of the Adriano Jorge Hospital Foundation (FHAJ) in Manaus, under number 022/11.

RESULTS

Of the 71 pediatric patients who suffered vascular trauma, the majority (78.87%) were male. The mean age was 7.63 years, ranging from one month to 14 years. The most frequent age group falls within the group of children of school age, ie over six years of age, with 42 cases (59.15%). Stab wounds accounted for 38.03% of the vascular lesions. The upper limb was the most affected body segment (53.52%) in this series (Table 1).

In total, there were 36 different injured blood vessels, with a predominance of venous lesions (52.77%) in relation to arterial ones (47.23%). Vascular lesions occurred mainly in the ulnar (15.66%), radial (12.04%) and brachial (12.04%) arteries of the total of 83 recorded vascular lesions (Table 2).

Table 1. *Distribution of patients as to gender. age group. trauma mechanism and topography of the lesions.*

	n	%
Gender		
Male	56	78.87
Female	15	21.13
Age Group		
0-6 years	29	40.85
Over 6 years	42	59.15
Trauma mechanism		
SW*	27	38.03
Fall from height	12	16.9
Topography of the lesions		
Abdomen	9	12.67
LL†	18	25.35
UL‡	38	53.52
Neck	4	5.63
Chest	2	2.81

**SW: stab wound; † UL: upper limbs; ‡ LL: lower limbs.*

Regarding the diagnosis method, clinical examination was used in 71 patients for identification of vascular injury. In 13 cases (18.3%), clinical examination was associated with another diagnostic method, such as arteriography (Figure 1) and ultrasound to confirm the vascular trauma. The main clinical presentation verified at the time of admission was bleeding at the site of injury (56.33%), followed by hypovolemic shock (7.04%).

The most common surgical procedure was vascular exploration (Figure 2) in 32.4% of cases, followed by vessel ligation (23.14%) and end-to-end anastomosis (16.66%). Postoperatively, there were complications in nine patients (12.68%); of these, in five (55.55%) amputation of the affected limb was necessary due to the vascular lesion (Table 3).

The average length of stay of patients was 10.18 days, ranging from one day to 55, with the longer time related to one patient victim of trampling and presenting lesions in the femoral and external iliac arteries. In 16 cases (22.53%), admission to the intensive care unit (ICU) was required, with an average length of stay of 8.81 days. There was one death (1.4%) among the 71 patients attended.

Table 2. *Distribution of vascular lesions according to the type of vessel.*

	n	%
Blood Vessels		
Artery	17	47.23
Vein	19	52.77
Total	36	100
Main Blood Vessels Injured		
Ulnar Artery	13	15.66
Radial Artery	10	12.04
Brachial Artery	10	12.04
Tibial Artery	7	8.43

Table 3. *Distribution of patients according to surgical procedure and postoperative complications.*

	n	%
Surgical Procedure		
Vascular exploration	35	32.4
Ligation of blood vessel	25	23.14
Termino-terminal anastomosis	18	16.66
Complications		
Amputation	5	55.55
Infection	1	11.11
Sepsis	2	22.22
Death	1	11.11
Total	9	100

DISCUSSION

Pediatric vascular injuries have complex management problems mainly due to the limited experience with vascular injuries in this age group, controversy surrounding conservative treatment, particular anatomy and physiology, requiring meticulous surgical technique and specialized pediatric follow-up after surgical treatment[6,14,16,17].

The different topographies of vascular lesions generate different characteristics to trauma. Central vascular trauma is uncommon and is associated with high mortality. Vascular neck injuries usually result from penetrating trauma and are related to favorable survival rates. At the extremities, vascular trauma is associated with vasospasm, complicating both diagnosis and treatment. There is in these cases an immediate concern for the viability of the body extremity affected by the vascular trauma, since it is necessary to occur restoration of blood flow and adequate circulation for the future musculoskeletal development of the affected limb, differing from the elderly in whom collateral circulation is already present[3,8,9,10,21,23].

Children whose age is equal to or less than five years old suffer from vascular trauma related to iatrogenic injuries[2,8,9,19-21,24,25]. Many of these injuries could be avoided by correct use of invasive techniques, such as insertion catheters for venous access[20,25,26]. In children older than five years of age, vascular lesions present an etiology similar to that observed in the adult population, that is, related to injury by firearm or stabbing wounds, falls from height, fractures, dislocations and closed trauma[2,3,9,27].

When treating a vascular lesion, the surgeon should know the pathophysiology and the main signs and symptoms of this type of injury. Diagnosis can be accomplished simply by careful physical examination. When the vascular injury is in the extremities, one must check the

Figure 1: *Contrast radiograph of pediatric patient victim of gunshot wound in lower limb showing vascular lesion. Source: author's Files.*

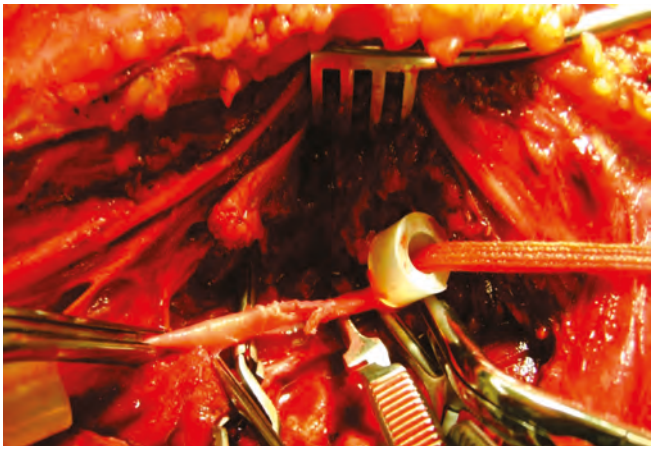

Figure 2: *Femoral artery injury in pediatric patient victim of gunshot wound. Source: author's Files.*

area adjacent to the lesion looking for blood infiltration into tissues. The pulses distal to the lesion should be palpated and compared with the contralateral limb when it is not injured. The temperature and the color of the extremity should be analyzed and, finally, one should auscultate the path of the main vessels near the wound[5,6,16]. Intra-abdominal or cervical arterial lesions may be diagnosed by ultrasound examinations and treated by early exploratory laparotomy and cervicotomy, respectively[16]. Even in the absence of signs and symptoms that confirm the possibility of vascular injury, physical examination should be repeated several times as it has been documented that the presence of signals such as distal pulses does not exclude the possibility of arterial injury and thus the symptoms of the vascular trauma can change[13].

Vascular ultrasound through the duplex scan with color flow mapping of the arteries and veins is an important diagnostic method for suspected vascular trauma. The use of anatomic and hemodynamic information of the Duplex Scan, with the image in real time, makes this a versatile examination and of reasonable accuracy when there is suspicion of pediatric vascular trauma.

Preoperative arteriography remains the gold standard as a supplementary examination in cases of vascular injury in childhood, favoring the early diagnosis of injury or even excluding its possibility[5,13,14,16,17]. It is important to know that the arterial vasospasm during angiography and artery manipulation is more common in pediatric patients than in adults.

The definitive treatment of a vascular injury depends on several factors. The most important are related to the type of vessel injury, the condition of the patient, the presence of materials and adequate facilities for the treatment and also the existence or not of hemorrhage[13,16]. Immediate surgery should be performed in situations such as the presence of persistent bleeding, pulsatile hematoma, open fracture, acute arterial insufficiency after reduction of a closed fracture, absence of pulses distal to the wound, in the upper and lower limbs or in the case of a significant amount of devitalized tissue[13]. Delaying the surgical treatment in order to improve collateral circulation and combat pathogens adjacent to the lesion[14] is a little defined measure, because the proper development of collateral circulation to maintain tissue viability does not ensure normal growth of the extremity[14,16].

When surgery is indicated, conventional surgery is still considered as the first option in treating these injuries, with the proximal and distal control of the lesion, vascular repair through direct arteriorrhaphy, use of "patch" or grafting[16,28]. Procedures such as appropriate debridement of the injury, clot removal with preservation of collateral circulation, anastomosis or local artery angioplasty are measures used in all age groups[5,13,14,16]. Endovascular surgery has several benefits as a treatment option for vascular trauma, such as remote approach of vascular lesions of difficult access, less invasiveness and minor intervention times. It also allows a temporary vascular control for definitive surgical repair, contributing to the stabilization of critically ill patients[16,28].

Where ligation of the vessel or anastomosis cannot be made, grafts with autogenous veins, such as the saphenous, are a good option[14,23]. The use of synthetic prostheses in children should be the exception, as these components do not follow the vessel's longitudinal and circular growths, their diameters are generally inadequate and the permeability rate is low due to lack of endothelium[5,14,16,23].

The advent of microsurgical techniques contributed to the treatment of low success rates vascular lesions[16]. In vascular repair, the use of absorbable sutures generates positive results in venous anastomosis compared to nonabsorbable ones. The use of atraumatic

clips, such as the "Uclips" represents a major step forward, facilitating the achievement of difficult vascular anastomoses[23] under optical magnification.

In cases where the vascular lesion is located in the upper or lower limbs, one should given due importance to the realization of fasciotomy. This procedure should be performed in patients with signs and symptoms of compartment syndrome or as prophylaxis for limbs affected by prolonged ischemia[6].

Systemic anticoagulation with heparin sodium is an important factor in the care of acute vascular injuries, also contributing to reducing the incidence of thrombosis associated with invasive procedures such as cardiac catheterization or obtaining arterial blood gases in children[14,23].

The increasing use of invasive procedures such as percutaneous arterial access or correction of congenital malformations in treatment centers for children and newborns makes the iatrogenic vascular trauma a subject for debate. Studies report that even with the increased number of invasive procedures, the rate of arterial lesions has not increased significantly. Some preventive measures should be taken to avoid iatrogenic vascular lesions, such as minimizing the number of arterial punctures in children, and the access should be limited to major arterial trunks, and perform pressure for several minutes at the site of catheter removal or puncture. When there is suspicion of arterial injury, such as fistula, thrombosis or pseudoaneurysm, one should initially perform Doppler ultrasound to verify arterial and venous patency, dilation or arteriovenous communication, and the flow rate of the vessel[23,24]. For this type of vascular trauma, microsurgery proves advantageous, especially avoiding vascular thrombosis[10,19,20,21,24].

Outpatient regular monitoring aims to identify the decrease in pulses of affected extremities, lowering blood pressure, length differences of the limbs or clinical manifestations of arterial insufficiency, such as fatigue and lameness. These signs are indications for angiographic evaluation of the circulation of the limb affected by the vascular injury[14].

The complications related to vascular trauma in childhood mainly comprise abnormalities of growth and development of the limbs affected by this type of injury, stenosis in injured vessels or complications related to the severity of the trauma. However, the incidence of complications is low[14,16]. The neurological injury associated with the vascular one contributes to the emergence of sequelae in the affected limb[5,17,23].

The end result after the diagnostic measures and treatment of vascular injury depends on several factors, mainly related to delays in care, experience of the surgical team to treat this type of injury, type and location of the injury and infection[11-13]. Early recognition and prompt treatment are considered important factors for achieving good postoperative results in pediatric patients with vascular injuries[1,2,5,6,8,10,11-14,19,29].

The pediatric vascular trauma is a neglected public health problem. Investments in prevention, surgical staff training and acquisition of appropriate instruments are crucial to reduce morbidity and mortality.

Concluding, the pediatric vascular injury occurred predominantly in the extremities. The dimensions of the injured vessels made surgical repair more complex and increased complication rates, particularly amputations.

R E S U M O

Objetivo: avaliar a incidência de traumatismos vasculares pediátricos em doentes atendidos no Hospital Pronto Socorro da Criança Zona Leste, na cidade de Manaus. **Métodos:** estudo retrospectivo de doentes pediátricos vítimas de traumatismos vasculares atendidos no período de fevereiro de 2001 a fevereiro de 2012. **Resultados:** foram estudados 71 doentes com predominância do sexo masculino (78,87%) com média de idade de 7,63 anos. O mecanismo de trauma predominante foi o ferimento por arma branca em 27 pacientes (38,03%). A média de internação foi 10,18 dias, com 16 doentes necessitando de cuidados em unidade de tratamento intensivo com permanência média de 8,81 dias. As principais lesões ocorreram em extremidades, com predomínio do membro superior, com lesões das artérias ulnar em 13 (15,66%) e radial em dez (12,04%). O procedimento mais utilizado foi a exploração vascular 35 (32,4%). Em nove doentes (12,68%) ocorreram complicações. A mortalidade foi 1,4%, em um paciente com lesão da veia ilíaca comum e da veia cava inferior, devido à queda de altura. **Conclusão:** o traumatismo vascular pediátrico ocorreu predominantemente em extremidades. As dimensões dos vasos lesionados tornaram a correção cirúrgica mais complexa e aumentaram os índices de complicações, particularmente, de amputações.

Descritores: Traumatismo vascular. Criança. Adolescente.

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Received in: 29/04/2016
Accepted for publication: 11/08/2016
Conflict of interest: none.
Source of funding: Support Fund to the Amazonas State Research - FAPEAM.

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DOI: 10.1590/0100-69912016005002

The deceptive concept of hypoparathyroidism and recurrence after parathyroidectomy in dialysis patients: are we offering a Procrustean bed to some patients?

O enganoso conceito de hipoparatireoidismo e recidiva após paratireoidectomia em pacientes dialíticos: estamos oferecendo uma cama de Procrustes a alguns pacientes?

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A B S T R A C T

Objective: *to analyze the frequency of hypoparathyroidism and of its recurrence after parathyroidectomy in dialysis patients according to different existing classifications.* **Methods**: *we conducted a retrospective study of 107 consecutive dialysis patients undergoing total parathyroidectomy with immediate autograft in a tertiary hospital from 2006 to 2010. We studied the changes in PTH levels in the postoperative period over time. Were grouped patients according to different PTH levels targets recommended according to the dosage method and by the American and Japanese Nephrology Societies, and by an International Experts Consortium.* **Results**: *after parathyroidectomy, there was sustained reduction in serum calcium and phosphatemia. The median value of PTH decreased from 1904pg/ml to 55pg/ml in 12 months. Depending on the considered target level, the proportion of patients below the target ranged between 17% and 87%. On the other hand, the proportion of patients with levels above the target ranged from 3% to 37%.* **Conclusion**: *the application of different recommendations for PTH levels after parathyroidectomy in dialysis patients may lead to incorrect classifications of hypoparathyroidism or recurrent hyperparathyroidism and resultin discordant therapeutic conducts.*

Keywords: *Hyperparathyroidism, Secondary. Parathyroidectomy. Hypoparathyroidism. Dialysis. Parathyroid Hormone*

INTRODUCTION

Despite recent advances in the clinical treatment of secondary hyperparathyroidism (2HPT) in dialysis patients, parathyroidectomy (PTx) may be necessary in some cases, especially in developing countries, where 10.7% of dialysis patients present parathyroid hormone (PTH) levels exceeding 1000pg/ml[1]. Parathyroidectomy is effective and its cost is lower than the long-term use of cinacalcet[2]. Surgical treatment may improve survival in long-term dialysis population with 2HPT[3,4]. In the past, PTH levels werenot often monitored after PTx. The objective of the operation was to reverse the 2HPT symptoms and to achieve normocalcaemia, without the need for supplemental calcium or vitamin D analogues[5]. The availability of PTH dosage exams led to better, still imperfect, understanding of the correlation between PTH levels and bone and cardiovascular diseases in dialysis patients.

There is consistent evidence of the benefit of PTx regarding survival[6]. Untreated persistent or recurrent 2HPT can theoretically have a negative effect on quality of life and survival. On the other hand, lower PTH levels were correlated with a worse postoperative survival[7]. Thus, the current target of the operation must be related not only to the demands of calcium and calcitriol, but to the possible actions of PTH on bone, cardiovascular system and, finally, survival.

The problem occurs when oneis to define the appropriate level of PTH to this significantly ill and highly heterogeneous patient population. The document from the National Kidney Foundation, called Kidney Disease Outcomes Quality Initiative (K/DOQI), published in 2003, recommended PTH levels of 150-300 pg/ml[8]. More recently, the guidelines from Kidney Disease: Improving

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Global Outcomes (KDIGO), produced by an international experts consortium, have advocated that PTH levels be maintained twice to nine times the normal upper limit for the appliedassay method[9]. The PTH target levels recommended by the K/DOQI and KDIGO have not been established with the purpose of application to the patient's condition after PTx. However, there is a tendency to extend the recommendation of the PTH levels of these guidelines todialysis patients after the operation.

We set the hypothesis that the use of different criteria for the appropriate levels of PTH after PTx can lead to contradictory recommendations, with unwanted clinical consequences. For example, there may be indication of additional surgical procedures, such as grafting of cryopreserved parathyroid tissue due topresumed hypoparathyroidism or excision of the autograft in the belief of relapsed disease. Even the use of medications, such as prescription calcimimetics or vitamin D analogues, could be suggested according to the adopted PTH target levels.

We analyzed a cohort of patients with severe 2HPT undergoing PTx to assess the impact of the use of different PTH target level proposals on subsequent therapeutic decisions.

METHODS

We studied dialysis patients operated for 2HPT at a single institution from January 2006 to March 2010. Although their renal replacement therapy were held in different locations in the community, all operations were performed in the same hospital and all patients held regular monitoring in the institution with nephrologists dedicated to bone disease and mineral disorder. Laboratory tests were also carried out in a single clinical pathology laboratory of the institution. The study was approved by ethics in research committee and received registration in the national system of ethics in research under the CAAE 1083.0.015.000-07 number.

We included only patients undergoing one initial operation. We excluded patients with prior successful kidney transplant because their metabolic targets are different from those of individuals on dialysis.

All patients were treated with the intention of total parathyroidectomy with immediate heterotopic parathyroid autograft. Thirty specimens of 2x1 mm of less sickly appearing parathyroids were macroscopically selected and grafted onto one or more sites, as previously described[10]. The indication for PTx are the ones recommended by the Brazilian Society of Nephrology[11]. We analyzed the following biochemical data before and after the operation: total calcium (tCA, reference values 8.6-10.2 mg/dl), ionized calcium (iCa, 4.6-5.3 mg/dl), phosphorus (P, 2.7-4.5 mg/dl) and PTH (16-87 pg/ml). The PTH intact dosage method used in the institution during the period of study was the IMMULITE 2000 with intra-assay and inter-assay variation of 6.3% and 5.4%, respectively.

We analyzed the PTH levels of patients at different times postoperatively, ranging from six to 60 months. When the patient received a successful kidney transplant after PTx, he/she was excluded from further analysis, as the full uremic stimulation was interrupted. The PTH values of patients with unresolved persistence were also not included in the postoperative analysis.

We defined three categories: below the recommended target (presumed hypoparathyroidism), within the recommended levels, and above the target level (presumed hyperparathyroidism). We stratified patients in these three categories according to four different recommendations for appropriate levels of PTH: the method's normal values (16-87 pg/ml); the target proposed by the Japanese Society for Dialysis Therapy (JSDT)[12] (60-180 pg/ml); the KDIGO target (2-9 times the method's upper normal limit); and the guidelines of the K/DOQI (150-300 pg/ml).

Descriptive statistical analysis included the Kolmogorov-Smirnov test for normality. We present continuous data with parametric distribution as mean (± standard deviation), and nonparametric distributions as median and interquartile range (Q1-Q3).

We present the scores of patients when stratified according to the aforementioned criteria in absolute and relative values. The statistical inference test employed in each case is described in the results' presentation.

Table 1. *PTH values (pg/ml) in different periods in months (m).*

	Preoperative	6m	12m	24m	36m	48m	60m
n*	107	97	87	73	61	42	21
Median	1904	43	55	47	63	62,5	52
Q1-Q3	1,288-2,500	20 -112.5	24 -105	16-113.5	25-1,975	24-289.8	17.5-169.5

** n = number of cases with available values for analysis.*

RESULTS

In total, 51 men and 56 women were operated with the intention of total PTx with immediate autografting. The age ranged from nine to 74 years, mean 44.6 (± 12.0). The preoperative mean values of tCA, iCa and P were 10.0mg/dl (± 0.9), 5.2mg/dl (± 0.4) and 6.0mg/dl (± 1.4), respectively. The level of preoperative PTH varied from 425 to 4,539pg/ml, with a median of 1,904pg/ml (1,288-2,500).

In these 107cases, four parathyroid glands were found in 96 individuals. Six patients had persistent 2HPT (5.6%). In two, the persistence was due to failure to find a fourth parathyroid (1.9%) and in four, due toa supernumerary parathyroid gland (3.7%). Three of these six patients lost follow-up before a new operation and the other three underwent a successfulsecond operation, all displaying supernumerary glands at reoperation and their prior parathyroid graft functioned properly after excision of the fifth parathyroid. Thus, the PTx success rate was 94.4% and, if considered the second operation, the overall rate of success in resolving severe 2HPT was 97.2%.

Of the study patients, 21 received a successful kidney transplant. The mean time elapsed until transplantation was 28.6 (± 18.7) months after PTx. There was a significant reduction in PTH in all periods after the parathyroid operation, as described in Table 1.

Table 2 brings the postoperative tCA, iCa, and P values. For all three items, only the preoperative values showed a statistically significant difference from all postoperative values ($p < 0.001$, ANOVA and Tukey tests).

The number of patients and their proportions classified as presumed hypoparathyroidism, normal state and presumed hyperparathyroidism according to the different proposed target values are described in Tables 3, 4, 5 and 6.

The tables show that, at a given time, the frequency of presumed hypoparathyroidism varies significantly depending on the definition used. At 12 months, it could be as low as 17% if the normality or the method was considered, or as high as 83% if the standard KDIGO be the norm. Rather, the presumed hyperparathyroidism wouldvary from 3% to 37%. The comparison of the differences in the proportions obtained by the use of different definitions for the target PTH, from six to 60 months, was always statistically significant, with $p < 0.0001$, confirming the effect of the disagreement between different conceptualizations in establishing the diagnoses of normality, recurrence (hyperparathyroidism) or hypoparathyroidism.

By the same criteria, the comparison of the proportion of patients with hypoparathyroidism, hyperparathyroidism or normal showed no statistically significant change over time, ie, no significant increase in PTH production over the years, in most cases.

DISCUSSION

In the present study, we showed that there is still no clear definition of hypoparathyroidism and hyperparathyroidism after PTx in dialysis patients. Different

Table 2. *Mean (± SD) of tCa, iCa and P values (mg/dl) in different periods in months (m)*

	Pre-PTx	6m	12m	24m	36m	48m	60m
tCa	10.3 (±0.9)	8.5 (±1.3)	8.4 (±1.3)	8.3 (±1.5)	8.7 (±1.2)	8.8 (±1.0)	9.0 (±0.8)
iCa	5.2 (±0.4)	4.5 (±0.8)	4.4 (±0.7)	4.7 (±1.2)	4.5 (±0.7)	4.5 (±0.7)	4.6 (±0.5)
P	6.0 (±1.4)	4.6 (±1.7)	4.6 (±1.5)	4.8 (±1.6)	4.7 (±1.4)	4.8 (±1.6)	4.5 (±1.2)

Table 3. *Number and proportion of patients with hypoparathyroidism and hyperparathyroidism according to the PTH levels recommended by the essay method (16-87pg/ml).*

	Hypoparathyroidism (<16pg/ml) n (%)	Normal (16-87 pg/ml) n (%)	Hyperparathyroidism (>87pg/ml) n (%)
6 months	21 (21.6%)	46 (47.4%)	30 (30.9%)
12 months	15 (17.2%)	40 (46.0%)	32 (36.8%)
24 months	17 (23.3%)	31 (42.5%)	25 (34.2%)
36 months	10 (16.4%)	25 (41.0%)	26 (42.6%)
48 months	8 (19.0%)	18 (42.9%)	16 (38.1%)
60 months	4 (19.0%)	10 (47.0%)	7 (33.4%)

specialized societiesgenerally have different goals for PTH in dialysis patients[8,9,12]. Although these recommendations have not been established for patients after PTx, these target levels are often extrapolated to this new condition[13]. The use of these recommendations determines conflicting diagnoses after PTx.

Studies in dialysis patients suggested survival correlations in "J" or "U" graphical shape between PTH levels and mortality of these patients[14]. In a small retrospective study, survival was also shorter in a subset of patients with a low PTH level after PTX[7]. However, in a larger retrospective study of a Japanese cohort, the U-shaped associated mortality according to PTH levels was not observed after PTx, and the risk of death was higher only in patients with higher PTH levels after PTx[15]. This evidence suggests a potential clinical interest in defining the appropriate levels of PTH in the long term after PTx.

Stimulation by uremia is often considered as a factor that will determine the progressive increase in PTH levels during the years after PTx. Although this increase occurs in some isolated patients, the proportion of patients in the same category in general has not changed over the years in this series. The attempt to adjust the length of parathyroidectomy deserves further investigation, since the dialysis patient will remain under stimulation and have higher recurrence expectations. The use of PTH dynamic secretion testing would be of great interest in research, but difficult to carry out in routine clinical practice[16].

The level of PTH after PTx usually guides the decision to graft cryopreserved tissue. In the present study, we show that such indication can vary from 17% to 83% of cases, depending solely on the criterion PTH used. Even if we used only the criteria of the nephrology societies, the diagnosis of discordant hypoparathyroidism one year after PTx would be different in 30% of patients (KDIGO=83% and JSDT=53%). Considering this discrepancy, it is reasonable to assume that a part of the patients would receive unnecessary cryopreserved tissue grafts, cryopreservation being a laborious resource that

Table 4. *Number and proportion of patients with hypoparathyroidism and hyperparathyroidism according to the PTH levels proposed by JSDT (60-180 pg/ml).*

	Hypoparathyroidism (<60pg/ml) n (%)	Normal (60-180 pg/ml) n (%)	Hyperparathyroidism (>180pg/ml) n (%)
6 months	55 (56.7%)	23 (23.7%)	19 (19.6%)
12 months	46 (52.9%)	27 (31.0%)	14 (16.1%)
24 months	40 (54.8%)	24 (32.9%)	9 (12.3%)
36 months	29 (47.5%)	16 (26.2%)	16 (26.2%)
48 months	20 (47.6%)	9 (21.4%)	13 (30.9%)
60 months	11 (52.4%)	6 (28.6%)	4 (19.0%)

Table 5. *Number and proportion of patients with hypoparathyroidism and hyperparathyroidism according to the PTH leves proposed by the K/DOQI (150-300 pg/ml).*

	Hypoparathyroidism(<150pg/ml) n (%)	Normal (150-300 pg/ml) n (%)	Hyperparathyroidism (>300pg/ml) n (%)
6 months	78 (80.4%)	9 (9.3%)	10 (10.3%)
12 months	71 (81.6%)	8 (9.2%)	8 (9.2%)
24 months	60 (82.2%)	9 (12.3%)	4 (5.5%)
36 months	44 (72.1%)	10 (16.4%)	7 (11.5%)
48 months	29 (69.0%)	4 (9.5%)	9 (21.4%)
60 months	15 (71.4%)	3 (14.3%)	3 (14.3%)

requires expensive maintenance[17]. The cryopreservation of parathyroid is available in few places, often far from the operations' sites[18]. The observations of the current study that PTH levels suffer little change over the years after PTx emphasize the need for a better definition of the appropriate level of PTH in dialysis patients. This pattern would be useful for the decision to use the cryopreserved tissue, avoiding a futile waiting for a delayed function of the autograft, which occurs in a minority of cases. Moreover, it would allow early discarding of the tissues, avoiding unnecessary storage.

The concept of hypoparathyroidism in patients on dialysis after PTx is not easily defined. A better classification is necessary, but the issue is complex. Concern about low reshuffling bone disease associated with low PTH levels guides the various recommendations of the target levels set by experts. The problem is that many of these studies used different PTH detection methods, with many misunderstanding possibilities. In addition, even the third generation assay that would detect only the intact hormone 1-84 molecule may be misleading, as there are oxidized PTH molecules (no biological action in bone remodeling) that affect the measurement, not expressing the actual amount of biologically active hormone[19].

There is also the concern about the concept of relapse. Although it is clear in patients with PTH levels above 800pg/ml and hypercalcemia, our study suggests that recommending the removal of a parathyroid graft based only on the PTH levelis questionable. If the JSDT criterion of excess PTH was used to recommend excision of the autograft, there would be a worsening of the patient's hypoparathyroidism according to the criteria of KDOQI or KDIGO.

The extrapolation of PTH level recommendations to patients after PTx is clearly imperfect. Although an imperfect tool is better than none, its use without critical thinking and care can lead us to act like the Procrustean Bed, in our case resulting in unintentional damage.

Table 6. *Number and proportion of patients with hypoparathyroidism and hyperparathyroidism according to the PTH levels proposed by the KDIGO (2 to 9 times the upper normal limit of the essay method).*

	Hypoparathyroidism (<174pg/ml) n (%)	Normal (174-783 pg/ml) n (%)	Hyperparathyroidism (>783pg/ml) n (%)
6 months	78 (80.4%)	15 (15.5%)	4 (4.1%)
12 months	72 (82.8%)	12 (13.8%)	3 (3.4%)
24 months	64 (87.7%)	7 (9.6%)	2 (2.7%)
36 months	45 (73.8%)	10 (16.4%)	7 (11.5%)
48 months	29 (69.0%)	9 (21.4%)	4 (9.5%)
60 months	16 (76.2%)	4 (19.0%)	1 (4.8%)

In Greek mythology, Procrustes was a thief who offered his iron bed for pilgrims to rest on their journey to Eleusis sanctuary. If they were smaller than the bed, Procrustes stretched them until they died. On the contrary, if they were larger than the bed, the villain cut their heads and feet. If necessary, the bed was changed in order to kill any stranger and get hold of his/her belongings. The myth symbolizes the attempt to force the adjustment to an arbitrary measure.

The use of an improper definition of the target PTH level to determine hypoparathyroidism or relapse might erroneously guide surgeons and physicians. The latest JSDT proposal seems to address this need. In this new recommendation, although the upper limit has been raised to 240pg/ml, the lower one was kept at 60pg/ml, with the observation that "for patients undergoing PTx, the PTH intact molecule levels are allowed to be below the lower limit of the target range"[20]. This observation of the Japanese school may indicate that other factors are more decisive for cardiovascular risk than a low PTH. Regardless of the PTH level, PTx reduces calcium and phosphorus levels, as shown in these data. This effect on mineral metabolism can have a greater impact on patients' survival than the PTH level alone.

In conclusion, the use of different recommendations for PTH target levels in the dialysis population after PTx can misidentify patients and result in contradictory conducts.

R E S U M O

Objetivo: analisar as frequências de hipoparatireoidismo e de recidiva do hiperparatireoidismo após paratireoidectomia em pacientes dialíticos de acordo com diferentes classificações existentes. **Métodos:** estudo retrospectivo de 107 pacientes dialíticos consecutivamente submetidos à paratireoidectomia total com autoenxerto imediato em um hospital terciário no período de 2006 a 2010. A variação dos níveis de PTH no pós-operatório foi estudada ao longo do tempo. Os pacientes foram agrupados de acordo com diferentes metas de níveis de PTH recomendados de acordo com o método de dosagem e pelas sociedades de nefrologia americana, japonesa e de um consórcio internacional de especialistas. **Resultados:** após a paratireoidectomia, houve redução sustentada da calcemia e fosfatemia. O valor mediano do PTH reduziu-se de 1904pg/ml para 55pg/ml, em 12 meses. Dependendo do nível alvo considerado, a proporção de pacientes abaixo da meta variou entre 17% e 87%. Ao contrário, a proporção de pacientes com níveis acima da meta variou de 3% a 37%. **Conclusão:** O emprego de diferentes recomendações de níveis de PTH em pacientes dialíticos após paratireoidectomia pode levar a classificações incorretas de hipoparatireoidismo ou hiperparatireoidismo recidivado e implicar em condutas terapêuticas discordantes.

Descritores: Hiperparatireoidismo Secundário. Paratireoidectomia. Hipoparatireoidismo. Diálise. Hormônio Paratireoideo.

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Received in: 17/05/2016
Accepted for publication: 18/08/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005010

Analysis of the Revised Trauma Score (RTS) in 200 victims of different trauma mechanisms

Avaliação do Escore de Trauma Revisado (RTS) em 200 vítimas de trauma com mecanismos diferentes

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A B S T R A C T

Objective: *to analyze the epidemiological profile and mortality associated with the Revised Trauma Score (RTS) in trauma victims treated at a university hospital.* **Methods**: *we conducted a descriptive, cross-sectional study of trauma protocols (prospectively collected) from December 2013 to February 2014, including trauma victims admitted in the emergency room of the Cajuru University Hospital. We set up three groups: (G1) penetrating trauma to the abdomen and chest, (G2) blunt trauma to the abdomen and chest, and (G3) traumatic brain injury. The variables we analyzed were: gender, age, day of week, mechanism of injury, type of transportation, RTS, hospitalization time and mortality.* **Results**: *we analyzed 200 patients, with a mean age of 36.42 ± 17.63 years, and 73.5% were male. The mean age was significantly lower in G1 than in the other groups (p <0.001). Most (40%) of the visits occurred on weekends and the most common pre-hospital transport service (58%) was the SIATE (Emergency Trauma Care Integrated Service). The hospital stay was significantly higher in G1 compared with the other groups (p <0.01). Regarding mortality, there were 12%, 1.35% and 3.95% of deaths in G1, G2 and G3, respectively. The median RTS among the deaths was 5.49, 7.84 and 1.16, respectively, for the three groups.* **Conclusion**: *the majority of patients were young men. RTS was effective in predicting mortality in traumatic brain injury, however failing to predict it in patients suffering from blunt and penetrating trauma.*

Keywords: *Traumatology. Wounds and injuries/epidemiology. Abdominal injuries. Thoracic injuries. Craniocerebral trauma. Injury Severity Score.*

INTRODUCTION

Annually, 5.8 million people of all age groups and different economic strata die from unintentional injuries and violence around the world, trauma receiving the name of modern society neglected disease[1-4]. It is the leading cause of death in the population aged 1-44 years old, mostly men[2,4-6]. According to the Trauma American Committee, the estimate for 2020 is that one in ten people will die from trauma[2].

Classically, mortality secondary to trauma is described as having a trimodal distribution. The first peak occurs in the first seconds to minutes following trauma due to fatal injuries. The second one occurs minutes to several hours after, resulting in serious, potentially fatal injuries if there is no intensive care. Finally, the third peak occurs several days to weeks after trauma, due to complications such as sepsis and multiple organ failure[2,7].

The trauma first mortality peak is due to serious and often fatal injuries, and only prevention can be applied in its reduction. The second peak is due to potentially fatal injuries, such as subdural and epidural hematoma, hemopneumothorax, splenic rupture, liver lacerations, among others. Mortality in these cases can be reduced with early diagnosis of injuries to their rapid resolution[2]. This is where the trauma scores should be used for a streamlined and effective approach to the trauma victim.

Many tools for the polytrauma care exist for better management of these patients, as well as to provide predictive factors of morbidity and mortality in order to generate statistical data for the establishment of preventive measures to trauma. Some of these tools are the trauma scores, which are mathematical or statistical values, quantified by numerical scores, which vary according to the severity of injuries resulting from trauma, and help the professional in the care of the

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injured, especially in the pre hospital environment and initial treatment in the emergency room[5,8,9].

There are several trauma scores, with different levels of complexity for practical implementation. The Revised Trauma Score (RTS) is widely used by emergency services around the world. It is classified as physiological, since it takes into account parameters of the patient's vital functions. This is an improvement of Trauma Score (TS), created in 1981, but without the assessment of capillary refill and respiratory effort, difficult variables to be analyzed in practice[10]. RTS assesses three parameters: neurological evaluation by the Glasgow Coma Scale (GCS); hemodynamic evaluation by systolic blood pressure (SBP); and respiratory rate (RR)[8]. Depending on the each parameter's outcome, there is a corresponding value in the RTS scale, able to evaluate the morbidity and mortality of the polytrauma patient and, depending on the severity, indicate the recruitment of more specialized teams, to improve the approach to this type of patient.

The values of variables must be weighted and summed by the formula: RTS = 0.9368 x GCS_v + 0.7326 x SBP_v + 0.2908 x RR_v, where v is the value (0-4) corresponding to the variables at the patient's admission. Thus, the RTS may vary from 0 to about 8, allowing fractions. The higher the final value, the better the prognosis, the survival probability being possibly known[8] (Table 1).

On the RTS calculation formula, the greater constant multiplies the Glasgow Coma Scale, the SBP and RR being multiplied by lower constants. From this, victims of neurological trauma, whose GCS values are smaller, will have a lower final RTS result and be classified as potentially more severe. In contrast, patients with thoracic or abdominal trauma, which at first may not display changes in level of consciousness, may result in an overestimated RTS value, apparently not predicting gravity. This failure in the evaluation of such patients may not correlate well with the actual clinical situation and case seriousness, often not demanding more specialized staff, which may impair the patient's progress.

This study aims to analyze the epidemiological profile and mortality associated with the Revised Trauma Score (RTS) in trauma victims treated at a trauma reference university hospital.

METHODS

This study was approved by the Ethics in Research Committee of the Pontifical Catholic University of Paraná (number 480483 of 04.12.2013).

We prospective collected data from trauma protocols of all trauma victims seen at the Emergency Room of the Cajuru University Hospital (HUC) between December 7, 2013 and February 1, 2014 for a period of 24 hours a day including holidays. For data collection, we used the help of the Medical School undergraduates of the Cajuru University Hospital Trauma League (LATHUC). The researchers trained 35 students, accounting for a total of four hours of training, explaining the research's importance and the proper way of filling the form.

This is a descriptive, cross-sectional study of trauma protocols (prospectively collected) held in Curiti-

Table 1. RTS Parameters and survival rate.

1A		Parameter values				1B	Survival Probability (%)		
GCS	v	SBP	v	RR	v	RTS	%	RTS	%
13-15	4	> 89	4	10-29	4	8	98.8	3	30.1
9-12	3	76-89	3	> 29	3	7	96.9	2	17.2
6-8	2	50-75	2	6-9	2	6	91.9	1	7.1
4-5	1	1-49	1	1-5	1	5	80.7	0	2.7
3	0	0	0	0	0	4	60.5		

GCS: Glasgow coma scale, v: value, SBP: systolic blood pressure, RR: respiratory rate, RTS: revised trauma score

ba, a city of great size of the State of Paraná. The survey took place through the data collection of 825 records of trauma patients seen in the HUC emergency room. We randomly selected the first 200 records that had the trauma mechanisms specific of the research. We divided patients into three groups according to their mechanism of injury: Group 1 – penetrating trauma to the chest and abdomen; Group 2 – blunt trauma to the chest and abdomen; and Group 3 – blunt trauma to the brain.

The group of variables consists of four parameters, trauma mechanism, Glasgow coma scale, systolic blood pressure and respiratory rate, besides epidemiological data, such as gender, age, day of the week, type of transportation, hospitalization time and patients who died.

After tabulating the results of quantitative variables, we described them by means and standard deviations or medians and quartiles. We described qualitative variables as frequencies and percentages. To compare the types of trauma (penetrating, blunt or brain) in relation to age, we used the analysis of variance (ANOVA) with one factor or the nonparametric Kruskal-Wallis test. For comparison regarding death, we used the Fisher's exact test. We considered p values <0.05 as statistically significant. We analyzed data with the software SPSS Statistics v.20.0.

RESULTS

The study included 200 trauma victims, ranging in age from six to 91 years (mean 36.42 ± 17.63), 73.5% being male. Of the total sample, we found 50 patients who suffered penetrating trauma – gunshot wounds (GW) and stabbing wounds (SW) – to the chest and abdomen, 74 patients sustaining blunt trauma to the chest and abdomen and 76 patients with brain blunt trauma. When comparing the quantitative variables between the groups with penetrating trauma (G1), with blunt trauma (G2) and traumatic brain injury (G3), we noted statistically significant (p <0.001) differences between G1 and G2 – mean age 27.1 ± 11.1 years versus 38.5 ± 15.5, and between G1 and G3 – 27.1 ± 11.1 years versus 40.6 ± 20.7. We did observe statistical significance (p =0.442) between G2 and G3 – 38.5 ± 15.5 years versus 40.6 ± 20.7 years. The male gender was the most frequent in the three groups: G1 = 46 (92%), G2 = 54 (73%) and G3 = 47 (61.9%).

The main type of pre-hospital transportation was the emergency room was SIATE (Emergency Trauma Care Integrated Service – 193), responsible for the transport of 116 (58%) patients, followed by SAMU (Mobile Emergency Service – 192), responsible for for 43 (21.5%), highway concessionaire, for 14 (7%), direct search for 14 (7%) and other means of transportation, by 13 (6.5%) patients.

The most common mechanisms of trauma in each group were: G1 – GW, 31 (62%) and SW, 19 (38%); G2 - motorcycle accident, 24 (32.4%), automobile accident, 20 (27%), fall from height, ten (13.5%), assault, six (8.1%), fall from own, height four (5.4%), bike accident, three (4.1%) and running over, 2 (2,7%); G3 – car accident, 14 (18.4%), fall from own height, 14 (18.4%), assault, 14 (18.4%), running over, 13 (17.1%), motorcycle accident, eight (10.5%), fall from height, seven (9.2%) and bike accident, six (8%).

With regard to the day of the week, 43 (21.5%) calls occurred on Saturday, followed by: Sunday, 37 (18.5%), Mondays and Wednesdays, 29 (14.5%), Thursday, 26 (13%) Friday, 21 (10.5%) and Tuesday, 15 (7.5%). By separately analyzing the groups, we observed that: in G1, 13 (26%) of the visits occurred on Saturday, followed by 11 (22%) on Sunday, six (12%) on Mondays, Wednesdays and Fridays, five (10%) on Thursdays and three (6%) on Tuesdays; in G2, 15 (20.3%) of the visits occurred on Saturdays, 13 (17.6%) on Mondays and Wednesdays, ten (13.5) on Thursdays and Fridays, eight (10.8%) on Sundays and five (6.8%) on Tuesdays; and in G3, 18 (23.7%) of the visits occurred on Sundays, 15 (19.7%) on Saturdays, 11 (14.5%) on Thursdays, ten (13.2%) on Mondays and Wednesdays, seven (9.2%) on Tuesdays and five (6.6%) on Fridays.

Table 2. Distribution of the RTS parameters by groups.

Variable		N (%)	N (%)	N (%)	N (%)	N (%)
2A. SBP (mmHg)		> 89	76-89	50-75	1-49	0
Penetrating	G1	48 (96%)	-	-	1 (2%)	1 (2%)
Blunt	G2	74 (100%)	-	-	-	-
Brain	G3	73 (95.8%)	1 (1.4%)	2 (2.8%)	-	-
2B. RR (irpm)		10-29	> 29	6-9	1-5	0
Penetrating	G1	37 (74%)	12 (24%)	-	-	1 (2%)
Blunt	G2	57 (77%)	17 (23%)	-	-	-
Brain	G3	63 (83%)	13 (17%)	-	-	-
2C. GCS		13-15	9-12	6-8	4-5	3
Penetrating	G1	42 (84%)	3 (6%)	1 (2%)	1 (2%)	3 (6%)
Blunt	G2	72 (97.3%)	1 (1.35%)	1 (1.35%)	-	-
Brain	G3	67 (87.4%)	3 (4.2%)	1 (1.4%)	2 (2.4%)	3 (4.2%)

SBP: systolic blood pressure, mmHg: millimeters of mercury, RR: respiratory rate, irpm: respiratory incursions per minute, GCS: Glasgow coma scale.

Table 2 shows the distribution of RTS parameters in each study group.

The mean RTS value for the total sample was 7.53. In G1, the average was 7.29 and median 7.84 with 1st and 3rd quartile = 7.84. In G2, the RTS average was 7.79 and median 7.84 with 1st and 3rd quartiles with the same value. In G3, the average was 7.44 with a median of 7.84 and 1st and 3rd quartile = 7.84. We found statistically significant (p =0.003) when comparing the medians between the groups G1 and G2, but not when assessing G1 versus G3 (p =0.207) and G2 versus G3 (p =0.052).

The data regarding the length of stay are shown in Table 3, the overall average being 12.76 ± 32.29 days.

Of the 200 evaluated patients, ten (5%) died, six as a result of penetrating trauma, three due to brain trauma and one victim by blunt trauma. Mortality and comparison between groups are presented in Table 4.

All G1 deaths were male and the median age was 25.5 years, with the 1st quartile 22.25, and 3rd, 31. The Glasgow Coma Scale presented a median of six, with 1st quartile three, and 3rd, 13.5. The median length of stay was 0.5 days, with 1st quartile in zero and 3rd quartile of 2.5 days. In G2, there was one death of a 78 year old woman, GCS 15, RTS 7.84 and two days of hospitalization. In G3, two (66.6%) were male, the median age was 81 years, with the 1st quartile 64 and 3rd, 82; median GCS was three, with 1st quartile 3 and 3rd quartile, seven; for RTS the median was 1.16, with 1st quartile 0.58 and 3rd, 2.62; and a median hospitalization time of six days, with 1st quartile six and 3rd quartile 12.

Table 3. Distribution and comparison by length of hospital stay.

Group	Median	1st quartile	3rd quartile	Range	Comparison	p
G1	5	3	7	0-200	G1xG2	< 0.001
G2	0	0	1	0-56	G1xG3	< 0.001
G3	1	0	3	0-140	G2xG3	0.005

Table 4. Mortality and RTS values.

Group	Deaths (n)	Mortality rate	Median RTS	1st quartile	3rd quartile	Comparison	p
G1	6	12%	5.49	2.44	7.38	P x C	0.017
G2	1	1.35%	7.84	-	-	P x Cr	0.154
G3	3	3.95%	1.16	0.58	2.62	C x Cr	0.620

DISCUSSION

One of the problems of the trauma victims approach is that the profile of the people cared differ as to the nature and severity of injuries. The heterogeneity and difficulty in adjusting these variations have stimulated scientific research[8]. In the present study there was a predominance of injuries in males (73.5% of the sample), in the age range considered economically active, ie young adults, as observed in the literature[2,4-6,8,11]. Penetrating injuries were the ones affecting younger patients, with a mean age of 27.1 years. The highest overall prevalence of injuries occurred on weekends, 40% of cases.

Regarding the type of transportation to the emergency room, there was a predominance of SIATE – 193 – in all groups, and SAMU – 192 – in blunt and head injuries, 22% of patients suffering from penetrating wounds having been admitted after arriving through direct search, the second most prevalent type of transportation in the group.

The most prevalent mechanism in the penetrating trauma group was gunshot wound, while in blunt trauma and brain injury groups it was accidents caused by motor vehicles. According to studies by the National Department of Highways (DNER), the average cost per injured person is US$ 13,360.00, this value comprising medical expenses, property damage (vehicles and highways) and the victim's loss of income during the period of inactivity[16]. This confirms the important role of trauma prevention in improving the economy and reducing public spending, which has been shown by several studies[11-13].

Regarding RTS variables, we found that patients who suffered penetrating and blunt trauma presented, within the physiological parameters, with lower values of respiratory rate, while the systolic blood pressure values did not show significant variations. On the other hand, patients suffering from blunt injury had higher Glasgow Coma Scale values compared with the other groups. RTS values were higher among victims of blunt injury compared with victims of penetrating injury. However, when analyzing the power in predicting mortality, the three groups had similar RTS mean values.

The length of stay proved to be significantly different when comparing the three groups. The victims of penetrating trauma required more in-hospital period, becoming more costly cases to the public health system, a fact corroborated by the literature, showing that individuals victims of gunshot wounds (penetrating) have an average of 7.7 days of hospitalization, with an average cost of US$ 692.95 to the hospital[4]. Another problem related to long hospital stay of trauma patients is that they contribute to overcrowding, since the lack of beds is a common health problem in the Brazilian system[4].

Most patients were admitted with RTS values above seven, predicting good chance of survival. Even with average RTS values similar to other groups, victims of penetrating wounds had a mortality of 12%. Among the cases of blunt trauma, mortality was 1.35%, and in victims of traumatic brain injury, 3.95%. We can therefore see that even being a universally accepted trauma score, RTS is faulty when analyzing patients in groups individualized by trauma mechanism, since it does not account for this variable.

The deficiency observed in the RTS computation between groups can be explained by the fact that the variable Glasgow Coma Scale (GCS) displays

the highest constant in the score calculation. In addition, patients suffering from brain trauma more often enter the emergency room with lower minor GCS values due to local injury, while in patients with trauma to the chest and abdomen (penetrating and blunt) the level of awareness may be maintained during initial evaluation. Thus, the hypothesis arises that the variable "mechanism of injury" is an important predictive factor of mortality, future studies being needed.

When comparing only patients who died, we found statistical significance: while in G2 the victim had a RTS median value of 7.84 (98.8% survival probability), in G1 and G3 the median values were 5.49 (60.5% to 80.7% probability of survival) and 1.16 (7% survival probability), respectively.

In conclusion, RTS was effective in predicting the sample overall mortality, the majority of cases displaying RTS above seven, which indicates a high probability of survival. However, when compared groups, RTS was more effective in analyzing the survival rate in patients suffering from traumatic brain injury than doing so for patients with penetrating and blunt trauma to the chest and abdomen.

R E S U M O

Objetivo: analisar o perfil epidemiológico e a mortalidade associada ao escore de trauma revisado (RTS) em vítimas de trauma atendidas em um hospital universitário. **Métodos:** estudo transversal descritivo de protocolos de trauma (coletados prospectivamente) de dezembro de 2013 a fevereiro de 2014, incluindo vítimas de trauma admitidas na sala de emergência do Hospital Universitário Cajuru. Três grupos foram criados: (G1) trauma penetrante em abdome e tórax, (G2) trauma contuso em abdome e tórax, e (G3) trauma cranioencefálico. As variáveis analisadas foram: sexo, idade, dia da semana, mecanismo de trauma, tipo de transporte, RTS, tempo de internamento e mortalidade. **Resultados:** analisou-se 200 pacientes, com média de idade de 36,42 ± 17,63 anos, sendo 73,5% do sexo masculino. A média de idade no G1 foi significativamente menor do que nos demais grupos (p <0,001). A maioria (40%) dos atendimentos ocorreu nos finais de semana e o serviço de transporte pré-hospitalar mais frequente (58%) foi o SIATE (Serviço Integrado de Atendimento ao Trauma em Emergência). O tempo de internamento foi significativamente maior no G1, em comparação aos demais grupos (p <0,01). Quanto à mortalidade, houve 12%, 1,35% e 3,95% de óbitos nos grupos G1, G2 e G3, respectivamente. A mediana do RTS entre os óbitos foi 5,49, 7,84 e 1,16, respectivamente, para os três grupos. **Conclusão:** a maioria dos pacientes eram homens jovens. O RTS mostrou-se efetivo na predição de mortalidade no trauma cranioencefálico, entretanto falhou ao analisar pacientes vítimas de trauma contuso e penetrante.

Descritores: Traumatologia. Traumatismos/epidemiologia. Traumatismos abdominais. Traumatismos torácicos. Traumatismos craniocerebrais. Escala de Gravidade do Ferimento.

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Received in: 18/05/2016
Accepted for publication: 18/08/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005008

Profile of renal trauma victims treated at a university hospital in Curitiba

Perfil dos pacientes vítimas de trauma renal atendidos em um hospital universitário de Curitiba

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A B S T R A C T

Objective: *to study the profile of victims of kidney trauma who underwent surgical and medical treatment in a hospital in Curitiba.* **Methods**: *we conducted a retrospective, analytical, quantitative, cross-sectional study of patients with renal trauma admitted to the Evangelical Hospital of Curitiba between February 2011 and January 2014.* **Results**: *participated in the study 38 patients, four women and 34, men with a mean age of 28.4 years. Most injuries (60.5%) was due to closed mechanisms, especially motorcycle accidents. Injuries were treated conservatively in most cases. Patients who required surgical treatment had severe kidney damage or some other associated lesion, usually intra-abdominal. Hospital stay was lower in the conservative treatment group (10.8 days) compared with the surgical treatment one (18.8 days); mortality was also lower in the conservative treatment group (8.3%) compared with the surgical (14.3%). There were no deaths associated to kidney damage itself.* **Conclusion**: *patients with renal trauma in this study were young men, victims of motorcycle accidents, taking place during the night and early morning. Most injuries were treated conservatively.*

Keywords: *Wounds and Injuries. Kidney/injuries. Abdominal injuries. Multiple Trauma. Traumatology.*

INTRODUCTION

The abdominal trauma has shown increased their rates in recent years and represents a diagnostic challenge in some situations where the physical examination is poor and obscured by neurological disorders. In such cases, the hemodynamic status, the mechanism of injury and a high rate of suspicion are important to the definition between surgical and conservative management[1,2]. The kidneys are located in the posterior region of the abdomen, in the retroperitoneum, between T12 and L3, being anterolaterally protected by a muscle-aponeurotic wall and the abdominal viscera, and posteriorly, by the last ribs and the para-vertebral muscular. This anatomical arrangement provides protection from external injuries, making renal trauma an uncommon condition in relation to other organs, although among the genitourinary viscera they are the most affected. Due to their anatomical arrangement, it is necessary that a large amount of energy cross through adjacent structures. Therefore, when present, renal lesions are indicative of injuries in other intra-abdominal components in blunt trauma. Thus, renal trauma accounts for approximately 10% of visceral lesions in abdominal trauma.

The affected population is predominantly made up of young men (20-30 years), subject to blunt trauma (80% of cases), from falls and traffic accidents, especially those involving motorcyclists[3-5]. There is no specific symptoms of renal trauma. Pain is not reliable. Being a retroperitoneal organ, there is little or no abdominal pain or signs of peritoneal irritation. A palpable flank mass is also rarely present. The most common clinical finding is hematuria, however, it is not specific and its absence does not exclude renal injury. The presence of lower rib fractures and high lumbar processes increases the possibility of renal injury. Diagnosis often occurs as a complementary exam finding, usually computed tomography, performed to investigate other related injuries, or in surgical explorations, indicated in general for other reasons[5-7].

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In closed traumas, renal lesions are mild in most cases, which allows a conservative approach. Penetrating injuries are less common but usually cause more serious injuries and often require surgical approach, but can also be effectively treated conservatively, depending, for this, on a team with experience in trauma and continuous monitoring of the patient's hemodynamic status[6,7].

This study evaluates the profile of patients with renal trauma treated at a trauma hospital in Curitiba.

METHODS

This is a quantitative, retrospective, analytical, cross-sectional study. We reviewed charts of patients with renal injury admitted to the Trauma Surgery Department of the Evangelical University Hospital of Curitiba (HUEC) between February 2011 and January 2014. We collected data related to age, gender, time and mechanism of injury, degree of found injury (stratified by Organ injury Scaling for Kidney trauma), diagnostic methods, associated injuries, therapeutic approach, clinical outcome and length of hospital stay. For the purpose of statistical calculations, we grouped renal lesions into minor lesions (grades 1 and 2) and major ones (grades 3, 4 and 5).

As for the period of the day when the trauma occurred, we divided the patients into four groups, defined as early morning (between 00:00 and 06:00 hours), morning (between 06:01 hours and 12:00 hours) afternoon (between 12:01 hours and 18:00) and evening (between 18:01 hours and 23:59). The topic "diagnostic method" was intended to indicate whether the identification of the injury was through imaging or during surgery. The associated lesions were stratified by body part and also the involvement of parenchymal or hollow organs in the case of abdominal cavity lesions.

We defined the initially administered treatment as surgical or nonsurgical. The patient undergoing laparotomy or some other intervention approach that did not involve the affected kidney was considered in the clinical treatment group.

The clinical outcomes comprised the patient discharge, death or conversion of an initially conservative treatment to a surgical one. In case of surgical treatment, we also specified the technique used (debridement, nephrorrhaphy, drainage, partial or total nephrectomy).

For a description of quantitative variables, we applied the mean, median, minimum, maximum and standard deviation. For summarization of qualitative variables, we used frequencies and percentages. For comparison of the types of approaches as to quantitative variables, we employed the Student's t test for independent samples and the nonparametric Mann-Whitney test. To evaluate the association between qualitative variables with the type of approach, we used the chi-square and Fisher's exact tests. For evaluation of the variables' normality, we applied the Jarque-Bera test. We considered p values less than 0.05 as statistically significant. We analyzed data with the computer software IBM SPSS, v.20.

The study was approved by the Ethics in Research Committee of the Beneficent Evangelical Society of Curitiba, CAAE 39364114.7.0000.0103, Opinion 908,938.

RESULTS

There were 45 patients treated in the period, of whom 38 were included in the study and seven excluded due to incomplete data. Of the analyzed sample, four patients (10.5%) were women, with a mean age of 26.25 years, and 34 (89.5%) male, with a mean age of 28.6 years. There was no statistical difference in age or in relation to gender. Most of the incidents occurred at night, with 13 patients (34.2%) attended at night and 12 (31.6%) in the early hours. The time of day with less patients admitted was the morning, with two individuals (5.2%), with no statistical difference. The distribution of months shows a higher incidence in the months of December, with five patients (13.1%), and February, with seven (18.4%). The average hospital stay was 13.7 days, being 10.8 days for patients with clinical management and 18.8 days for those undergoing a

surgical approach, with no statistical difference between these groups (p=0.112).

Closed traumas totaled 23 cases (60.5%), of which 21 (91.3%) underwent clinical treatment and two (8.7%), surgical. Penetrating trauma occurred in 15 patients (39.5%), 12 (80%) underwent surgical treatment and three (20%), conservative one (p<0.001). In the group of penetrating injuries, stab wounds were the less common, in four patients (26.7%), two (50%) submitted to clinical treatment and two (50%), to surgical. Among the 11 patients (73.3%) with injuries by firearms, ten underwent surgical treatment (90.9%) and one, clinical (9.1%), with no statistical difference (p=0.07). Figure 1 depicts the stratification of mechanisms between closed traumas.

The diagnosis of renal injury was performed by computed tomography (CT) in 20 patients (52.6%), and by laparotomy, in 18 (47.4%). Among those who were diagnosed by CT, 18 (90%) underwent conservative treatment, and two (10%) required surgery. In patients whose diagnosis was done through laparotomy, 12 (66.7%) required surgical intervention, and six (33.3%) were treated conservatively (p<0.05).

Through the diagnostic method, it was also possible to know the stage of renal injury, whose distribution is shown in Figure 2.

In 12 cases (80%) with minor injuries, treatment was conservative, and three (20%) required some surgery, while among those with major lesions, seven patients (43.75%) were treated conservatively and nine (56.25%) required surgery (p=0.157). We also compared the major lesions to each other as for the treatment used, surgical or clinical, but without significant differences, as Table 1 shows.

Thirty patients (78.9%) had associated injuries, 24 (80%) being intra-abdominal, 12 (40%) in the chest and two (6.7%) in the spinal cord. In the group of patients with some associated injury, 14 (46.7%) required some surgery and 16 (53.3%) did not. Among the eight subjects who had no associated injury, none required surgery (p<0.05).

Of the 24 patients that had some other abdominal viscera affected besides the kidney, in

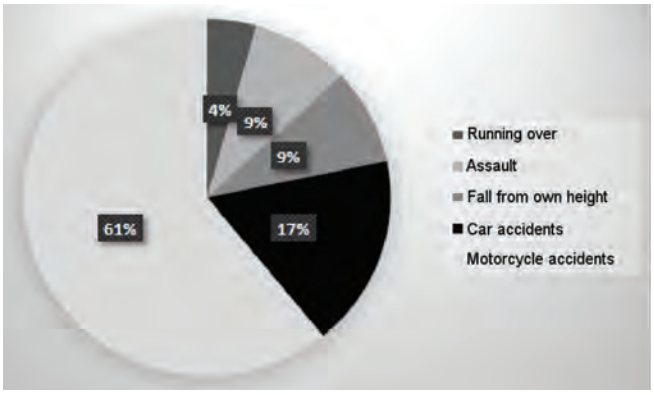

Figure 1. *Mechanisms of blunt trauma.*

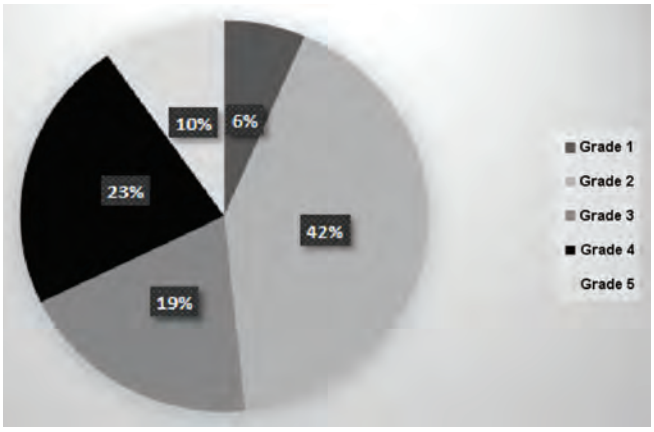

Figure 2. *Staging of renal lesions.*

12 (50%) we found only solid viscera lesions, in six (25%), only hollow viscera lesions, and in six (25%), both. Of those with involvement of solid viscera, only three (25%) required surgical treatment and nine (75%) were treated conservatively. In six patients with involvement of hollow viscera, four (66.6%) required surgery and two (33.3%) had the renal injury treated conservatively. In the group with combination of solid

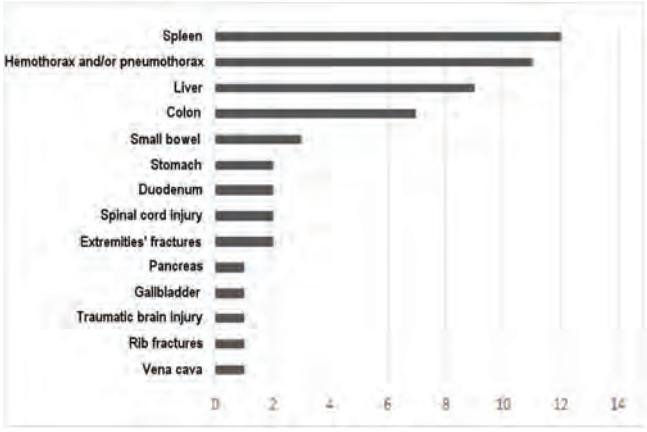

Figure 3. *Distribution of associated injuries.*

Table 1. Comparison of major renal lesions.

Stage	Surgical treatment		Clinical treatment		
	n	%	n	%	p
Grade 3	3	50	3	50	
Grade 4	2	28.6	5	71.4	
Total	5	38.5	8	61.5	0.43
Grade 3	3	50	3	50	
Grade 4	2	28.5	5	61.5	
Grade 5	2	66.7	1	33.3	
Total	7	43.7	9	53.3	0.49

and hollow viscera injuries, all required some surgery of the renal injury (p<0.05). Of the 24 patients with associated abdominal injury, 13 (54.2%) required some type of intervention, while among the 14 individuals who had no abdominal or pelvic injury, one (7.1%) required surgery (p<0.01). Associated lesions in other areas showed no statistical difference as for the need or not of surgical treatment for the renal trauma.

Figure 3 shows the types of lesions found. We calculated the data based on the total number of lesions found, not the total number of patients, for a single patient could have more than one lesion.

Clinical treatment was applied in 24 patients (63.15%) and the remainder required surgical treatment as a primary approach. Nephrorrhaphy was used in six patients (42.9%) and nephrectomy in eight (56.1%). Of those who underwent clinical treatment, only one required conversion to surgery to perform nephrectomy.

The overall mortality rate was 10.52% (4 patients). In the surgical treatment group, 12 patients (85.7%) were discharged and two (14.3%) died. In the clinical treatment group, the outcome was favorable in 22 patients (91.7%) and two (8.3%) died for reasons other than renal trauma. There was no statistical difference between the groups (p>0.05).

DISCUSSION

Trauma is the third leading cause of death in Brazil and the leading cause of morbidity and mortality among the population under 40 years[8]. The abdominal trauma, specifically, still brings a diagnostic challenge, since there are no reliable signs of intra-abdominal injury, and the anamnesis may be impaired by conditions associated with trauma[9]. Usually, in penetrating trauma the small intestine and liver are affected, while in closed traumas the liver is the most affected organ, followed by the spleen and the kidneys[10-12]. In the latter case, the profile of patients with this type of injury usually follows the same epidemiology of trauma, as seen in our study and in other national and international series[3,4,7]. The occurrences concentrate in the night time, with most held at night (34.2%) and in the early morning (31.6%). Other studies on trauma using the same methodology for division of day periods show a difference in the proportion of cases, some with concentration in the night and early morning of 31.1% to 42%[13,14], and others in the afternoon[15].

Most kidney damage (80-90%) occur by closed traumas, usually resulting from traffic accidents involving cars, pedestrians and especially motorcycles[1,4,16]. In our study, the closed mechanism involving traffic accidents especially with motorcycles was also the most common, found in 60.5% of cases, lower values than those referenced in other regions[2,3,7,12]. Penetrating injuries had a higher proportion of affected (39.5%) compared to other regions of the country, although to a lesser extent in relation to closed trauma. They were for the most part (73.3%) caused by firearms. A Curitiba trauma service even showed values much higher than the national

average, around 84.8% of penetrating trauma, mostly by firearms[17]. This may be the result of a selection bias due to population profile attended by the hospital, or merely the result of urban violence in one of the cities with the highest homicide rates in the country. In other cities, penetrating injuries accounted for 10-20% of the causes of renal trauma.

Because of the kidneys' anatomical position, which provides protection in blunt trauma, renal lesions are indicative of high-energy trauma and usually come with injuries to other parts of the abdomen or other body systems[11]. In our study, 30 patients (78.9%) had at least some other associated injury, mostly (80%) represented by other abdominal viscus and 40% represented by lesions in the thorax. The literature does not reach an agreement regarding injury association, and the values found differ depending on the study. Our results are equivalent to 78.8% of cases found in the city of Sorocaba and 65.1% in Coimbra[4,7], but are higher than the values found by other authors, who reported rates between 13-34%[12]. In agreement with other studies, liver and spleen are among the major abdominal associated injuries[4,9,16].

Currently, conservative treatment is recommended for solid viscera injury. For its adoption, however, a hospital structure is required to dispose of ICU beds, professionals with experience in trauma and the patient should be hemodynamically stable and without active bleeding signals. Computed tomography becomes indispensable for this type of treatment, since it can diagnose associated abdominal injuries and reveal exactly the staging of renal injuries. Major renal lesions have a higher chance of needing surgery compared with minor ones. The staging alone does not indicate intervention, but allows damage estimation and an improved interventional programming, if necessary, either by surgery or by angioembolization[3-5,11,12,17,18]. The tomographic diagnosis was used in 20 patients (52.6%), and of these, 18 (90%) were treated conservatively. Of the 18 patients (47.4%) who were diagnosed during surgery, only six (33%) had conservative management. There are few studies on the diagnostic methods used to identify kidney injury. One study observed CT use in 33.3% of cases, the other 66.6% requiring laparotomy for diagnosis[4]. Another found diagnosis by CT in 41% of cases[18]. We found no data in the literature comparing the use of diagnostic methods with the type of treatment employed.

The higher the degree of injury, the greater the chance of need for surgical intervention. Overall, injury grades 1 and 2, the most common, are managed conservatively, while larger lesions require a surgical procedure[1]. In our study, the profile of these lesions is different from that found in other studies. We found 16 patients (52%) had high-grade lesions, seven (43.7%) of whon being treated conservatively, and 15 (48%) had low-grade lesions, with 12 (80%) receiving conservative treatment. Another trauma service in Curitiba has a proportion of 51.4% low-grade and 49.6% high-grade lesions but virtually all (90.9%) were surgically treated[17]. These are data divergent from other articles, but it is worth mentioning that in that study about 90% of traumas were penetrating[17]. One of the questions in the literature revolves around the management of 4 and 5 degree injuries. In our study, there was no significant difference on who required surgery or were medically treated. Other authors seek to stratify the need or not of surgery through imaging methods, however, without consensus yet[18].

The conservative approach, as seen in our study, is associated with lower morbidity and a shorter hospital stay, resource saving, avoiding surgical complications, avoiding the possible loss of the involved organ and allowing an earlier return to normal activities. The mean duration of hospitalization in the literature ranges from less than six days (2 to 23)[4] to 16.5 days[7].

The lesions who underwent surgical treatment occurred in patients with classical indication for laparotomy, such as hemodynamic instability, peritonitis or in cases where the performance of imaging was not indicated[2,3,12,13]. The association of other abdominal injuries also increases the chance of surgical treatment[12]. The mortality rate was 10.5% and occurred

in two patients in the clinical treatment group (8.3%) and in two patients in the surgical group (14.3%). None of the deaths occurred due to the renal trauma itself, being caused by other associated injuries. Other authors reported mortality rates ranging from 6.6% to 26%, also related to associated injuries[17,18].

In conclusion, the profile of patients with renal trauma treated at the Evangelical Hospital in Curitiba-PR is represented by young men, victims of road accidents involving motorcycles, in particular occurring during the night and early morning. Most injuries were treated conservatively, with a low rate of conversion to surgery. Patients who required surgical management for the most part had more severe kidney injuries and/or associated lesions in some abdominal viscus. The hospital stay was lower in the group treated conservatively and the deaths that occurred were due to other associated injuries and not to renal trauma.

R E S U M O

Objetivo: estudar o perfil das vítimas de traumas renais submetidos a tratamento cirúrgico e clínico em um hospital de Curitiba. **Métodos**: estudo transversal quantitativo analítico retrospectivo de pacientes com trauma renal admitidos no Hospital Universitário Evangélico de Curitiba entre fevereiro de 2011 e janeiro de 2014. **Resultados**: fizeram parte do estudo 38 pacientes, sendo quatro mulheres e 34 homens, com média de idade de 28,4 anos. A maior parte dos traumas (60,5%) foi decorrente de mecanismo fechado, em especial acidentes automobilísticos envolvendo motos, tratados de maneira conservadora na maior parte dos casos. Os pacientes que necessitaram de tratamento cirúrgico possuíam lesões renais graves ou alguma outra lesão associada, geralmente intra-abdominal. O tempo de internamento foi menor no grupo de tratamento conservador (10,8 dias) em relação ao grupo de tratamento cirúrgico (18,8 dias), assim como a mortalidade também foi menor no grupo de tratamento conservador (8,3%) comparada ao cirúrgico (14,3%). Nenhuma morte foi relacionada à lesão renal em si. **Conclusão**: os pacientes com traumatismo renal neste estudo foram homens jovens, vítimas de acidentes automobilísticos com motos, ocorrendo durante a noite e madrugada. A maioria das lesões foi tratada de modo conservador.

Descritores: Ferimentos e Lesões. Rim/Lesões. Traumatismos Abdominais. Traumatismo Múltiplo. Traumatologia.

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Received in: 17/05/2016
Accepted for publication: 24/08/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005012

Kidney ischemia and reperfusion syndrome: effect of lidocaine and local postconditioning

Síndrome de isquemia e reperfussão renal: efeito da lidocaína e do pós-condicionamento local

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ABSTRACT

Objective: *to evaluate the effects of blocking the regulation of vascular tone on the ischemia and reperfusion syndrome in rats through the use of lidocaine in the postconditioning technique.* **Methods**: *we randomized 35 rats into seven groups of five animals: Group 1- Control; Group 2- Ischemia and Reperfusion; Group 3- Ischemia, Reperfusion and Saline; Group 4- Ischemic Postconditioning; Group 5- Ischemic Postconditioning and Saline; Group 6- Lidocaine; Group 7- Ischemic Postconditioning and Lidocaine. Except for the control group, all the others were submitted to renal ischemia for 30 minutes. In postconditioning groups, we performed ischemia and reperfusion cycles of five minutes each, applied right after the main ischemia. In saline and lidocaine groups, we instilled the substances at a rate of two drops per minute. To compare the groups, we measured serum levels of urea and creatinine and also held renal histopathology.* **Results**: *The post-conditioning and postconditioning + lidocaine groups showed a decrease in urea and creatinine values. The lidocaine group showed only a reduction in creatinine values. In histopathology, only the groups submitted to ischemic postconditioning had decreased degree of tubular necrosis.* **Conclusion**: *Lidocaine did not block the effects of postconditioning on renal ischemia reperfusion syndrome, and conferred better glomerular protection when applied in conjunction with ischemic postconditioning.*

Keywords: *Reperfusion Injury. Warm Ischemia. Reperfusion. Ischemic Postconditioning. Lidocaine. Rats.*

INTRODUCTION

The ischemia and reperfusion syndrome contributes to 60-70% of the morbidity and mortality related to the Cute Kidney Injury (AKI) present in various clinical situations, such as renal transplantation and renal artery embolism[1-5]. Although the immediate arterial blood reperfusion is the best approach to eliminate the ischemic process[6], cell reoxygenation is associated with an increase in lipid peroxidation, in cellular damage and in deterioration of the function[7,8].

The recent description of "tissue conditioning" techniques, consisting of alternate cycles of brief ischemia and reperfusion, is a promising approach for controlling damage by prolonged ischemia and reperfusion injury[6].

In 2003, Zhao *et al*.[9] developed the concept of ischemic postconditioning (POS), which consists of small ischemia and reperfusion cycles before free reperfusion in a previously ischemic tissue. This technique can be easily applied in unexpected ischemias, especially when compared with preconditioning, with studies showing beneficial effects in humans[10,11].

The mechanisms involved in the protective effect of POS against ischemia and reperfusion injury are poorly understood. It is known that this procedure works in modulation of mitochondrial potassium channels, the mitochondrial permeability transition pore and via p13-kinase-pAkt signaling[12].

The exact POS intracellular mechanisms have not been fully determined. A mechanism suggested by some studies would be the vascular tone modulation[13,14], wherein the postconditioning would increase the number and duration of contraction of the arterioles, preventing a large influx of oxygen and therefore the generation of reactive oxygen species. However, in the literature review, we identified no study directly assessing this route.

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Lidocaine is a local anesthetic, often used to perform minor surgical procedures. It acts by blocking sodium channels, preventing the nerve impulse and the painful feeling[15,16]. However, when administered systemically, it has a vasodilatory effect, which could be used to block the vascular tone modulation[17].

Thus, this study aims to assess the effects of blocking the regulation of vascular tone in ischemia and reperfusion syndrome in rats, through the use of lidocaine in the ischemic postconditioning technique.

METHODS

We used thirty-five male Wistar rats (*Rattus norvegicus*) aged 15 to 20 weeks, weighing 250-300 g study. We kept the animals in a vivarium of the Experimental Surgery Laboratory of the Pará State University, in a controlled environment, with water and food offered ad libitum. This research followed the Brazilian law of animal experimentation (11,794/08). The research project was approved by the Ethics in Research Committee of the Pará State University (43/12)

We randomly divided the animals into seven groups of five animals each: 1) Control group (CON), in which renal ischemia was not induced; 2) Group ischemia and reperfusion (IR), which underwent renal ischemia for 30 minutes followed by reperfusion without any conditioning technique; 3) Group ischemia and saline reperfusion (IRS), which underwent renal ischemia for 30 minutes followed by saline infusion in the renal artery at a rate of two drops per minute (Figure 1); 4) Ischemic postconditioning group (POS), subjected to 30 minutes of renal ischemia followed by 30 minutes of local postconditioning (three cycles of five minutes of perfusion interspersed by five minutes of ischemia)[13]; 5) Ischemic postconditioning and saline group (POSS), submitted 30 minutes of renal ischemia followed by 30 minutes of the local postconditioning (3 cycles of 5 minutes of renal perfusion interspersed with five min of renal ischemia)[11] and instillation of saline in the renal artery at a rate of two drops per minute; 6) Lidocaine group (LIDO), subjected to 30 minutes of renal ischemia followed by 30 minutes of lidocaine instillation into the renal artery at a rate of two drops per minute; 7) Postconditioning and lidocaine group (POLI), submitted 30 minutes of renal ischemia followed by 30 minutes of the local postconditioning and instillation of lidocaine in the renal artery.

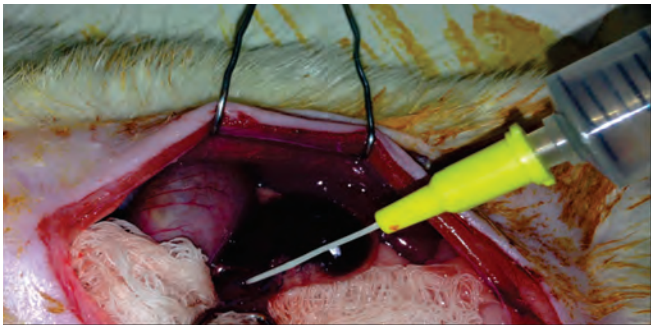

Figure 1. *Technique of instillation in the left renal artery.*

We performed all procedures under anesthesia with ketamine 70mg/kg and xylazine 10mg/kg intraperitoneally. In all groups, we performed right nephrectomy and dissected the left renal artery with the aid of a microsurgical microscope. We induced renal ischemia by applying a microsurgical clamp on the left renal artery for 30 minutes. We maintained the temperature of the animals at 37°C using a thermal blanket throughout the procedure. We performed postoperative rehydration through saline injection (10ml/kg) subcutaneously.

During the observation period, the animals received analgesia with dipyrone 30mg/kg every eight hours and water and food *ad libitum*. The animals were individual in cages postoperatively. We evaluated the amount of food and water consumed before and after surgery.

Twenty-four hours after surgery, animals were again anesthetized. We obtained blood samples from the vena cava and immediately sent them to biochemical analysis. Serum urea and creatinine were measured using the colorimetric assay in a Selectra-E device using specific Labtest® kits. We removed the left kidney and fixed it in 10% buffered formalin. The pieces were stained with hematoxylin and eosin. We analyzed the presence of tubular necrosis, medullary congestion and retraction of the glomerular tuft, graduating it as 0 – absent; 1 – mild; 2 – moderate; and 3 – intense. We euthanized the animals by anesthesia overdose.

Table 1. Serum levels of urea and creatinine.

Group	Urea (mg/dl)	Creatinine (mg/dl)
CON	39.40 ± 3.43	0.50 ± 0.10
IR	216.30 ± 2.52	2.06 ± 0.26
IRS	208.40 ± 4.66	2.11 ± 0.19
POS	141.40 ± 43.77	0.93 ± 0.18
POSS	140.20 ± 30.98	1.02 ± 0.26
LIDO	187.80 ± 53.73	1.27 ± 0.41
POLI	80.50 ± 15.08	0.76 ± 0.08

p<0.05 CON vs other groups; p>0.05 IR and IRS vs POS, POSS and LIDO; p>0.05 vs IRS and POS vs POSS.

We expressed the results as mean ± standard deviation. We used the BioEstat® 5.4 software (Belém, PA, Brazil) for statistical analysis. We used the ANOVA test followed by Tukey's post-test to compare the levels of urea and creatinine between groups, and the Kruskal-Wallis test to compare the histopathological scores. We adopted a value less than 0.05 or 5% to reject the null hypothesis.

RESULTS

During the entire study period, no animal died or needed resuscitation maneuvers. There was no change in the feeding patterns of animals during pre and postoperative periods (18.63 g/day vs 17.44 g/day, p<0.05). We noticed that the IR group had higher urea levels that CON, POS and POLI groups (p<0.01), showing no significant difference when compared with the LIDO group (p=0.62). The POLI group achieved better serum levels than the POS group (p=0.045), and was the only group that showed urea levels similar to the CON group (p=0.32).

With respect to creatinine, the IR group showed the highest levels when compared with all other groups (p<0.001); the POLI group achieved better serum levels than the POS group (p=0.043) and was the only group that showed creatinine levels statistically similar to the CON group (p=0.57). The LIDO group showed higher creatinine levels than POS and POLI groups (p<0.01). Table 1 shows the serum levels of urea and creatinine per group.

Table 2 shows the results of the histopathological analysis. We identified a lesser degree of glomerular injury in all treated groups (p<0.05), but only in the postconditioning groups there was a reduction in the level tubular injury (p<0.05).

DISCUSSION

The exact mechanism of ischemic postconditioning is poorly understood. It is known that its effects are mediated through potassium channels[16,18], modulated by neural and humoral mechanisms that critically depend on the time at which the conditioning is applied. When performed immediately after the main ischemia, the neuronal pathway is dominant, through a parasympathetic action[19]. However, when applied shortly after the main ischemia, the humoral mechanism is predominant, through the RISK and SAFE pathways[8].

One of the parasympathetic actions is the regulation of vascular tone that, when activated, causes an increase in blood flow by vasodilatation[20]. The tone of the renal artery is regulated primarily by the sympathetic pathway, which promotes dilation when inhibited[21]. Our hypothesis with lidocaine instillation in the renal artery is that it should generate a parasympathetic effect through of the sympathetic-type blocking of the vascular tone, resulting in a sustained vasodilation with blocking of the postconditioning neurogenic pathway.

The blood markers of renal function were decreased in the group subjected to the postconditioning, as identified in several other studies. However, lidocaine-treated animals also showed a beneficial effect,

Table 2. Average histopathological scores.

Parameter	CON	IR	IRS	POS	POSS	LIDO	POLI
Tubular necrosis	0.00	2.60	2.40	1.40	1.20	2.20	1.20
Medullary congestion	0.00	2.80	2.60	1.20	1.40	2.20	1.00
Glomerular retraction	0.00	2.40	2.60	1.40	1.00	1.40	1.20

p<0.05 CON vs other groups; p>0.05 IR vs IRS and POS vs POSS. Tubular necrosis and Medullary Congestion: p<0.05 POS, POSS and POLI vs CON, IR, IRS and LIDO; Glomerular retraction: p<0.05 POS, POSS, POLI and LIDO vs CON, IR and IRS.

particularly in relation to creatinine, displaying an additional glomerular protection[22]. We did not observed this difference regarding urea levels, demonstrating a higher tubular compromise since, under normal conditions, the loop of Henle is responsible for 60% of urea urinary secretion[23].

It is important to note that the groups treated with saline had no effect similar to the lidocaine group, indicating that the reduction of markers was due to the pharmacological properties of lidocaine and not to a possible volume overload of the instilled lidocaine.

One possible mechanism involved in the lidocaine protective effect of is the blockade of NaV 1.9 channels, which are closely related to the pathophysiology of ischemia and reperfusion syndrome[16]. When this channel is blocked, there is a decrease in the intracellular influx of sodium and less reperfusion injury. However, Lee *et al*.[24] demonstrated that the continuous infusion of lidocaine in rats' subcutaneous tissue had deleterious effects on the ischemia and reperfusion syndrome, suggesting that there is still need for greater understanding of this drug effects and the influence of the route of administration.

Histologically, no significant differences were evident when comparing the histological grade of glomerular and tubular injury, with results similar to those identified in the analysis of serum urea and creatinine and confirming the initial conclusions. We observed no further lesion by the use of lidocaine, which some studies proved to be toxic to the renal epithelium[24,25].

Further studies are required before the clinical use of lidocaine, especially using other analysis parameters such as oxidative stress and cell viability, not tested in this initial work[26]. Furthermore, there is controversy in the literature on whether the ischemic postconditioning is influenced by the number of cycles or by the conditioning time[27]. Five-minute cycles may not have been the appropriate model to determine the maximum protective effect on ischemia and reperfusion. Thus, if we had applied an ideal cycle, lidocaine solution could not have presented the described effects.

In conclusion, lidocaine did not block the postconditioning effects on the ischemia and reperfusion syndrome, but determined a better result in glomerular protection when applied in conjunction with this technique.

R E S U M O

Objetivo: avaliar os efeitos do bloqueio da regulação do tônus vascular por meio do uso da lidocaína na técnica de pós-condicionamento isquêmico na síndrome de isquemia e reperfusão renal em ratos. **Métodos**: trinta e cinco ratos foram randomizados em sete grupos de cinco animais: Grupo 1- Controle; Grupo 2- Isquemia e Reperfusão; Grupo 3- Isquemia, Reperfusão e Solução Salina; Grupo 4- Pós-condicionamento Isquêmico; Grupo 5- Pós-condicionamento Isquêmico e Solução Salina; Grupo 6- Lidocaína; Grupo 7- Pós-condicionamento Isquêmico e lidocaína. Com exceção do grupo controle, todos os demais foram submetidos à isquemia renal de 30 minutos. Nos grupos de pós-condicionamento, foi realizado o ciclo de isquemia e reperfusão de cinco minutos cada, aplicado logo após a isquemia principal. Nos grupos salina e lidocaína foram instiladas as substâncias numa taxa de duas gotas por minuto. Para comparar os grupos, foram dosados os níveis séricos de ureia e creatinina e análise histopatológica renal. **Resultados**: os grupos pós-condicionamento e pós-condicionamento + lidocaína apresentaram uma redução nos valores de ureia e creatinina. O grupo lidocaína apresentou apenas uma redução nos valores de creatinina. Na análise histopatológica, apenas os grupos submetidos ao pós-condicionamento isquêmico apresentaram redução do grau de necrose tubular. **Conclusão**: a lidocaína não bloqueou os efeitos do pós-condicionamento na síndrome de isquemia e reperfusão renal, mas conferiu melhor na proteção glomerular quando aplicada em conjunto com o pós-condicionamento isquêmico.

Descritores: Traumatismo Por Reperfusão. Isquemia Quente. Reperfusão. Pós-Condicionamento Isquêmico. Lidocaína. Ratos.

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Received in: 06/04/2016
Accepted for publication: 01/09/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005013

Relationship between anxiety, depression and quality of life with the intensity of reflex sweating after thoracoscopic sympathectomy for treatment of primary hyperhidrosis

Relação entre ansiedade, depressão e qualidade de vida com a intensidade da sudorese reflexa após simpatectomia torácica por videocirurgia para tratamento da hiperidrose primária

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ABSTRACT

Objective*: to compare the intensity of reflex sweating with the degree of anxiety and its interference in the quality of life of patients undergoing Thoracoscopic (VATS) sympathectomy in the pre- and postoperative period.* **Methods***: we evaluated 54 patients with a mean age of 26 years (16-49 years) undergoing sympathectomy in the R3-R4 level. We applied two questionnaires at three different times: "Quality of life in patients with primary hyperhidrosis" and "Scale for anxiety and depression".* **Results***: of the patients studied, 93% showed significant improvement in quality of life 30 days after surgery, the effects remaining after six months. There were no postoperative complications. The patient's level of anxiety is highly correlated with the intensity of reflex sweating after 30 and 180 days.* **Conclusion***: Thoracoscopic sympathectomy improves quality of life of patients with primary hyperhidrosis, even with the emergence of reflex sweating. Anxiety directly relates to the intensity of reflex sweating, without compromising the degree of patient satisfaction.*

Keywords: Hyperhidrosis. Quality of Life. Anxiety. Sympathectomy. Thoracic Surgery, Video-Assisted.

INTRODUCTION

Primary hyperhidrosis (PH) is a clinical condition defined as sweating, localized excessive, which mainly affects the hands, armpits, feet and face. It has unknown etiology, occurring due to hyperactivity of the sympathetic nervous system. The literature reports an incidence of 1% and it is more frequent in young adult patients[1].

Currently the first choice therapy, and the providing better outcomes in PH treatment, is the thoracoscopic sympathectomy[2,3]. Its most common side effect is the reflex sweating (RS), characterized by increased sweating in other parts of the body such as the back, abdomen and thighs[4].

The use of scores allows for better quality and refinement of diagnostic assessments and/or monitoring of patients in clinical trials[5].

The literature extensively discusses the relationship between RS intensity and the adopted surgical level[2], but few studies have correlated this side effect with the degree of anxiety and depression and the quality of life in patients undergoing thoracoscopic sympathectomy.

METHODS

This was a prospective cohort study conducted between January 2010 and September 2013 in the Department of Thoracic Surgery, State University of Campinas (UNICAMP), Brazil. We analyzed 54 PH patients of both genders, aged between 16 and 70 years, submitted to thoracoscopic sympathectomy, the surgery being performed in the R3-R4 levels for all the different sweating sites.

Participants responded to the questionnaires on quality of life and anxiety in the preoperative period and 30 and 180 days after surgery. To evaluate the quality of life of patients with PH, we applied the "Quality of Life Questionnaire in Patients with Primary hyperhidrosis"[1].

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Table 1. Sites of primary Hyperhidrosis

Sites of involvement	%
Hands and armpits	54
Hands, armpits and feet	28
Armpits	9
Hands and feet	5
Hands	4
Total	100.0

The questionnaire consists of 20 questions divided into five domains. The higher the score, the worse the patient's quality of life. Each domain contains different levels of responses based on tables that admit only one answer. The difference between the pre and postoperative assessment is considered the treatment effect on quality of life[1].

Regarding the anxiety of patients with PH, we used the questionnaire "Scale for Anxiety and Depression (HAD)" translated and validated by Botega *et al.*, in 1995[6]. This is a self-rating scale consisting of 14 multiple choice questions, requiring approximately four minutes to perform. The patient is requested to respond according to what he/she has felt during the last week[6]. In addition, all participants signed an informed consent form previously approved by the local Ethics in Research Committee.

After 30 and 180 days, we questioned the patient if there was sweating in another location and its intensity: absent (did not develop RS), mild (presented sweating in other areas, without relapse, but not bothersome), moderate (presented sweating in other areas, without recurrence, but it did not hinder usual daily activities) or severe (presented sweating in other areas, without recurrence, and desired treatment).

We carried out the comparisons between the three evaluation periods with respect to the variables quality of life, anxiety and depression using the Friedman test, and when we found a significant difference, we applied the non-parametric Wilcoxon test considering the Bonferroni correction[7] for multiple comparisons. The p value was considered <0.01. For the analyzes of reflex sweating levels with respect to quality of life scores, anxiety and depression during periods 30 and 180 days after surgery, we used the Kruskal-Wallis test, and when necessary, the Dunn post-test, also considering the Bonferroni correction and contemplating the value of p <0.02. We used the software the SAS (Statistical Analysis System) version 9.2.

RESULTS

We analyzed all 54 patients enrolled in the study, with a median age of 26 years (16-49), of whom 33 (61%) were female. The main localization of excessive sweating was in the hands and armpits (54%), as shown in Table 1.

Before surgery, 32% of patients rated their quality of life (QOL) as very bad, 43% bad, 24% good and 2% very good. After 30 days, 87% of patients rated their quality of life regarding hyperhidrosis as much better, 9% a little better, 2% as the same and 2% as much worse. After six months, 80% of patients rated their quality of life as much better, 13% a little better, 5% as unchanged and 2% as slightly worse (p<0.0001). Regarding the domains assessed, before surgery they showed statistically significant differences when compared to the domains after 30 or 180 days, reflecting the effect of treatment (p<0.0001), while the domains of QOL within 30 and 180 days did not result in any difference. Table 2 shows the distribution of values for QOL scales, anxiety and depression in the respective analyzed times and their p values.

As for the classification of reflex sweating after 30 days, its frequency was: mild in 24 cases (44%); moderate in 19 (35%); intense in 10 (18%) and only one (2%) individual denied having RS in any period. After 180 days, 16 (30%) classified it as mild; 21 (39%) moderate

Table 2. Comparison of QOL versus anxiety and depression at different times

	Quality of life			Anxiety			Depression		
	Before	30 d	180d	Before	30 d	180d	Before	30 d	180d
Median	83.0	20.5	20.0	6.0	6.0	6.0	3.0	2.0	2.5
Range	49-100	20-95	20-91	1-6	0-18	0-18	0-19	0-20	0-13
Average	80.4	27.3	25.2	7.1	6.2	6.9	3.5	3.4	3.2
SD	± 13.9	± 12.7	± 11.8	± 4.4	± 4.1	± 4.51	± 3.6	± 3.7	± 3.2
p-value *		< 0, 0001			0.30			0.89	

** p values obtained through the Friedman test.*

and 16 (30%) intense, showing increase in cases of severe sweating (p<0.0001) in the late postoperative period. There was no recurrence, in any individual, in the hands, armpits or feet. The sites mentioned with reflex sweating were thighs, abdomen and back.

Table 3 makes possible to identify the changes in classification referred to by patients after 30 and 180 days after surgery, as well as the absence of symptoms in one individual.

By analyzing the distribution of reflex sweating rating with the quality of life of patients and the level of anxiety and depression after 30 and 180 days, we found a significant difference in the intensity of sweating with the anxiety level (Figures 1 and 2). On the other hand, the comparison between the different domains of QOL and the rates of depression were not significant.

DISCUSSION

Currently, quality of life questionnaires have been highlighted as an important tool to assess results in medicine, as psychosocial factors may result in better patients' management[4]. In this study we applied the quality of life questionnaire for individuals with specific PH, allowing a careful analysis of these patients' quality of life. Furthermore, we used a questionnaire to assess the intensity of anxiety and depression, aiming to verify the presence and magnitude of these disorders in our sample.

Clinical symptoms lead to consider PH's diagnosis as a psychiatric disorder, with some studies characterizing such individuals as anxious[8,9]. In our study, patients reported excessive fear and embarrassment, anxiety features known as social phobia.

Table 3. Reflex sweating intensity 30 and 180 days after surgery

Sweating	Period	n	%
	30 days		
Mild		24	44.45
Moderate		10	18.51
Severe		19	35.19
Absent		1	1.85
Total		54	100.00
	180 days		
Mild		16	29.63
Moderate		16	29.63
Severe		21	38.89
Absent		1	1.85
Total		54	100.00

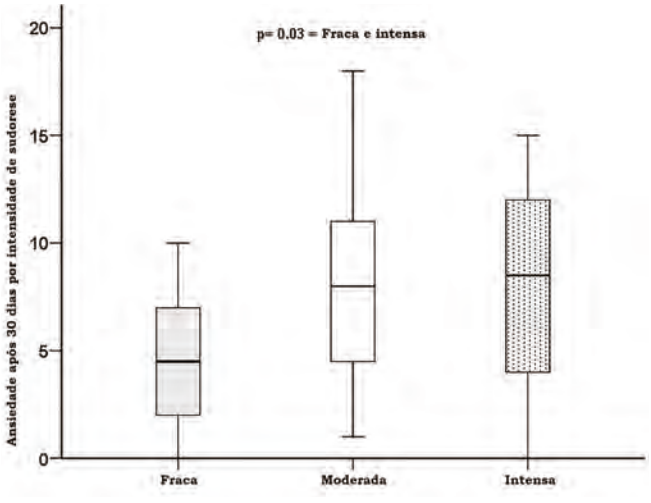

Figure 1. *Anxiety level stratified b reflex y sweating 30 days after surgery.*

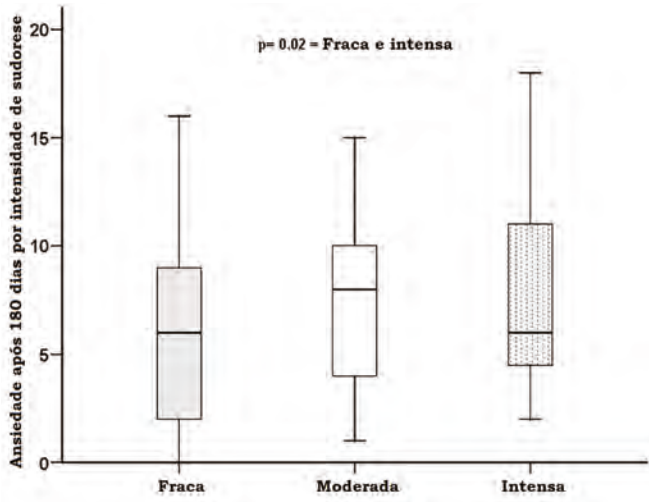

Figure 2. *Anxiety level stratified by reflex sweating 180 days after surgery.*

Before surgery, patients were very committed to participating in the study due to the problem presented, ie, excessive sweat that bothered so much. After 30 days, they found themselves happy, with high self-esteem due to the initial improvement and the positive impact that surgery performed in their lives, and still willing to collaborate, responding calmly to the questionnaires, on request. However, after six months, with the problem solved, ie, hands and armpits dry as part of the routine, there was a greater resistance to cooperation with this study regarding the questionnaires. At this time of the postoperative period, even with full return to daily activities, it was possible to correlate the rise in anxiety level with the most intense sweating reflex, and slight decrease in quality of life. The evaluation after 30 days already presented evidence that the rate of anxiety was related to the intensity of RS, being confirmed in the evaluation after 180 days, showing that the higher the level of anxiety, the greater the RS intensity.

PH may be associated with significant impairment in patients' quality of life, interfering with social and professional activities[8,10]. Wolosker *et al*.[4] demonstrated that the quality of life of individuals with PH is severely diminished, though not at risk of death. These authors add that, in some cases, not only anxiety, stress and apprehension are present, but also risks in professional activities, such as police handling weapons and electricians. They observed that the preoperative quality of life was significantly affected by the presence of abundant sweating in the hands, armpits and/or feet.

Primary hyperhidrosis and anxiety seem to have a complex relationship[11]. Excessive sweating, especially in the hands, is accompanied by a high degree of anxiety and sympathetic overactivity[4,12]. This study demonstrated the presence of anxiety both in the pre and postoperative periods, sometimes at high levels, suggesting the need for medical/psychological evaluation and support.

Reflex sweating is the main side effect of sympathectomy. It comprises episodes of sweating in other body parts that were not common before surgery. It usually occurs in the back, legs, abdomen, thighs, groin, feet and butocks[13]. The signs and symptoms start soon after surgery and may worsen with the climate and/or psychological and emotional fluctuations[14]. This side effect appeared in the 30-day postoperative evaluation in 53 cases, with main complaints in the back, abdomen and thighs. Lyra *et al*.[15] describe the need for psychological support and claim that the reflex sweating resembles PH, being induced by mental stress or anxiety.

One can also observe significant improvement in patients' quality of life 30 days after surgery, such result being persistent after 180 days. Moreover, the improvement of quality of life related to the intensity of reflex sweating over time showed that the results were significantly better not only till the thirtieth day after the surgery, but also after 180 days, though with a slight decrease at this later time, and directly related to the RS intensity.

Apparently most patients accept RS well, since they respond to postoperative assessment questionnaires as the operation result being excellent or satisfactory. The study from Stefaniak and Cwigon in 2013[16] shows improvement in the quality of life of more than 90% of patients after sympathectomy. Of the 54 patients in this study, none regretted having undergone sympathectomy, proving that the RS is preferable to PH, as also demonstrated in the Cardoso *et al*.[3]. Baroncello *et al*.[17] reported that reflex sweating is generally weak in most of patients and does not cause as much social, emotional or professional commitment as primary hyperhidrosis, patients preferring the reflex sweating. In this study, 53 (98%) of the 54 patients experienced this side effect, reporting that the higher the level of anxiety presented at any given time, the worse the sweating int the reflex sweating sites (abdomen, thighs, back and groin). However, there were no cases of intolerable reflex sweating.

The main disadvantage of this procedure is its potential irreversibility and, therefore, the patient should be fully informed of the possible complications and postoperative side effects[2].

The qualitative analysis of this group of patients' psychosomatic factors demonstrated in this study will allow other quantitative analyzes, such as different levels of the sympathetic chain blockage or even the extent of the interrupted area, to be better studied.

R E S U M O

Objetivo: avaliar a intensidade de sudorese reflexa com o grau de ansiedade e sua interferência na qualidade de vida de indivíduos submetidos à simpatectomia por videotoracoscopia nos períodos pré e pós-operatório. **Métodos:** foram avaliados 54 pacientes com média de idade de 26 anos (16 a 49 anos), submetidos à simpatectomia em nível R3-R4. Dois questionários foram aplicados em três momentos diferentes: "Qualidade de vida em pacientes com hiperidrose primária e "Escala para ansiedade e depressão". **Resultados:** dos pacientes estudados, 93% mostrou melhora significativa na qualidade de vida após 30 dias da cirurgia, com os efeitos remanescentes após seis meses. Não houve complicações pós-operatórias. A análise mostrou que o nível de ansiedade do paciente é altamente correlacionado com a intensidade da sudorese reflexa após 30 e 180 dias. **Conclusão:** a simpatectomia torácica por videotoracoscopia melhora a qualidade de vida de pacientes com hiperidrose primária, mesmo com o surgimento de sudorese reflexa. A ansiedade está diretamente relacionada com a intensidade da sudorese reflexa, sem comprometer o grau de satisfação do paciente.

Descritores: Hiperidrose. Qualidade de Vida. Ansiedade. Simpatectomia. Cirurgia Torácica Vídeoassistida.

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Received in: 16/06/2016
Accepted for publication: 04/09/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005009

Bariatric surgery: is it reasonable before the age of 16?

Cirurgia bariátrica: é razoável antes dos 16 anos de idade?

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A B S T R A C T

Objective: *to assess the severity of obesity in children and adolescents through the presence of comorbidities and the potential indication of bariatric surgery.* **Methods**: *we conducted a cross-sectional study with clinical and laboratory data of the first consultation of patients at the childhood obesity clinic at a tertiary hospital from 2005 to 2013. We divided the patients into groups with or without potential indication for surgery, and recorded age, gender, birth weight, age of obesity onset, BMI Z score, presence of acanthosis nigricans, blood pressure, total cholesterol and fractions, triglycerides, blood glucose and fasting insulin, HOMA1-IR, CRP and ESR. The group with potential indication for surgery included: BMI > 40 or between 35-40 with comorbidities (Triglycerides >130mg/dl, glucose levels >100mg/dl, HOMA1-IR >3.16, Total Cholesterol >200mg/dl, LDL >130mg/dl and HDL <45mg/dl), regardless of age, epiphysis consolidation and previous treatment.* **Results**: *of the 296 patients included in the study, 282 (95.3%) were younger than 16 years. The most frequent change was the HDL (63.2%), followed by HOMA1-IR (37.5%). Of the group of 66 patients with potential indication for surgery (22.3%), only ten (15.1%) had more than 16 years. Acanthosis nigricans, the average HOMA1-IR, insulin, CRP, ESR, age, BMI Z score and systolic and diastolic blood pressure were significant in the group with potential surgical indication.* **Conclusion**: *bariatric surgery might be indicated by BMI and comorbidities in children and adolescents under 16 years.*

Keywords: *Pediatric obesity. Child. Adolescent. Bariatric surgery.*

INTRODUCTION

In the last 50 years, there have been changes in the profile of health problems in children and adolescents and, in this context, obesity has emerged as a pandemic disease of high prevalence and morbidity[1]. After nearly three decades of alarming increase in its prevalence in the world, the latest studies in developed countries show a trend of stabilization, but with worsening severity[2-4]. In some developing communities, where we observe the coexistence of growth delay and obesity, it is believed that this population is changing from malnutrition to excess weight, without going through eutrophy[5]. In Brazil, after the measures of social inclusion, there was decrease in the levels of poverty and malnutrition. On the other hand, new challenges emerged, as the increase of overweight, currently three times greater than malnutrition[6]. The latest data show increased prevalence in all age groups, a little lower in children under five years, and in both genders[6,7].

Despite numerous efforts, the difficulty in combating obesity is evident, due to it highly complex etiology and pathophysiology. When present in children and adolescents, it causes a negative impact on the secular increase in life expectancy[8], as well as commitment in the psychological domain[9,10], becomes persistent in adulthood[11] and predisposes to the occurrence of premature death from endogenous causes (insulin resistance and hypertension)[12].

In view of this, various forms of treatment have been studied, the main and initial one being the recommendations for change in lifestyle, including decreased caloric intake, increased energy expenditure and psychological evaluation with emphasis on individual, family, school and community. However, in practice the long-term results are not very encouraging[10,13,14]. Drug treatment, little used and contraindicated in children, also does not show good results[10,15]. Due to the increased severity of cases and the positive results obtained with bariatric surgery in adults, both in relation to weight loss as the correction of comorbidities, indications in adolescents, initially restricted to the most serious patients with complete pubertal development, is becoming most studied[11,13].

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However, it is important to note that the surgical option is an aggressive and controversial treatment in this age group, mainly due to the physical, psychological and metabolic changes[16,17].

Given these considerations, this study aims to assess the severity of obesity in children and adolescents referred to the outpatient clinic of a tertiary hospital, through the presence of comorbidities and the potential for bariatric surgery indication.

METHODS

This is a cross-sectional study based on data from the first patient consultation at the Referenced Multidisciplinary Clinic for Obesity in Children and Adolescents of the Clinics Hospital of the Campinas State University (UNICAMP), from 2005 to 2013. After exclusion of patients with a genetic syndrome, renal, hepatic or endocrine disease, continuous use of psychoactive drugs and/or oral corticosteroids and physical disabilities that prevented the realization of anthropometry, we included 333 patients. We recorded the following data from the first consultation: date of birth, obesity onset age, birth weight, weight and height, body mass index (BMI), BMI Z score[18], presence of acanthosis *nigricans*, blood pressure (BP), systolic and diastolic.

We also evaluated the first laboratory tests: total cholesterol and fractions (LDL and HDL), triglycerides, fasting glucose, insulin, C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR). These tests were performed by the UNICAMP Clinics Hospital central laboratory. We calculated the HOMA1-IR index by the following formula[19]: fasting insulin (mU/l) x fasting glucose (mmol/l) / 22.5.

In 2013, The Brazilian Ministry of Health published a decree allowing bariatric surgery from the age of 16 up, using as criteria, in addition to BMI, the presence of comorbidities, clinical treatment failure (for at least two years) and the consolidation of growth epiphyses [20]. In this study, the classification of patients with potential indication for bariatric surgery was based on BMI values of the International Pediatric Endosurgery Group (IPEG)[21] and on the American standards[18], which are the same for adults determined by the Brazilian Ministry of Health [20]. Therefore, we divided patients into BMI <35, BMI between 35-40 and BMI >40. We included in the group with potential surgical indication (G2) patients with BMI >40 or BMI between 35-40 with comorbidities. We considered the following as comorbidities: triglycerides >130mg/dl, total cholesterol >200mg/dl, LDL cholesterol >130mg/dl, HDL cholesterol <45mg/dl, blood glucose >100mg/dl and HOMA1-IR >3.16.

After splitting into groups without (G1) or with (G2) potential surgical indication, we performed the analysis of variables, both clinical (age, gender, birth weight, obesity onset age, BMI Z score, presence of acanthosis *nigricans* and BP) and laboratorial (total cholesterol and its fractions, triglycerides, blood glucose and fasting insulin, HOMA1-IR, CRP and ESR).

For the evaluation of non-numeric variables, we used the chi-square test, and for numeric variables, the Student's t test, since all were normally distributed (Kolmogorov-Smirnov). The data were stored and organized in the computer program SPSS 16.0. We considered α <0.05.

The work was approved by the Ethics in Research Committee (CEP) of the Faculty of Medical Sciences (FCM) of Unicamp, № 376,289, on August 27, 2013.

RESULTS

The distribution of frequency, mean and standard deviation of clinical and laboratory variables are shown in Table 1. There was difference in the frequency due to lack of information in the medical records. Of the 333 patients, we excluded 37 (11.1%) due to lack of at least one result of laboratory tests. Of the 296 remaining, 152 (51.4%) were male, 282 (95.3%) were under 16 and 47 (15.9%) had normal laboratory tests. Of those with normal laboratory tests, 45 (95.7%) had a BMI <35, two (4.3%), BMI 35-40, and none, BMI >40 (Table 2).

The distribution of comorbidities according to the BMI is shown in Table 2. The most frequent alteration was HDL cholesterol <45mg/dl in 187 (63.2%) individuals, followed by HOMA1-IR >3.16 in 111 (37.5%). We detected the presence of two comorbidities in 90 (30.4%) patients, and the presence

Table 1. Distribution of frequency, mean and standard deviation (SD) of the studied clinical and laboratory variables.

Variables	N (%)	Mean (SD)
Age (years)	333 (100)	10.53 (3.53)
Birth weight (g)	235 (70.6)	3.38 (0.63)
Age (years)	262 (78.7)	4.10 (3.09)
BMI Z score	329 (98.8)	2.49 (0.59)
Diastolic BP (mmHg)	318 (95.5)	73.63 (11.72)
Systolic BP (mmHg)	318 (95.5)	115.11 (16.23)
Blood glucose (mg/dl)	289 (86.8)	83.20 (7.16)
Insulin (μ IU/ml)	264 (79.3)	16.55 (12.08)
HOMA1-GO	254 (76.3)	3.45 (2.76)
Total cholesterol (mg/dl)	292 (87.7)	163.07 (33.70)
LDL cholesterol (mg/dl)	284 (85.3)	99.14 (31.71)
HDL cholesterol (mg/dl)	287 (86.2)	43.28 (9.95)
Triglycerides (mg/dl)	292 (87.7)	112.14 (56.53)
CRP (mg/dl)	131 (39.3)	0.65 (1.51)
ESR (mm/h)	115 (34.5)	20.04 (15.29)

of three comorbidities in 55 (18.6%). Only the HOMA1-IR showed statistical difference between normal and abnormal values and BMI.

Of those with normal laboratory tests, 45 (95.7) had a BMI <35, two, BMI 35-40, and none, BMI >40 (Table 3). Of the total, 66 (22.3%), at the first visit, already had potential indication for bariatric surgery (BMI between 35 and 40 with one or more abnormal laboratory tests or BMI >40 – group with potential surgical indication), yet only ten (15.1%) of these had more than 16 years (Table 3).

The comparison of clinical and laboratory data between the group without indications for bariatric surgery (G1) and the group with potential indication (G2) is shown in Table 4. In clinical analysis, we found that the average age (p=0.006), the BMI Z score (p=0.005) and the systolic and diastolic BP measurements (p=0.000) were significant in the group with potential surgical indication, as well as the presence of acanthosis nigricans (p=0.006). Among the laboratory variables, the mean HOMA1-IR (p=0.000), insulin (p=.000), CRP (p=0.012) and ESR (p=0.013) were also significantly higher in this group. The other variables did not differ.

DISCUSSION

This study revealed the severity of the patients coming to primary care in this specialized clinic due to the large number of comorbidities. It also showed that about a quarter of these patients, regardless of age, presence of epiphyseal consolidation or prior treatment, prerequisites determined by the health ministry, had potential indication for bariatric surgery. Of these, only ten (15.1%) were in the age range recommended by the Brazilian Ministry of Health, over 16 years. However, it is important to note that BMI increases with age since four to five years old, which may underestimate the actual number of patients with potential surgical indication in this study. Teens that have a BMI greater than or equal to 35 over 12 years of age are approximately in the 99th percentile or above, a percentile that is associated with increased metabolic risk. For this reason, the BMI of 35 is used as the minimum cutting value for the indication of bariatric surgery[18,21]. Another alarming fact showing the seriousness of these patients is that most (61.8%) individuals who were not included in the group with potential indication for bariatric surgery due to BMI <35 already had one or more abnormal laboratory tests at the first outpatient visit.

Table 2. Distribution of the 249 patients with one or more altered laboratory tests according to the body mass index (BMI).

Laboratory Exams		BMI			p
		< 35	35-40	> 40	
		N (%)	N (%)	N (%)	
CT	Normal	194 (86.2)	37 (92.5)	21 (77.8)	0.228
	Altered	31 (13.8)	3 (7.5)	6 (22.2)	
LDL	Normal	185 (84.9)	34 (87.2)	22 (81.5)	0.817
	Altered	33 (15.1)	5 (12.8)	5 (18.5)	
HDL	Normal	82 (37.1)	9 (23.1)	9 (33.3)	0.234
	Altered	139 (62.9)	30 (76.9)	18 (66.7)	
TGL	Normal	161 (86.2)	27 (92.5)	18 (77.8)	0.785
	Altered	64 (28.4)	13 (32.5)	9 (33.3)	
Homa 1-GO	Normal	129 (66.5)	9 (27.3)	5 (18.5)	0.000
	Altered	65 (33.5)	24 (72.7)	22 (81.5)	
2 alterations	No	118 (64.7)	22 (59.5)	19 (65.6)	0.898
	Yes	65 (35.3)	15 (40.5)	10 (34.4)	
3 or + alterations	No	147 (80.3)	27 (73.0)	20 (69.0)	0.264
	Yes	36 (19.7)	10 (27.0)	9 (31.0)	

Reference values for changed: CT = total cholesterol >200 mg/dl; LDL = LDL cholesterol >130mg/dl; HDL = HDL cholesterol <45 mg/dl; TGL = Triglycerides >130mg/dl; HOMA1-GO >3.16.

In line with the literature, we found that patients with higher BMI had a higher number of comorbidities. This points to the severity of the condition, because, as discussed by Salawi *et al*., in 2014[22], in a Canadian study, comorbidities in children evolve faster and more severely than in adults. Still, the same study found that obese patients who come to the health facility seeking treatment already have clinical and laboratory severity criteria since the first approach by the medical team, which includes the presence of many comorbidities. The same could be observed in this study, in which many patients referred to the basic sectors of the health system have reached the specialized clinic for obesity in children and adolescents with several comorbidities.

The mostly observed comorbidities in the group with potential surgical indication were increased systolic and/or diastolic blood pressure, insulin resistance and dyslipidemia (primarily increased triglycerides). Regarding acanthosis *nigricans*, its significant presence in the group with surgical potential corroborates its importance in the clinical diagnosis of insulin resistance in obese children and adolescents, also evidenced by abnormal laboratory values of insulin and HOMA1-IR. As for the significant number of patients with altered ESR and PCR, this datum suggests the association of obesity with inflammatory disease, which strengthens the hypothesis of its involvement in diseases such as asthma and cancer, for example[23,24].

In the current context of obesity in children and adolescents, the initial therapy for all patients should include changes in measures of lifestyle, with multidisciplinary team for at least two years[10,13,15]. So far, though, long-term studies have found failure to reduce BMI, especially in older children and with higher BMI[10,15,25]. Drug treatment also does not show good results and few drugs are released. Bariatric surgery, even being an aggressive and controversial procedure, has been increasingly performed in younger patients[13,16,25].

Table 3. Distribution of the 296 children and adolescents according to the presence of comorbidities and minimum age (16 years) for potential indication of Bariatric Surgery according to BMI.

BMI	Without Comorbidities			With Comorbidities		
	<16a	>16a	Total	<16a	>16a	Total
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
<35	43 (14.5)	2 (0.7)	45 (15.2)	181 (61.1)	2 (0.7)	183 (61.8)
35-40	2 (0.7)	0	2 (0.7)	35 (11.8)	2 (0.7)	37 (12.5)
>40	0	0	0	21 (7.1)	8 (2.7)	29 (9.8)

Bariatric surgery began to be carried out in adults in 1960, and two decades ago also in adolescents[26]. To date, three surgical techniques have been widely studied, with different results and complications: adjustable vertical band, sleeve gastrectomy, and Roux-en-Y gastric bypass. According to the technique, the decrease in weight after surgery can vary between 58 and 73% of adolescents, with a greater chance of the patient reaching a BMI within normal values the lower the baseline BMI. Regarding comorbidities, long-term studies in this age group are still few, but early studies suggest improvements in psychological and cardiovascular risk. Mortality due to the surgical risk is low, as well as the lower length of stay and the risk of cholelithiasis and "dumping". Among surgical complications, nutritional deficiencies of vitamins and minerals and the loss of bone mass in younger age groups should be well studied, even as supplementation should be long-term and observed less adherence to treatment from[16,25-27]. As for the loss of bone mass, this may be more relevant in adolescence, since the peak bone mineral density occurs at 20 years of age[25,28].

Beyond these considerations, studies indicating who would be the ideal patient to undergo bariatric surgery are still scarce, especially in children and adolescents. Among the difficulties, there is the need for a careful assessment of the mental health of patients prior to surgery in an attempt to identify those with disorders like depression, anxiety, drug abuse, compulsory feeding and provocation of vomiting. However, no one knows for sure if these changes are related or not to obesity. Thus, it becomes difficult to determine whether bariatric surgery would bring advantages and disadvantages in this regard. Therefore, it is essential that the initial treatment include a family approach, both for the procedure indication and for the discussion about the possible results and subsequent follow-up[25,27].

Finally, for surgery indication, besides considering the child's BMI and age, studies reinforce the importance of assessment of pubertal development (Tanner stages IV to V), skeletal maturity (at least 95%), previous treatment with changes in lifestyle habits (importance of diet and physical activity), psychological development (mature decision), social and family support and understanding of nutritional supplementation[13,21,25]. Therefore, it is important to note that the treatment of obesity in adolescents with bariatric surgery is complex. One must take factors into consideration, such as prior assessment of the patient by a multidisciplinary team, choosing the best age, surgical technique to be employed, diagnosis and monitoring of comorbidities, understanding of long-term follow-up by the patient and the family and informed consent, as it is a procedure that causes various biological and psychosocial effects[13,25,29].

Brazilian studies on bariatric surgery in this age group are few. Velhote, in 2007[30], studied the evolution after one year of eight teenagers from ten to 19 years with a BMI >40, operated by adaptive gastro-entero-omentectomy technique with intestinal reserve (GARI). Ferraz *et al*., in 2015[31], studied 20 patients with a mean age of 18.1 years, who underwent Roux-en-Y gastric bypass after a multidisciplinary clinical follow-up. In both studies, they observed large weight loss, reduction of comorbidities, low rates of complications and no deaths.

This study has some limitations due to being a cross-sectional chart review. In addition, there are few studies in the literature for comparison, which limited

Table 4. Comparison of clinical and laboratory variables between groups without (G1) and with (G2) potential surgical indication.

Variables	Groups	N	Mean	SD	p
Gender	G1	F = 110 M = 120			0.597
	G2	F = 34 M = 32			
Age (years)	G1	230	9.79	3.38	0.000
	G2	66	13.09	2.93	
Birth weight (g)	G1	161	3380.55	660.45	0.582
	G2	48	3438.75	578.11	
Age (years)	G1	181	3.91	2.91	0.109
	G2	53	4.66	3.25	
BMI Z score	G1	226	2.44	0.64	0.005
	G2	66	2.68	0.33	
Acanthosis *Nigricans*	G1	A = 46 P = 91			0.006
	G2	A = 6 P = 41			
Diastolic BP (mmHg)	G1	218	71.62	10.09	0.000
	G2	66	80.86	12.85	
Systolic BP (mmHg)	G1	218	111.17	14.02	0.000
	G2	66	128.08	16.82	
Blood glucose (mg/dl)	G1	223	71.62	7.21	0.439
	G2	66	83.80	7.01	
Insulin (µ IU/ml)	G1	197	14.35	11.43	0.000
	G2	58	23.79	11.64	
HOMA1-GO	G1	196	3.01	2.69	0.000
	G2	58	4.93	2.51	
Total cholesterol (mg/dl)	G1	227	163.59	33.03	0.624
	G2	65	161.26	36.15	
LDL cholesterol (mg/dl)	G1	219	99.51	30.47	0.723
	G2	65	97.92	35.81	
HDL cholesterol (mg/dl)	G1	222	43.60	10.52	0.303
	G2	65	42.15	7.69	
Triglycerides (mg/dl)	G1	227	109.37	55.65	0.118
	G2	65	121.80	58.96	
CRP (mg/dl)	G1	100	0.48	0.89	0.012
	G2	26	1.33	2.84	
ESR (mm/h)	G1	94	18.38	13.70	0.013
	G2	21	27.48	19.73	

G1 = without surgical potential, G2 = with surgical potential, F = female, M = male, A = absent, P = present, SD = Standard Deviation.

the results' analysis of. However should note that the project was carried out with data from the first visit to the Obesity Multidisciplinary Reference Clinic, which meant that the study sample was invariably composed of more serious patients than those seen in the primary care network, and this severity was evaluated through the potential indication of bariatric surgery.

The study revealed that a significant percentage of children and adolescents already has very high BMI, associated with high prevalence of comorbidities and consequent potential indication of bariatric surgery, regardless of age, which makes us think about the best way of monitoring and management of this population.

R E S U M O

Objetivo: avaliar a gravidade da obesidade em crianças e adolescentes pela presença de comorbidades e pela potencial indicação de cirurgia bariátrica. **Métodos:** estudo transversal com dados clínicos e laboratoriais da primeira consulta de pacientes do ambulatório de obesidade infantil em um hospital terciário no período de 2005 a 2013. Os pacientes foram divididos em grupos com ou sem potencial indicação cirúrgica, e associados com idade, sexo, peso de nascimento, idade de início da obesidade, escore z de IMC, presença de acantose *nigricans,* pressão arterial, colesterol total e frações, triglicérides, glicemia e insulina de jejum, HOMA1-IR, PCR e VHS. O grupo com potencial indicação cirúrgica incluiu: IMC >40 ou IMC entre 35-40 com comorbidades (Triglicérides >130mg/dl, Glicemia >100mg/dl, HOMA1-IR >3,16, Colesterol total >200mg/dl, LDL >130mg/dl e HDL <45mg/dl), independente da idade, consolidação das epífises e tratamento prévio. **Resultados:** de 296 pacientes incluídos no estudo, 282 (95,3%) tinham menos de 16 anos. A alteração mais frequente foi a do HDL (63,2%), seguido do HOMA1-IR (37,5%). Do grupo de 66 pacientes com potencial indicação cirúrgica (22,3%), apenas dez (15,1%) tinham mais de 16 anos. Acantose *nigricans*, as médias de HOMA1-IR, insulina, PCR, VHS, idade, escore z de IMC e pressões sistólica e diastólica foram significantes no grupo com potencial indicação cirúrgica. **Conclusão:** os resultados sugerem que a cirurgia bariátrica, poderia estar indicada pelo IMC e presença de comorbidades, em crianças e adolescentes com menos de 16 anos.

DESCRITORES: Obesidade Pediátrica. Criança. Adolescente. Cirurgia Bariátrica.

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Received in: 14/06/2016
Accepted for publication: 06/09/2016
Conflict of interest: none.
Source of funding: Scientific Initiation Grant through the Institutional Program for Scientific Initiation Scholarships - PIBIC / CNPq, 2014/2015 share with accepted on 06/24/2014.

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DOI: 10.1590/0100-69912016005015

Comparative study of abdominal cavity temporary closure techniques for damage control

Estudo comparativo de técnicas de fechamento temporário da cavidade abdominal durante o controle de danos

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A B S T R A C T

The damage control surgery, with emphasis on laparostomy, usually results in shrinkage of the aponeurosis and loss of the ability to close the abdominal wall, leading to the formation of ventral incisional hernias. Currently, various techniques offer greater chances of closing the abdominal cavity with less tension. Thus, this study aims to evaluate three temporary closure techniques of the abdominal cavity: the Vacuum-Assisted Closure Therapy - VAC, the Bogotá Bag and the Vacuum-pack. We conducted a systematic review of the literature, selecting 28 articles published in the last 20 years. The techniques of the bag Bogotá and Vacuum-pack had the advantage of easy access to the material in most centers and low cost, contrary to VAC, which, besides presenting high cost, is not available in most hospitals. On the other hand, the VAC technique was more effective in reducing stress at the edges of lesions, removing stagnant fluids and waste, in addition to acting at the cellular level by increasing proliferation and cell division rates, and showed the highest rates of primary closure of the abdominal cavity.

Keywords: *Abdomen. Peritonitis. Wounds and Injuries. Abdominal Wall. Infection.*

INTRODUCTION

Initially, the surgical principles in the abdominal trauma approach were based on anatomical repairs aimed at primary and final organic repair. In the last decade, more importance was given to correct the physiological problems, leading to the concept of damage control surgery, with special emphasis on maintaining the abdomen open through laparostomy, or peritoneostomy[1]. It represents a way to treat the physiological exhaustion and to postpone some procedures that, when performed at the first operative time, only lead to worsening of the patient's physiological condition, with impossibility of recovery[1]. At this time the scope is to control bleeding and treat contamination of the cavity to stop the lethal trauma triad.

The main indications for laparostomy are the inability to close the abdominal cavity, documented intra-abdominal hypertension, abdominal compartment syndrome, need for drainage of the abdominal cavity by severe infection, need for relaparotomy, coagulopathy, hypothermia (<35°C) and hemodynamic instability[2,3].

During the time the abdomen remains open, there is lateral retraction of the aponeurosis, hindering the closure of the cavity and favoring the appearance of incisional hernias. These lead to the formation of adhesions and make future abdominal surgery more complicated, with increased morbidity and mortality[4]. This, however, can be avoided by employing temporary closure techniques such as: Bogotá bag technique, Barker machines (Vacuum -pack) and Vacuum Assisted closure Therapy (VAC) among others, which allow for closure of the abdominal cavity with less tension.

Edelmuth *et al*.[4] found that surgery for damage control was efficient in patients with hemodynamic instability due to severe sepsis, massive hemorrhage, acute mesenteric ischemia or necrotizing infections. These factors, together with the need for repeated peritoneal irrigations to eradicate infectious foci and reevaluate sutures and anastomoses, can also be indications for damage control surgery in emergency cases not caused by trauma.

The objective of this study is to compare the three aforementioned temporary closure techniques of

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the abdominal cavity after abdominal surgery resulting from trauma, by reviewing the literature on Medline, Pubmed, SciELO and Lilacs, with selection of 28 articles published on the matter over the past 20 years.

DESCRIPTION OF TECHNIQUES

Bogotá Bag

It was first described in 1984, when using plastic bags containing parenteral solutions to coat the abdominal opening in a patient in the third surgical intervention[5]. It therefore comprises the use of polyvinyl chloride (plastic bag) for maintaining the abdomen open[5], through its suture directly to the abdominal wall skin or fascia[6]. Initially called the Bogotá Bag or Borráez bag (Figure 1), it can be used in combination with a polypropylene mesh as a way of strengthening and restraint, in an attempt to avoid eviscerations and difficulties in mobilizing the patient, which constitute one of the problems arising from this technique[1].

The Bogotá technical advantages are: low cost, immediate availability, flexibility and high strength, non-adherence to tissues, absence of allergic or inflammatory reactions and quick and easy installation without the need for major surgical experience[5]. It is also considered an efficient protector against water and heat loss[7].

It is, however, a procedure which requires increased use of drains and repeated cleansing, presenting risk of evisceration and difficulty in mobilizing the patient[8]. It can also generate lacerations of the skin, gut adhesion to the abdominal wall, difficulties in reproaching the abdomen and the need for sterilization of the bag before use. Moreover, it allows the output of peritoneal fluids between the bag and the skin.

Vacuum-Pack

Described in 1995 it uses vacuum dressings for temporary closure of the abdominal cavity and has since been called the "vacum-pack" (VP) or Barker technique[9]. It is low cost and simple[10-12]. It consists in placing a fenestrated polyethylene sheet between the abdominal viscera and the anterior parietal peritoneum, a moist surgical compress on the sheet with two suction drains, and an adhesive sheet over the entire wound including a wide margin surrounding skin. The drains are then connected to a suction device, which can provide 100-150 mmHg continuous negative pressure[13] (Figure 2).

This technique prevents damage to the abdominal wall by not using sutures, preserving it for future approaches or permanent closure by maintaining the integrity of the fascia for later closing, and allows a quick rapprochement to the abdominal cavity. The material in contact with the abdominal viscera – the polyethylene sheet – is non-adherent, and this technique allows secure control of the amount of fluid produced[12].

Regarding the primary fascial closure with the use of this technique, in 1997 a study obtained success in 61% of cases. The patients, who were trauma victims

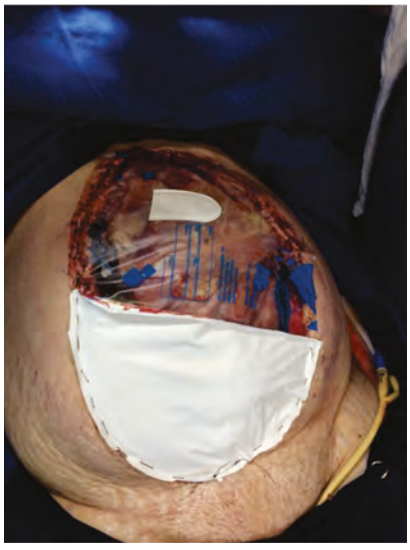

Figure 1. *Bogotá bag technique.*

Figure 2. *Barker Technique.*

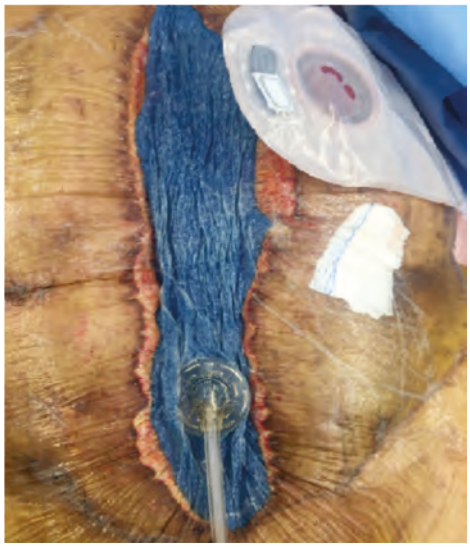

Figure 3. *Vaccum - Assited Closure – VAC.*

subjected to the Barker technique, had primary fascial closure at the second laparotomy [13]. Other studies had success rates of 29-100%[11,14-16]. The permanent closure of the abdominal cavity after the 8th day of laparotomy was associated with higher incidence of complications[17].

Barker *et al*. presented their experience using this technique in intestinal lesions undergoing resection, a study that lasted 11 years. There was no difference between patients who used the Barker technique or other techniques in relation to fistulas or anastomotic leaks. Other studies, however, reported fistula rates of 3% to 5%[14,18,19]. A combined study of victims of trauma and other causes of open abdomen reported as complications related to the use of this technique: abdominal abscess/infection, abdominal compartment syndrome, dehiscence, anastomotic leak, coagulopathy, deep vein thrombosis, fascial necrosis, ischemia/gastrointestinal necrosis, intestinal fistula, intestinal obstruction, pulmonary embolism and multiple organ failure[20]. The complication rates reported by Barker *et al*. are 15%[11].

V. A. C. System

This system uses crosslinked polyurethane foam (PU) or polyvinyl alcohol (PVA), with pores of 400-600 micrometers, applied and held in place by an adhesive (Figure 3). A plastic film interface sits between the viscera and the foam, and adjusts the same to the edges of the lesion[19,21]. The foam is covered with adhesive, which is coupled to the skin with a margin of 3 to 5 cm from the wound. In this adhesive, a small hole of about 2cm in diameter is created in the center and a TRAC™-DAP adhesive (device leading the discharge to the reservoir) is coupled to it. Thus, the system connects to a pump (vacuum) generating continuous or intermittent subatmospheric pressure. The pressure is generally set at 125mmHg and distributed uniformly over the entire wound through the sponge pores[19,21-23].

The vacuum-assisted closure is also known as negative pressure therapy, sub-atmospheric pressure or vacuum sealing technique. Argenta *et al*., in 1997, published an experimental work with the VAC system using acute wounds in pigs. In this work, they postulated that the VAC system has a multimodal mechanism of action[19,24]. Its effectiveness in severe traumatic wounds caused to evolve an area that belonged mainly to plastic and reconstructive surgery[19].

The purpose of the VAC system is to remove the stagnant fluid and debris and to optimize the supply of blood and matrix deposition. Thus, the partial pressure of oxygen within the tissues increases and proliferation of bacteria is reduced. Also, there is a local increase of interleukin-8 and vascular endothelial growth factor, which may cause the accumulation of neutrophils and angiogenesis[25].

The complications of VAC therapy are infrequent when the system is used correctly. The rates of most complications reported in the literature stem from previous co-morbidities of the patient and skin irritation by the adhesive use. Complications such as pain, bleeding and infection are more difficult to occur. Situations such as toxic shock syndrome, anaerobic sepsis, or thrombosis have also been described as a result of this technique, but are very rare[21].

The total cost of VAC therapy is greater than that of other techniques. However, when analyzing the time involvement and costs with the nursing staff, there is a considerable reduction of the total cost. The advantage of comfort for patients is described in many studies as a relevant factor in choosing this therapy[26].

DISCUSSION

The realization of laparostomy has been recommended since 1979. This technique allows extensive drainage of purulent secretion through the wall opening and also facilitates cleaning of the peritoneal cavity through scheduled or demand reoperations[7]. In this procedure, the abdominal wall plans are not completely approximated, allowing a regular inspection of intracavitary content. It can be used in the treatment of abdominal sepsis, abdominal compartment syndrome and damage control operationa[7]. The optimum technical requirements: protection of abdominal contents; prevention against evisceration; preservation of the fascia; minimal damage to the viscera; allowing to quantifying the loss of fluid to the third space; allow selective tamponade; minimize loss

of domain; control the infection and inflammation and facilitate patient`s management[7].

Comparison between the different techniques for damage control.

Comparing the use of VAC to other methods, several studies have shown a better performance of this in relation to others. A prospective study conducted by Batacchi *et al*.[27] in 2009 performed the comparison between abdominal trauma patients treated with Bogotá bags and the VAC technique during the temporary closing stage of the abdominal cavity. Treatment with VAC was more effective in better controlling intra-abdominal pressure ($p<0.01$) and normalization of serum lactate ($p<0.001$), as well as displaying shorter mechanical ventilation time, faster abdominal closure, and consequently lower time in the intensive care unit (ICU) and hospital. The scores' 'Sequential Organ Failure Assessment' (SOFA) and the mortality rate did not differ significantly.

Kaplan *et al*.[6], in 2005, concluded that VAC is the technique that can meet the requirements of an ideal material for satisfactory temporary closure. The Bogotá technique showed 53% mortality, and the techniques of Barker and VAC displaied rates of 31 and 30%, respectively. Regarding the occurrence of complications such as fistulas, the VAC technique presented a rate of 2.6%, as opposed to 7% of the Barker technique and 13% of the Bogotá technique. The fascial closure was achieved in 79% of patients undergoing VAC, while in 58% with the Barker technique and 18% with Bogotá technique[6].

As for the control of intra-abdominal pressure (IAP), Batacchi *et al*.[27], in 2009, compared the use of the Bogotá bag with the VAC system and concluded that the latter was more effective in controlling the IAP ($p<0.01$) and lactate levels ($p<0.001$) during the first 24 hours after surgical decompression. These patients had faster abdominal closure and discharge from ICU in less time, but mortality rates did not differ between the two groups.

Cheatham *et al*.[20], in 2013, compared the use of VAC with the Barker technique, showing that both had similar rates of complications such as the development of abdominal compartment syndrome (8% in both techniques) and fistulas (4% in both techniques). The VAC was associated with a primary fascial closing rate significantly higher at 30 days (73% versus 27% for the Barker technique) and lower mortality in the same period in patients who required open abdomen for at least 48 hours. Differences in mortality rates between the VAC and the Barker technique significantly increased during the first 30 days, due to the subsequent development of multiple organ failure in patients undergoing Barker technique due to better removal of rich peritoneal fluid cytokine (which increase organ dysfunction) at VAC.

Bruhin *et al*.[28], in a recent study comparing the various techniques through aspects such as contamination, fistula, mortality among others, obtained higher primary fascial closure rates after the use of VAC in combination with the technique of "dynamic closure" (mesh mediated traction, dynamic retention sutures or ABRA™) when compared with other techniques. In patients without contamination, this treatment resulted in a 81% closure, having been 72% with the exclusive use of VAC and 58% by the Barker technique. Data on the Bogotá bag technique were insufficient. In infected lesions, the combined technique resulted in the greater abdominal closure rate (74.6%), followed by its exclusive use (48%), by the Barker technique (35%) and the Bogotá bag technique (27%). Regarding the presence of fistulas and mortality rate, the VAC technique was the one with the lowest incidences.

CONCLUSION

The Bogotá bag technique was less efficient, but still is widely used due to its lower cost and greater ease of access to the material. The Barker technique may represent a reasonable cost alternative for patients who are subjected to damage control surgery for trauma, considering that 60% of cases will have the cavity closed after the first repproach. The VAC therapy was superior compared with other techniques, with greater control of the liquid of the third space, a lower rate of complications such as fistulas, lower mortality rates, lower rates of infection and greater ease in the primary closure of the abdominal cavity, and should be, whenever possible, the therapy of choice for the cases where one opts for maintaining laparostomy.

R E S U M O

A cirurgia de controle de danos, com ênfase em peritoneostomia, geralmente resulta em retração da aponeurose e perda da capacidade de fechar a parede abdominal, levando à formação de hérnias ventrais incisionais. Atualmente, várias técnicas oferecem maiores chances de fechamento da cavidade abdominal, com menor tensão. Deste modo, este estudo tem por objetivo avaliar três técnicas de fechamento temporário da cavidade abdominal: fechamento a vácuo (*Vacuum-Assisted Closure Therapy* – VAC), Bolsa de Bogotá e Vacuum-pack. Realizou-se uma revisão sistemática da literatura com seleção de 28 artigos publicados nos últimos 20 anos. As técnicas de Bolsa de Bogotá e Vacuum-pack tiveram como vantagem o acesso fácil ao material, na maioria dos centros, e baixo custo, ao contrário do que se observa na terapia a vácuo, VAC, que além de apresentar alto custo, não está disponível em grande parte dos hospitais. A técnica VAC, por outro lado, foi mais eficaz na redução da tensão nas bordas das lesões, ao remover fluidos estagnados e detritos, além de exercer ação a nível celular, aumentando as taxas de proliferação e divisão celular, e apresentou as maiores taxas de fechamento primário da cavidade abdominal.

Descritores: Abdome. Peritonite. Ferimentos e Lesões. Parede Abdominal. Infecção.

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Received in: 31/03/2016
Accepted for publication: 16/06/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005017

Thoracic damage control surgery

Cirurgia de controle de danos torácico

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ABSTRACT

The damage control surgery came up with the philosophy of applying essential maneuvers to control bleeding and abdominal contamination in trauma patients who are within the limits of their physiological reserves. This concept was extended to thoracic injuries, where relatively simple maneuvers can shorten operative time of in extremis patients. This article aims to revise the various damage control techniques in thoracic organs that must be known to the surgeon engaged in emergency care.

Keywords: *Multiple Trauma. Thoracic Injuries. Emergency Medicine.*

INTRODUCTION

The damage control strategy emerged in the Allied navy campaign during World War II. It was observed that in ships severely hit during the fighting, there were minor casualties and shipwrecks where efforts focused on extinguishing fires and keeping the boat running, retreating while covered by other friendly fleet ships, rather than continuing to fight. Then, in friendly territory, on construction sites, far from hostile areas, definitive repairs were held.

The concept in the field of trauma surgery emerged in the nineties, for patients in near exhaustion of their physiological reserves, with manifestation of hypothermia, metabolic acidosis and coagulopathy ("deadly triad"). The adopted strategy consisted in making the minimum necessary (bleeding and contamination control) in the shortest time, the patients being referred to the intensive care unit to be heated and stabilized, and only then, have their injuries definitely repaired in the operating environment. There were thus three defined stages through which the survivors would pass before recovery, accompanied by a multidisciplinary team, always led by surgeon[1,2].

Shortly after the first Damage Control publications, arose the concept of the so-called phase 0, wherein even before starting the damage control operation (Phase 1), the surgeon should have in mind which patients would be candidates for this type of therapy, even in the pre hospital setting and emergency room. That is, aim to "control the damage" before the lethal triad ensues and when the chances of survival are very low. The so shortened surgery, without definitive correction of injuries, implies an increase in morbidity in exchange for decreased mortality[3].

In thoracic trauma, most patients are treated by simple measures, such as supplementation with oxygen therapy and pleural drainage as effective and definitive measures. However, in a fraction of patients, this strategy can be employed. Some patients evolve with continuous bleeding from the drain with maintained shock despite resuscitation, with air leak impairing ventilation or with vascular or esophageal injury, which are classical indications for intervention. These situations may be associated with injuries to other body compartments, adding in the consumption of the traumatized physiological reserves. In these individuals, or when the surgical time and bleeding extend, the surgeon must know thoracic damage control surgery.

SPECIFIC THORACIC INJURIES (temporary and final control)

HEART

Most patients who have cardiac injuries die at the trauma scene. Of those who live to arrive at the emergency room, penetrating trauma is the most common and often the patient is unstable, a thoracotomy being

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required already in the emergency room. Despite the high mortality rate associated with this procedure, due to the extreme patient's conditions, this type of approach has indications and set goals. The emergency thoracotomy may represent the biggest paradigm of damage control in surgery, as it involves aggressive, fast and often temporary control of lesions that are consuming the patient's physiological reserves, in an inhospitable environment (emergency room). Then the patient is sent to the operating room, and finally, to the most appropriate environment, the ICU, for compensation of acidosis and coagulopathy, and where he/she will be monitored, heated and reanimated.

The objectives of an emergency thoracotomy include: cardiac tamponade relief that is causing diastolic restriction, control of heart wound or exsanguinantion due to vascular injury, descending aortic clamping to increase coronary and brain blood flow, internal cardiac compressions and occlusion of pulmonary hilum to reduce possibility of air embolism and decreased bleeding in severe lung injury[4].

In ventricular wounds, the temporary initial control should be performed by digital occlusion or introduction of a Foley catheter through the wound and inflation of its cuff[5]. The ventricular suture must be performed with nonabsorbable suture and vascular needle (4-0 polypropylene) in "U" or "Halsted"-shape stitches. In injuries close to the coronary arteries, the stitches must be passed beneath these structures. In the event of coronary lesions, distal lesions should be treated with ligation. Proximal lesions display high mortality, since most often myocardial infarction is already installed. These require a cardiovascular surgeon for correction and extracorporeal circulation may be necessary, which in most cases is impractical for this type of patient. The option then is ligation, with high mortality rates[6].

Atrial wounds have higher friability, demanding a more careful suture. Their initial control can be accomplished with lateral application of a vascular clamp, and then holding the repair with continuous nonabsorbable suture.

Some maneuvers can be employed in an attempt to stabilize the cardiac movements during cardiorraphy. Among these, there are the application of stitches in the heart apex, which are then tractioned, or the application of a Satinsky vascular clamp in the right ventricular angle with gentle traction to stabilize the movements and get a more accurate suture[7].

In recent years there have descriptions of the use of skin staplers for primary control of ventricular lesions in the emergency room with good results[8] (Figure 1). Extensive cardiac lacerations may require interruption of blood flow, but this tactic should be the last resort, as it will reduce and even stop the heartbeats, and will often be difficult to restart them. There are at least two maneuvers for this purpose: the first is to clamp the superior vena cava and the inferior vena cava and thereby reduce the preload, with cardiac emptying and

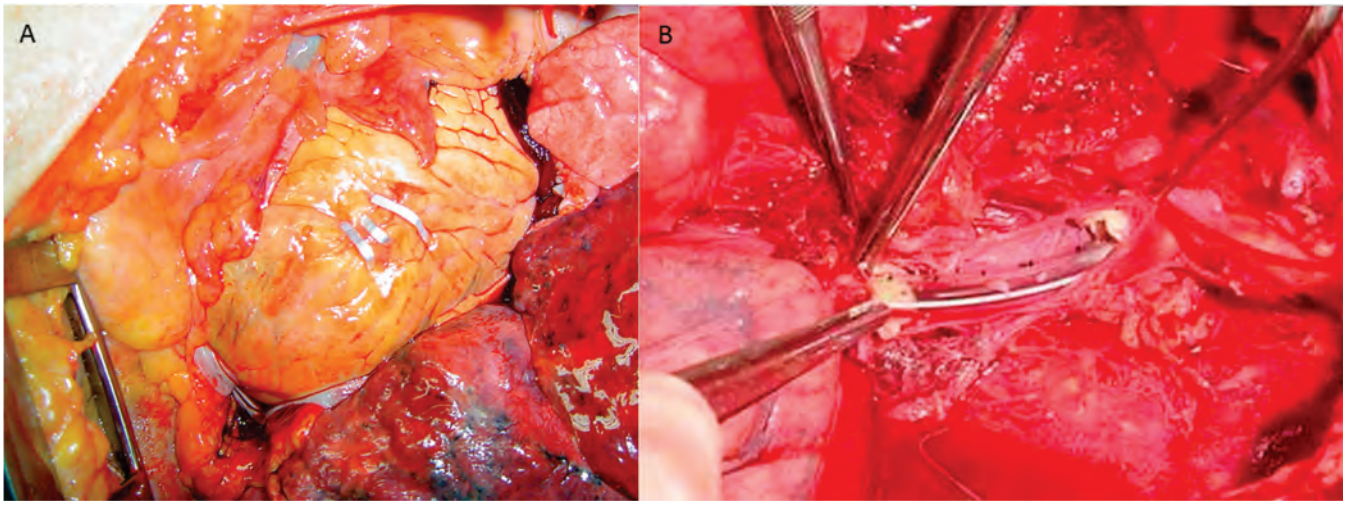

Figure 1. *Aspects of cardiac and vascular damagecontrol. A) Cardiac wound synthesis with metal clips through an left anterolateral thoracotomy; B) Positioning ofendoarterial shunt with a 22F chest tube segment in a descending aortic injury.*

arrest; the second technique is done by a right atrium manual compression against the ventricular mass[9]. The principle is the same as the first technique, as it will lead to decreased blood flow and eventually cardiac arrest. After these maneuvers, suturing will be possible for a few minutes. Following suture, the heart must be heated with saline while performing direct compressions. At the moment that there is fibrillation, defibrillation can be applied directly to the heart with energy up to 30-50 Joules.

LUNG

The surgeon will hardly come across a lung injury where there is difficult bleeding control. This is mainly due to two factors: the pulmonary vasculature houses a low-pressure system and the lung parenchyma is rich in thromboplastin. However, there are situations where bleeding may be profuse, both due to the anatomy where the lesion is located, and to the patient's metabolic exhaustion. Among these types of injury, we can mention the tunnelling or transfixing lesions that do not reach the hilum, the hilar lesions, and the diffuse parenchymal lesions.

Tunnelling or transfixing injuries: patients who have this type of injury possibly have bleeding from the inlet and outlet of the lung. Simple closure of these injuries would imply a large lung dissecting hematoma or infection in the postoperative period, with lung abscess formation. The technical solution for this type of injury occurs through pulmonary tractotomy. It consists in applying two long vascular clamps or parts of a linear cutting stapler through the "path" of the lesion and sectioning the parenchymal bridge between the clamps, which exposes the interior of injury to the outside, and then holding selective hemostasis and aerostasis inside the wound. When using clamps, aerostasis and hemostasis are terminated with a running absorbable suture over the clamps, which is unnecessary when using the stapler[10,11] (Figure 2). Peripheral bleeding and air-leaking lesions may be quickly resected using the mechanical suture[12].

Hilar injuries: in this type of injury, often lethal, the victim is extremely ill on admission to the emergency room. It classically presents with profuse bleeding into the pleural cavity or pericardial tamponade, if the injury is within the pericardial sac, which in both cases will require an emergency thoracotomy. The primary control of hilar bleeding should be manual, through the fastening between the thumb and index finger, followed

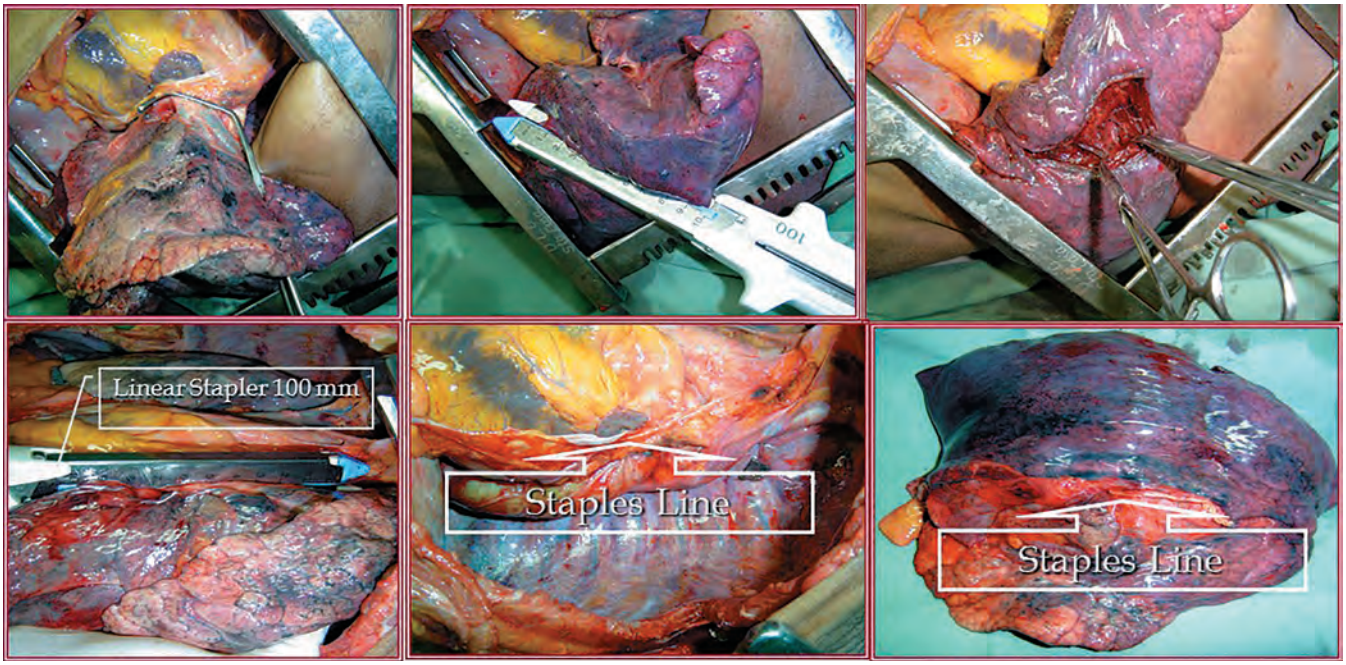

Figure 2. *Aspects of lung damage control: A) Clamping of the pulmonary hilum after release of the pulmonary ligament; B) Tractotomy with stapler in tunnelling, bleeding lesion in the left upper lobe; C) Selective ligation after lung tractotomy; D) Left pneumonectomy with stapler. E) Justa-pericardial staples line; F) Specimen from pneumonectomy, with the line of staples on the left hilum (details in the text).*

by pulmonary mobilization by section of the pulmonary ligament and only then the placement of a large vascular clamp around the hilum[13]. This type of patient generally tolerates badly this maneuver, developing severe right ventricular dysfunction, which requires rapid diagnosis of the extent to which the hilum was affected. Partial arterial or venous lesions should be treated with lateral sutures. Venous transection imply corresponding lobectomy, while the arterial lesion will usually require pneumonectomy, with a high degree of mortality. When this is unavoidable, it can be quickly made using a stapler with a vascular load[13,14]. The technique consists in applying the stapler as distal as possible so that one can perform a reinforcement suture, and after firing, holding the stump with two Allis clamps. Only then one opens the stapler and completes hemostasis with nonabsorbable suture.

Some injuries are central, but spare the pulmonary hilum. In those situations where bleeding is profuse and air embolization may occur through some larger caliber pulmonary vein, one can use Lung Twist Maneuver for the rapid control of the wound. This consists in quickly releasing the pulmonary ligament and rotating the lung 180 degrees around the hilum. With this done the hilar vessels undergo a "sprain", immediately stopping the bleeding[15].

Diffuse lung injuries: sometimes the lungs may be diffusely bruised or lacerated and the patient already has coagulopathy. In such dramatic situations, the options are pneumonectomy, which can be devastating for the patient. Alternatively, one can set up a selective ventilation of the non-traumatized lung, when possible, and packaging of the traumatized one[16], a technique that has emerged for control of extensive lesions of the liver parenchyma, an organ that has also an extensive, low-pressure vascular network. One should take care that packs do not cause cardiac diastolic restriction or mediastinal shift, which would lead to a low cardiac output. Packs are to be removed after the correction of coagulopathy (Figure 3).

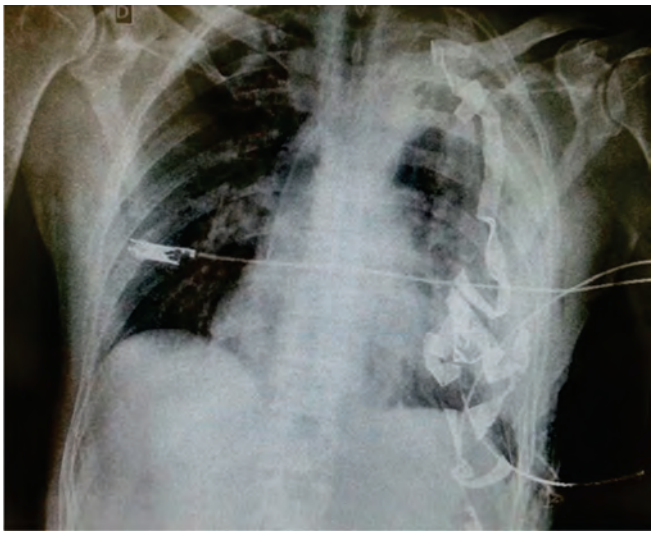

Figure 3. *Chest radiography in the postoperative period of thoracic packaging for coagulopathy. Note the presence of radiopaque stripes of seven packs in the left hemithorax.*

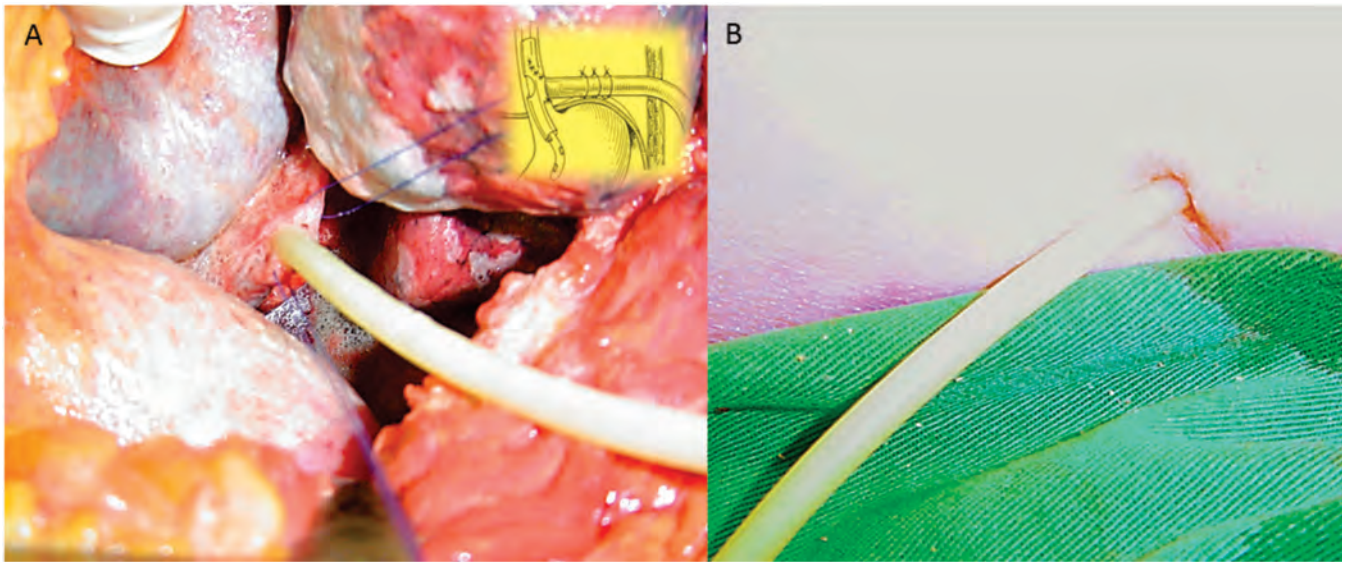

Figure 4. *A) Positioning of a large caliber Kher drain in an esophageal injury. The schematic detail depicts the approaching of the lesion, the passing of nasal-enteral feeding tubes inside the "T" drain and the fixation with absorbable sutures in the diaphragm; B) Exteriorization of the Kherdrain through the chest wall*

THORACIC VESSELS

Within the concept of damage control, in thoracic vascular trauma there are the following situations: active bleeding externalizing through an open wound; active bleeding into some thoracic compartment (mediastinal or pleural); or bleeding contained as a extrapleural or mediastinal hematoma. The first situation can be exemplified by a penetrating wound in the cervicothoracic region with active bleeding. The temporary control of the bleeding can be done by introducing a Foley catheter in the wound, balloon inflation and traction of the catheter. If the wound is extensive in the skin, one can apply stitches around the catheter. During the surgical exploration one can again use a Foley or Fogarty catheter for compressing bleeding coming from a deep spot of the thoracic cavity. One should keep in mind which vessels could be ligated[17]. Theoretically, one can perform ligation of all thoracic venous vessels, with the exception of the venae cavae; amongst the arterial branches, the ligation of the innominate artery can result in extensive stroke. The subclavian arteries, however, ultimately may be ligated because they have a rich collateral circulation network in the shoulder girdle. An alternative to arterial ligation is construction of an intravascular shunt (Figure 1) through a silicone conduit tied to the arterial ends, particularly in the subclavian ones. In the event of a stable mediastinal or extrapleural hematoma due to a greater vascular injury, the conduct may be initially conservative in a seriously injured patient in whom a thoracic operation would involve major trauma and bleeding, consuming the last physiologic reserves. The classic case to illustrate this is a patient with multi-systemic trauma and a contained injury in the descending aorta. This patient may benefit from a conservative approach, with resolution of the other injuries (brain, orthopedic and abdominal), and only then be submitted to aortic endovascular treatment[18].

ESOPHAGUS

Early diagnosed lesions have been treated by primary surgical synthesis associated with nasogastric catheterization and pleural drainage. In iatrogenic perforation during endoscopic procedures, there have descriptions of endoscopic treatments with clipping, positioning of esophageal stents, endoscopic suturing and even conservative treatment for minor injuries in stable patients[19,20].

However, injuries of the thoracic esophagus from external causes (i.e. stabbing of gunshot wounds) are often silent lesions that go unnoticed, with late diagnosis performed by pleural effusion and by sepsis installed due to associated mediastinitis. In these critically ill patients with low physiological reserve for arepair attempt (with high rates of fistula), or to perform esophagectomy (high mortality), the choices left are the bypass and exclusion,through cervical esophagostomy, associated with gastrostomy

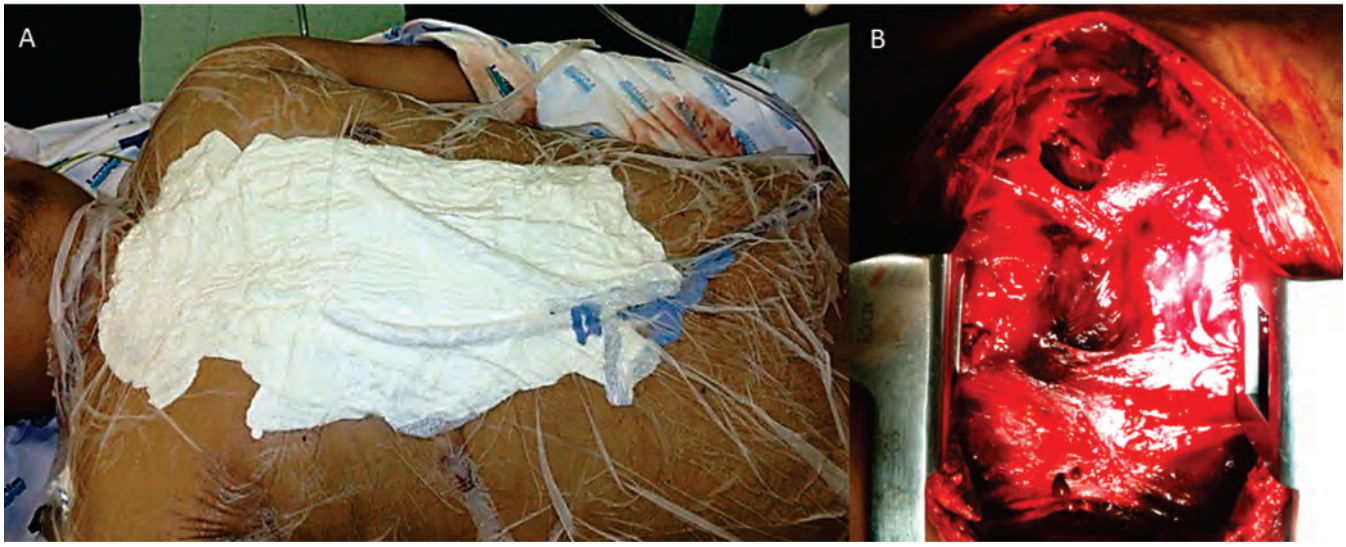

Figure 5. *A) Thoracic Packing after sternotomy and coagulopathy. After placing packs in the mediastinum and sternum, a suction drain was placed and adhesive fields applied to seal the dressing (VAC technique); B) Mediastinal appearance with firm clots after the patient homeostasis restoration.*

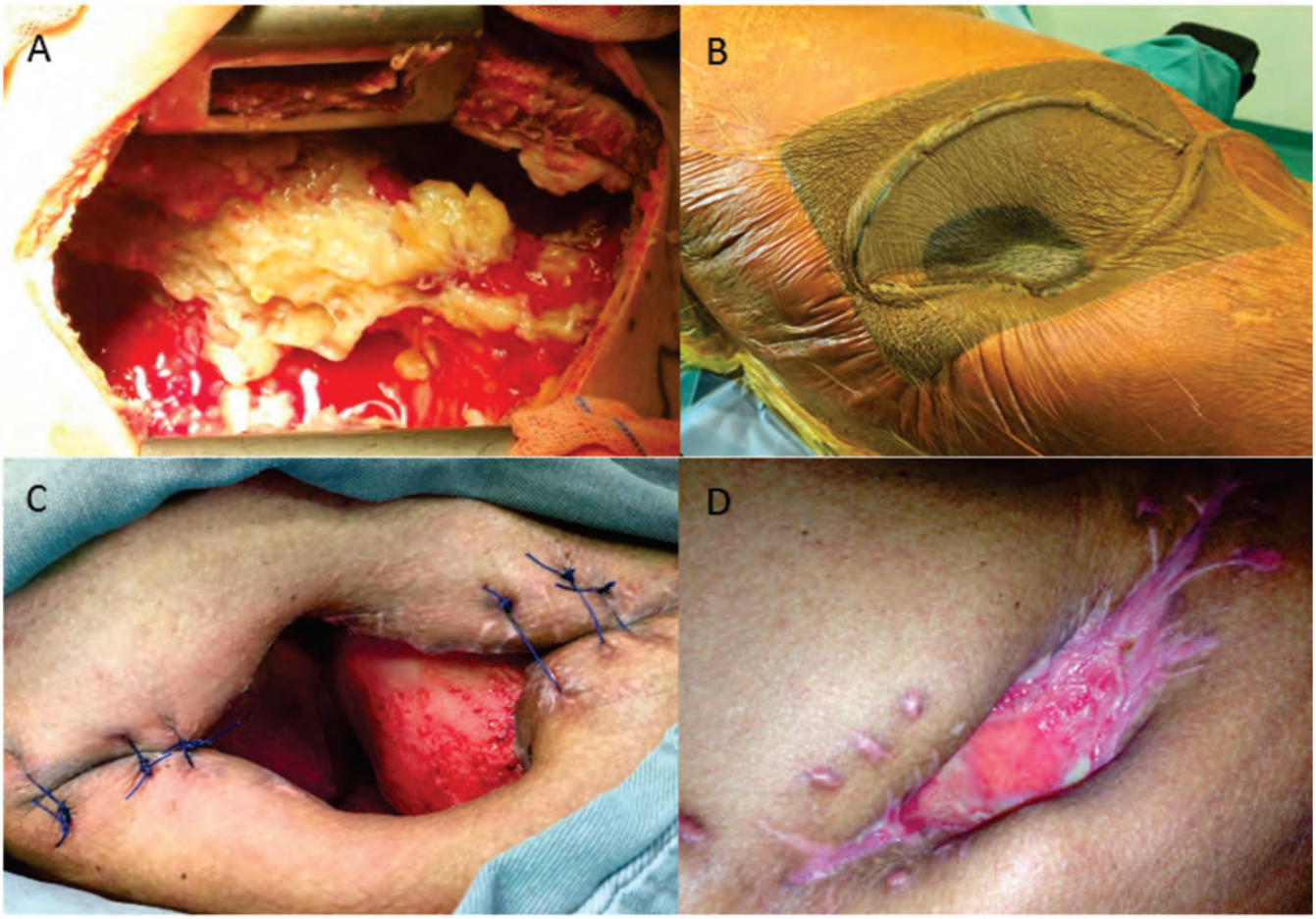

Figure 6. *A) Infected pleural and mediastinal wound; B) Vacuum dressing aspect with sponges, suction drain and adhesive drape; C) Evolution of the wound with sanitation of the pleural space and development of granulation tissue; D) Final phase of wound evolution, with obliteration of the pleural space and exuberant granulationtissue; after this phase a skin flap was performed, with satisfactory functional and aesthetic result.*

or jejunostomy, or a T-tube drainage (either a large Kehr drain or a Montgomery tube), introduced inside the esophageal lumen, coming out through the organ lesion and exteriorized through the skin, thus creating a controlled fistula[21]. A nasogastric catheter may be passed into the tube for subsequent feeding. An abundant pleural drainage should be associated with this procedure (Figure 4).

CHEST WALL

Situations involving damage control in the chest wall can be divided into control of parietal bleeding and temporary closure of the chest wall. One of the most common causes of review and re-operating of the thoracic cavity is in a parietal bleeding vessel. Intercostal and internal thoracicarteries havetheir flow greatly diminished in a patient with hypovolemic shock. However, when the individual returns to the hemodynamically normal state, these vessels can reach a flow rate of 300ml per minute. Hence, the cautious ligature of these vessels becomes an important part in the first approach. Sometimes an intercostal vessel may present bleeding at the time of surgical exploration and, after sectioned, retract and become difficult to ligate. The options in this case are: "U" stitches parallel to the ribs; stitches circulating the entire rib and intercostal region into two segments and piercing of the wall through the bleeding point, and positioning of a catheter balloon (Foley or Fogarty) and fixing it to the skin, leaving it for a few days until the thrombosis of the affected vessel. In multiple traumato the ribs and thoracic wall, in which there is diffuse bleeding, one can apply thoracic packaging[22].

The temporary closure (abbreviated thoracotomy) is indicated in two situations. The first one, in which there is temporary control of the injuries, with coagulopathy and requiring rapprochement to remove packs or to

repair the injuries permanently. The other indication is in the event of an anterolateral thoracotomy or sternotomy where, after opening the pericardium, the heart is very dilated and the closing of the wall will restrict the heartbeats[23,24] (Figure 5).

The temporary closure technique may be performed only by approximation of the skin or, in extreme cases where there is still cardio-respiratory restriction, by suturing a Smarchtape to the skin. One can also use an open urine collection bag (similar to the "Bogota bag" principle), or placing packs, covered by adhesive surgical drapes in the skin, like steri-drape, with application of vacuum (VAC – vacuum-assisted closure– technique), in particular in infected wounds[25,26] (Figure 6). The final synthesis of the chest wall may take several days to complete.

In conclusion, we believe that the general surgeon who serves in the emergency should know the thoracic damage control techniques, so as they can serve as therapeutic management tools in critically ill patients.

R E S U M O

A cirurgia de controle de danos surgiu com a filosofia de se aplicar manobras essenciais para controle de sangramento e contaminação abdominal, em doentes traumatizados, nos limites de suas reservas fisiológicas. Este conceito se estendeu para as lesões torácicas, onde manobras relativamente simples, podem abreviar o tempo operatório de doentes *in extremis*. Este artigo tem como objetivo, revisar as diversas técnicas de controle de dano em órgãos torácicos, que devem ser de conhecimento do cirurgião que atua na emergência.

Descritores: Traumatismo Múltiplo. Traumatismos Torácicos. Medicina de Emergência.

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Received in: 18/08/2016
Accepted for publication: 29/09/2016
Conflict of interest: none.
Source of funding: none.

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Systematic training model for teaching, development and training of instructors in inguinal hernia treatment using the Lichtenstein technique. Hernia campaign 2014 & 2015.

Modelo de treinamento sistematizado para o ensino, desenvolvimento e formação de instrutores no tratamento da hérnia inguinal pela técnica de Lichtenstein. Mutirão da hérnia 2014 e 2015.

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ABSTRACT

Objective: *to evaluate the method of training and continuing education of 18 surgeons in 2014, and 28 surgeons in 2015, in the Holy Homes of Ribeirao Preto, Araraquara, Franca and San Carlos of São Paulo, in the performance of Lichtenstein inguinal herniorrhaphy, tutored by the Faculty of Medical Sciences of the São Paulo Holy Home and the organization HERNIA HELP – "Hernia Repair for the Underserved".* **Methods**: *the training was tutored and systematized through an active methodology of teaching and learning, aiming to offer competence, skills and attitudes, measured by a previously validated Qualification Form, qualifying leaders in trainees' improvement.* **Results**: *in 2014 the outcomes were: the difficulty of the case, direction, incision, dissection, mesh preparation, mesh cutting, mesh setting, closing, instruments, respect to tissues, flow, time and motion, and performance, all presented change in the general rating (p=0.000002); there was greater confidence in the execution of the procedure in 80% of trainees, considered "very valuable" in 93.3% of the interventions. In 2015, 28 surgeons were trained by ten surgeons previously qualified in 2014. The nerve identification rate, a relevant time the Lichtenstein technique, was 95.5% for the Iliohypogastric, 98.5% for the ilioinguinal and 89.4% for the genital branch of the genitofemoral nerve.* **Conclusion**: *the applied teaching method is possible, reproducible, reliable and valid. The joint efforts offer enormous opportunity of directed education, reaching underserved populations, revealing the great teacher-student social responsibility.*

Keywords: *Educational Measurement. Hernia, Inguinal. Professional Training. Surgical Procedures, Operative. Teaching.*

INTRODUCTION

The concepts of Medical Education have been strong influences of society, of knowledge "per se" and of health systems. The National Curriculum Guidelines Law of the Brazilian Graduate Courses in Medicine establishes precepts in "Skills and Abilities", subclause – Continuing Education, stating that: "Providers should be able to learn continuously, both in their education and in their practice. Thus, health professionals must learn to learn and take responsibility and commitment to their education and training of future generations of professionals, but providing conditions so that there is mutual benefit among the future professionals and the staff, including stimulating and developing academic/vocational mobility, training and cooperation through national and international networks"[1].

It should be considered that the professional inserted in Public Health should include in his/her scope, beyond the technical-scientific issues, the question of social responsibility, allying with government sectors[2]. The certification, recertification and maintenance of skills in the medical field are widely applied and discussed in various forms and in various countries like USA, Canada, New Zealand, Britain, France, Germany, Portugal, Argentina, Chile, Colombia, Mexico and Panama. In Brazil there are already initiatives in this area[3,4].

According to Youngsson[5], in an article that discussed the teaching and assessment of non-technical skills, surgical excellence is a composite of skill, ability,

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behavior and attitudes with solid intellectual foundation. According to MacRae[6], the need for objective assessment of technical skills can be accomplished in several ways, each with its own peculiarities and criticism; however, there is consensus that when properly applied it minimizes errors.

There were several proposals for inguinal hernia correction in the course of the surgery history, among them the Lichtenstein technique, presented in 1989 and referred to as "tension-free", replacing sutures under tension in the groin, interposing a polypropylene prosthetic mesh[7].

In Brazil, the use of meshes is authorized and standardized in accordance with Article 5 of the Ministry of Health's Ordinance No. 2036, of November 24, 2002[8].

Despite herniorrhaphies being an option, the tension-free technique with prosthesis under local anesthesia takes an important position since the systematic review of the Cochrane Library in 2002 and the guidelines of the European Hernia Society for treating adult inguinal hernias[9-11].

Based on these assumptions, we believe that the teaching of the Lichtenstein technique is important in public health, as a means of continuous and supervised medical education, provided its assessment through a systematic and institutional teaching method, offering surgeons the opportunity of acquiring skills, abilities and attitudes appropriate to the proposed task.

The aim of this study was to evaluate the systematic training through an active teaching methodology in the realization of Lichtenstein inguinal hernia repair under joint supervision of the Brotherhood of The São Paulo Holy Home of Mercy of / Faculty of Medical Sciences of The São Paulo Holy Home of Mercy (FCMSCSP) and the non-governmental organization HERNIA HELP – Hernia Repair for the Underserved (HRFU), coordinated by the Abdominal Wall Group of the Department of Surgery FCMSCSP.

METHODS

Through standardized and systematic teaching, 18 surgeons from hospitals of the Brotherhood of The São Paulo Holy Home in 2014, and 28 surgeons of the The Holy Homes of the cities of Ribeirão Preto, Araraquara, Franca and São Carlos in the State of São Paulo in 2015. They attended a lecture on the surgical treatment of inguinal hernia by the Lichtenstein technique, when they received detailed explanation of the technical aspects, intraoperative traps, tactics to avoid complications and critical analysis of postoperative complications, interactively discussing, criticizing and asking questions about the technique's step-by-step. In the 2015 Campaign, ten surgeons from the 2014 training participated as teachers. Teachers, as well as students and patients, signed the Informed Consent Form, according to the Opinion of the Ethics in Research Committee of the Brotherhood of The São Paulo Holy Home of Mercy, CAAE: 47189715.1.0000.5479.

Once known the surgical tactic and technique, surgeons were summoned to the operating room for a detailed discussion of the cases to be operated, in an individualized way, with their respective tutor.

To measure skills, abilities and attitudes, the surgeon, then called student, actively participated in five procedures. In the first surgery, students helped the teacher, and from then on, performed four operations aided by the teacher, in which he/she should demonstrate knowledge, skill and ability to conduct the operative times. After each intervention where the student performed the procedure, the teacher performed the assessment by the Qualification Form[12], and scored the questions assigning from 1 to 5, namely (Annex):

For analysis of the Qualification Form outcomes, we used the Student's test t (α=0.05).

We adjusted generalized estimating equations models with the Poisson distribution, considering the correlation between the measurements of the same student in different assessments of the same item. We presented the model results by adjusted average values and 95% confidence intervals.

Multiple comparisons were corrected by the Bonferroni method, adopting the 0.05 significance level (α=5%). We used the SPSS software, version 18.0 (SPSS Inc. Released 2009 PASW Statistics for Windows, Version 18.0 Chicago. SPSS Inc.).

RESULTS

We applied the Lichtenstein inguinal hernia repair technique in 74 patients, with 79 inguinal hernias, training 18 surgeons at four hospitals in a three-day period in the 2014 Campaign. There was no mortality and no reoperations. As for surgical skills, there was a significant change in the items: Incision (p=0.001), dissection (p=0.009), preparation (p=0.02) mesh cutting (p=0.01), mesh fixation (p=0.0004) instruments handling (p=0.004), respect for tissues (p=0.03), time and motion (p=0.005), operative flow (p=0.01), closing (p=0.004) and general classification (p=0.000002) (Table 1), shown by the range performance curves (Figure 1).

The questionnaire noting the outcome "Changes in Post-Training Practice" revealed "extensive changes" in 13.3%, "moderate change" in 73.3% and "no change" in 13.3%. As for the "Confidence level", data revealed "Same Confidence" in 20% and "More Confidence" in implementing the procedure in 80% of students. As for the post-training questionnaire, "training value" revealed: "Something valuable" by 6.7% and "very valuable" in 93.3% of the cases.

In 2015 Campaign, 28 surgeons were trained by ten surgeons previously qualified in 2014, operating 139 patients with 141 hernias in three days. We excluded one patient from the study due to lack of anesthetic conditions.

We found no significant differences between the average scores in the four assessments regarding case difficulty, mesh preparation, closing, instruments and respect to the tissues (p>0.05 for all comparisons). We observed higher means in the fourth evaluation when compared with the average of the first evaluation for the direction (p=0.038) and dissection (p=0.013). The incision item had a higher average in evaluation three when compared with evaluation one (p=0.010). We observed that the average scores for the outcome cut in the fourth assessment was higher than the average ratings in the first evaluation (p<0.001). The average grades for mesh

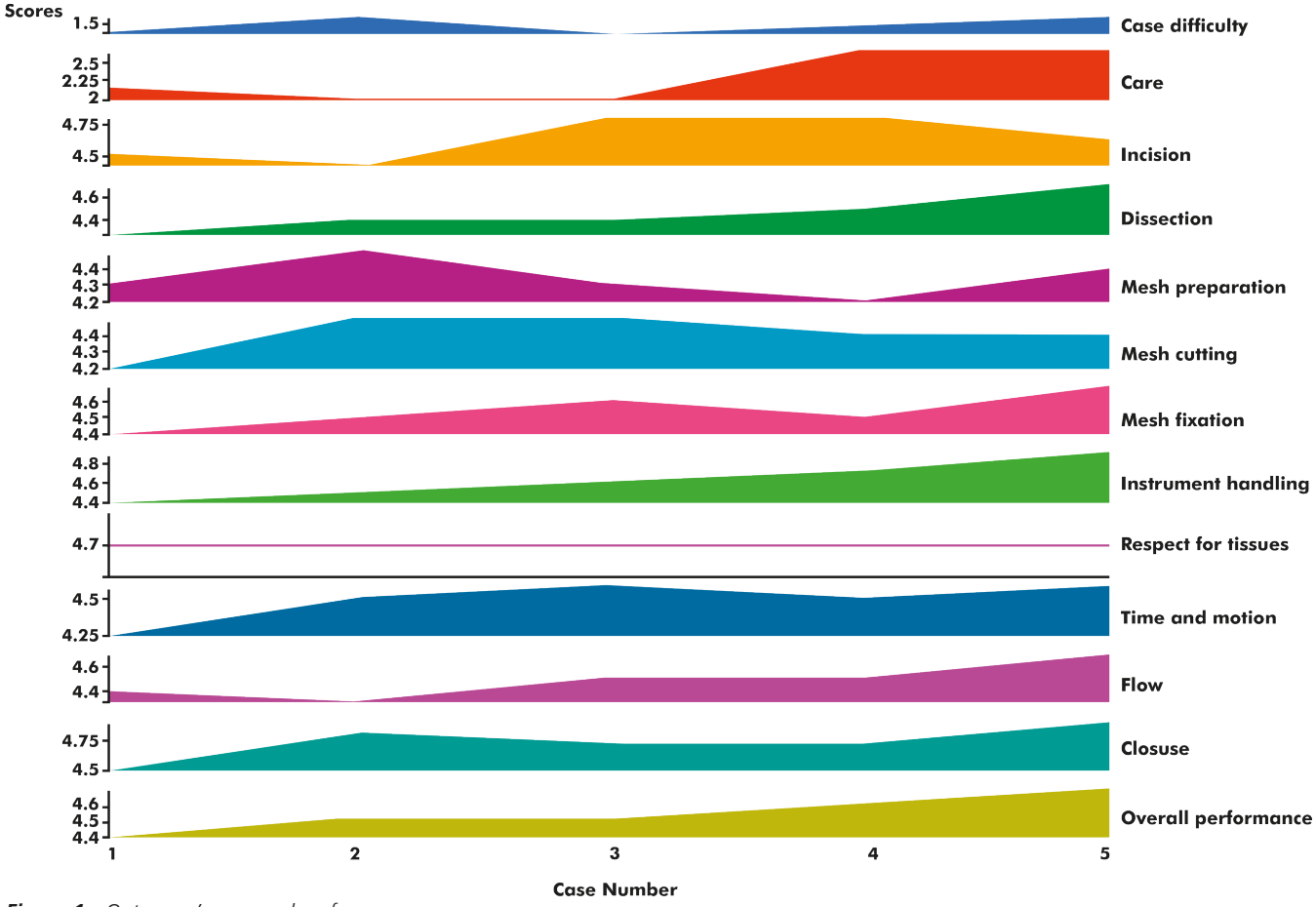

Figure 1. *Outcomes' curve and performance scores*

Table 1 - Statistical analysis of outcomes.

Surgical Skills	Score 1st case[a]	SD_1	SEM_1	Score final case[a]	SD_2	SEM_2	p-value [b]
Incision	4.27	0.67	0.04	4.88	0.32	0.025	0.001
Direction	4.16	0.71	0.04	4.72	0.46	0.03	0.009
Preparation	4.22	0.73	0.04	4.72	0.46	0.03	0.02
Mesh cutting	4.11	0.76	0.04	4.72	0.57	0.03	0.01
Mesh fixation	4.16	0.62	0.03	4.83	0.38	0.02	0.0004
Instrument handling	4.27	0.67	0.04	4.83	0.38	0.02	0.004
Respect for tissues	4.38	0.50	0.03	4.77	0.55	0.03	0.03
Time and motion	4.05	0.64	0.04	4.66	0.59	0.03	0.005
Flow	4.22	0.55	0.03	4.66	0.49	0.03	0.01
Closing	4.44	0.51	0.03	4.88	0.32	0.02	0.004
Overall performance	4.11	0.47	0.03	4.88	0.32	0.02	0.000002

[a] Points for average, [b] t-test, $\alpha = 0.05$, SD: standard deviation; SEM: standard error of the mean.

fixation in evaluation three was greater than the first assessment (p=0.038). For the time and motion outcome, we found a higher average score in the fourth assessment compared with the second one (p=0.003). We observed that the average scores for the flow and performance outcome in the fourth evaluation were higher than the average ratings in the first (p=0.027 for Flow and p=0.017 for Performance). Table 2 shows the statistical analysis.

DISCUSSION

The teaching of surgery dates back to centuries. However, it fell to Dr. William Stewart Halsted, at Johns Hopkins Hospital in 1889, the merits of introducing a supervised and tutored education and training system for surgeons in the learning phase, featuring the creation of the Medical Residency[13].

In Brazil, Decree No. 80281 of September 5, 1977[14] formally regulated the medical residency as a form of post-graduate education. Over the years, the surgical specialties advanced in number and importance, so much so that there are schools of thought that believe that there will not be, in the near future, a Surgeon General, but "Surgeons of hernias and abdominal wall", for example[13].

In Education, the classic Miller pyramid has been widely used for the understanding and development of knowledge construction methods, where the individual shows that he knows, knows how, shows how and does. Nevertheless, one must recognize the necessary of skills assessment in the real clinical practice, the DOES level[15,16].

Among the many teaching tools, the David Ausubel Theory of Meaningful Learning, published in 1968, states that the individual can significantly learn certain content, adding new information to those which were constant in his cognitive structure, on the premise that there is willingness to learn. This justifies the use of active learning methodologies in the sense that the professional incorporates elements indispensable to clinical practice[15,16].

Attentive to national and international humanitarian actions, the authors considered that the proposed task force for surgical treatment of inguinal hernia to needy populations might represent a significant contribution and enhancement of social responsibility of health professionals[17].

This humanitarian action is not aimed at the study of new surgical techniques, applying treatment already established in the literature, offering the Brazilian public health system the opportunity to shorten the long queues.

The teaching method used in this study showed a clear evolution of the concept: "See One, Do One,

Table 2 - Estimated Measures of ratings' scores and 95% confidence intervals.

Notes	Reviews of procedures			
	1	2	3	4
	Mean (CI)	Mean (CI)	Mean (CI)	Mean (CI)
Difficulty of the case	1.2 [1.1; 1.4]	1.3 [1.1; 1.4]	1.4 [1.2; 1.7]	1.2 [1.0; 1.4]
	1 x 2: p = 1.000		2 x 3: p = 1.000	
Multiple comparisons	1 x 3: p = 0.583		2 x 4: p = 1.000	
	1 x 4: p = 1.000		3 x 4: p = 0.502	
Direction	1.9 [1.6; 2.2]	2.1 [1.8; 2.3]	2.2 [2.4 1.9;]	2.4 [2.1; 2.8]
	1 x 2: p = 1.000		2 x 3: p = 1.000	
Multiple comparisons	1 x 3: p = 0.757		2 x 4: p = 0.186	
	1 x 4: p = 0.038		3 x 4: p = 0.379	
Incision	4.1 [3.8; 4.3]	4.1 [3.8; 4.4]	4.6 [4.8 4.3;]	4.5 [4.2; 4.9]
	1 x 2: p = 1.000		2 x 3: p = 0.067	
Multiple comparisons	1 x 3: p = 0.010		2 x 4: p = 0.149	
	1 x 4: p = 0.093		3 x 4: p = 1.000	
Dissection	4.1 [3.8; 4.3]	4.1 [3.8; 4.3]	4.3 [3.9; 4.6]	4.6 [4.9 4.3;]
	1 x 2: p = 1.000		2 x 3: p = 1.000	
Multiple comparisons	1 x 3: p = 1.000		2 x 4: p = 0.069	
	1 x 4: p = 0.013		3 x 4: p = 0.538	
Mesh preparation	4.1 [3.8; 4.3]	4.1 [3.8; 4.4]	4.2 [3.9; 4.5]	4.5 [4.1; 4.8]
	1 x 2: p = 1.000		2 x 3: p = 1.000	
Multiple comparisons	1 x 3: p = 1.000		2 x 4: p = 0.602	
	1 x 4: p = 0.254		3 x 4: p = 0.613	
Mesh Cutting	3.9 [3.6; 4.1]	4.1 [3.9; 4.4]	4.4 [4.1; 4.6]	4.6 [4.4; 4.8]
	1 x 2: p = 0.429		2 x 3: p = 0.541	
Multiple comparisons	1 x 3: p = 0.026		2 x 4: p = 0.004	
	1 x 4: p < 0.001		3 x 4: p = 0.377	
Mesh Fixation	4.2 [3.9; 4.4]	4.1 [3.8; 4.4]	4.6 [4.4; 4.8]	4.5 [4.2; 4.8]
	1 x 2: p = 1.000		2 x 3: p = 0.003	
Multiple comparisons	1 x 3: p = 0.038		2 x 4: p = 0.108	
	1 x 4: p = 0.408		3 x 4: p = 1.000	
Closing	4.4 [4.7 4.2;]	4.5 [4.8 4.3;]	4.7 [4.5; 4.9]	4.8 [4.6; 5.0]
	1 x 2: p = 1.000		2 x 3: p = 0.955	
Multiple comparisons	1 x 3: p = 0.248		2 x 4: p = 0.337	
	1 x 4: p = 0.197		3 x 4: p = 1.000	
Instruments Handling	4.4 [4.1; 4.6]	4.2 [3.8; 4.5]	4.5 [4.7 4.3;]	4.5 [4.8 4.3;]
	1 x 2: p = 1.000		2 x 3: p = 0.389	
Multiple comparisons	1 x 3: p = 1.000		2 x 4: p = 0.202	
	1 x 4: p = 1.000		3 x 4: p = 1.000	
Respect for tissues	4.4 [4.2; 4.6]	4.2 [3.9; 4.5]	4.4 [4.7 4.2;]	4.7 [4.4; 4.9]
	1 x 2: p = 1.000		2 x 3: p = 0.996	
Multiple comparisons	1 x 3: p = 1.000		2 x 4: p = 0.081	
	1 x 4: p = 0.905		3 x 4: p = 0.947	
Time and Motion	4.1 [3.8; 4.4]	3.9 [3.5; 4.3]	4.3 [3.9; 4.6]	4.6 [4.9 4.3;]
	1 x 2: p = 1.000		2 x 3: p = 0.163	
Multiple comparisons	1 x 3: p = 1.000		2 x 4: p = 0.003	
	1 x 4: p = 0.056		3 x 4: p = 0.509	
Flow	4.1 [3.8; 4.4]	4.0 [3.7; 4.4]	4.3 [4.0; 4.6]	4.6 [4.4; 4.9]
	1 x 2: p = 1.000		2 x 3: p = 0.425	
Multiple comparisons	1 x 3: p = 1.000		2 x 4: p = 0.020	
	1 x 4: p = 0.027		3 x 4: p = 0.412	
Overall Performance	4.1 [3.9; 4.3]	4.0 [3.7; 4.3]	4.4 [4.1; 4.7]	4.6 [4.4; 4.9]
	1 x 2: p = 1.000		2 x 3: p = 0.123	
Multiple comparisons	1 x 3: p = 0.495		2 x 4: p = 0.005	
	1 x 4: p = 0.017		3 x 4: p = 0.839	

(CI): Confidence Interval.

Teach One", recorded in the Post-training practice questionnaire, to the extent that the students demonstrate the evolution of their skills[18,19].

Through the results of studying the teaching method in question, we clearly observed that the proximity between student and teacher, focused on the pursuit of perfection, attended principles of learning in which the teacher acted as supervisor, advisor and facilitator, of reflective character, as a sponsor and friend[20,21]. These aspects were highlighted in the 2014 Confidence Level and Training Value questionnaires.

The analysis of the performance curves for the outcomes in skills acquisition was evidenced by the item Overall Performance (p=0.000002) in the 2014 Campaign, demonstrating that the method was effective.

The study showed a significant and relevant difference on outcomes during the four herniorrhaphies that unequivocally demonstrated an obvious continuing medical education character in the 2015 Campaign, when the 2014 students, then teachers, implemented and transferred abilities and attitudes in promoting skills. The outcomes Direction, Incision, Dissection Mesh Cutting, Mesh Fixation, Flow and Overall Performance composed the success of this training scenario.

CONCLUSION

The joint and quality effort between national and international institutions is possible, strengthening human relationships that go beyond technology. The training of surgeons was essential for technical standardization of surgical tactics, allowing them to become multipliers of education and training of their peers.

Skills, competencies and attitudes were fully achieved with this type of education. The Campaigns demonstrated citizenship and social responsibility outside the university environment. The teaching method allowed us to conclude that there is full conditions of reproducibility of this continuing education method.

RESUMO

Objetivo: avaliar resultados do método de treinamento e educação continuada de 18 cirurgiões, em 2014, e 28 cirurgiões, em 2015, nas Santas Casas de Ribeirão Preto, Araraquara, Franca e São Carlos do Estado de São Paulo, na realização da Herniorrafia Inguinal à Lichtenstein, tutorados pela Faculdade de Ciências Médicas da Santa Casa de São Paulo e pela organização HERNIA HELP – "Hernia Repair for the Underserved". **Métodos:** treinamento tutorado e sistematizado, através de metodologia ativa de ensino e aprendizagem, visando a oferecer competência, habilidade e atitudes, auferidas por um Formulário de Qualificação previamente validado, qualificando líderes no aperfeiçoamento de treinandos. **Resultados:** em 2014, os desfechos foram: dificuldade do caso, direção, incisão, dissecção, preparo da tela, corte da tela, fixação da tela, fechamento, instrumentos, respeito aos tecidos, fluxo, tempo e movimento e desempenho, apresentaram mudança na Classificação Geral (p=0,000002); houve maior confiança na execução do procedimento em 80% dos treinandos, sendo considerado "Muito Valioso" em 93,3% das participações. Em 2015, os 28 cirurgiões foram treinados por dez cirurgiões previamente qualificados em 2014. A taxa de identificação dos nervos, tempo relevante da técnica de Lichtenstein, foi 95,5 % para o ílio-hipogástrico, 98,5% para o ilioinguinal e 89,4% para o ramo genital do nervo genitofemoral. **Conclusão:** o método de ensino aplicado é possível, reprodutível, confiável e válido. Os mutirões oferecem a enorme oportunidade do ensino, dirigido, atingindo populações carentes, revelando a grande responsabilidade social docente-discente.

Descritores: Avaliação Educacional. Capacitação Profissional. Ensino. Hérnia Inguinal. Procedimentos Cirúrgicos Operatórios

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Received in: 16/06/2016
Accepted for publication: 04/09/2016
Conflict of interest: none.
Source of funding: none.

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Annex

Form 1 - Lichtenstein Inguinal Hernia Repair - Rating Form

Evaluator:	
Student:	
Program:	
Case Number:	
Please rate this trainee's performance during this operative procedure. The caption above each item provides descriptive anchors for 3 of the 5 points on the rating scale. "N/A" (Not applicable) should only be selected when the trainee did not perform that part of the procedure.	

Patient Location – hospital name:					
Ambulatory		3-4 hour recovery			
O		O			
Hospital Medical Record Number					
Date of Procedure MM/DD/YY					
Case Difficulty Indicate the difficulty of the case					
1		2		3	
Straightforward anatomy with moderate sized groin hernia and normal bleeding		*Intermediate difficulty with moderate bleeding*		*Abnormal anatomy, extensive bleeding, and large scrotal hernia*	
O		O		O	
Degree of Prompting or Direction					
1		2		3	
Substantial direction by mentor. Trainee performs all steps but the mentor provides constant direction to the trainee and surgical team.		*Some direction by mentor. Trainee performs all steps but the mentor provides occasional direction to the trainee and /or to the surgical team.*		*Minimal direction by mentor. Trainee performs all steps and directs the surgical team independently with minimum or no direction from the mentor, to either the resident or to the surgical team.*	
O		O		O	
Procedure Specific Criteria Incision					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Safe, efficient and placing the 6 cm or larger incision's medial end at the pubic tubercle with complete hemostasis		*Functional but awkward positioning of the incision with moderate bleeding*		*Poor positioning and inadequate length of incision with poor hemostasis*	
O	O	O	O	O	O

Dissection of tissue and hernia sac					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Optimizes visualization, and sees ilioinguinal, iliohypogastric and genital branch of genitofemoral nerve, vas deferens and cord vessels with careful sac dissection and complete inversión.		*Adequate visualization, and sees ilioinguinal, iliohypogastric and genital branch of genitofemoral nerve, vas deferens and cord vessels with difficulty. Sac dissection is complete but with moderate bleeding and probable satisfactory inversion or ligation.*		*Poor visualization and sees only the ilioinguinal nerve. Sac dissection is incomplete with poor hemostasis and unsatisfactory sac inversion or ligation.*	
O	O	O	O	O	O
Preparation for Mesh Placement					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Expedient with rectus sheath completely defined, course of iliohypogastric nerve well seen and room for mesh placement.		*Adequate with rectus sheath and iliohypogastric nerve seen but more cephalad, caudad and medial dissection needed.*		*Rectus sheath and iliohypogastric nerves not identified and more dissection required in all directions.*	
O	O	O	O	O	O
Mesh Cutting					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Expedient with rectus sheath completely defined, course of iliohypogastric nerve well seen and room for mesh placement.		*Adequate with rectus sheath and iliohypogastric nerve seen but more cephalad, caudad and medial dissection needed.*		*Rectus sheath and iliohypogastric nerves not identified and more dissection required in all directions.*	
O	O	O	O	O	O
Mesh Fixation					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Accurate careful and correct suture placement in rectus sheath inguinal ligament and internal oblique aponeurosis with satisfactory mesh buckle, 2cm medial overlap of pubic tubercle and satisfactory sized mesh spermatic cord opening.		*Adequate fixation but awkward suture placement with no more than two sutures slightly misplaced but still with mesh buckle, and satisfactory spermatic cord opening and medial mesh overlap.*		*Awkward fixation with sutures not including rectus sheath or internal oblique aponeurosis, or too large or too small mesh opening for spermatic cord, or mesh too lateral in relation to pubic tubercle.*	

Closure					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Accurate external oblique aponeurosis and subcutaneous closure with complete hemostasis and good skin apposition.		*External oblique and subcutaneous tissue closure with acceptable hemostasis and satisfactory skin closure.*		*Forgot to close one layer or inadequate hemostasis or poor cosmetic closure of skin.*	
O	O	O	O	O	O
General Criteria Instrument Handling					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
		Moderately awkward use of instruments, occasionally used excessive force, or did not always have complete visualization.		*Dangerous use of instruments with excessive force or accepted inadequate visualization at important parts of procedure.*	
O	O	O	O	O	O
Respect for Tissue					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
		Moderately awkward use of instruments, occasionally used excessive force, or did not always have complete visualization.		*Dangerous use of instruments with excessive force or accepted inadequate visualization at important parts of procedure.*	
O	O	O	O	O	O
Time and Motion					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Clear economy of motion, and maximum efficiency.		*Efficient time & motion, some unnecessary movement.*		*Many unnecessary movements.*	
O	O	O	O	O	O
Operation Flow					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
Obviously planned course of operation and anticipation of next steps.		*Some forward planning, reasonable procedure progression*		*Frequent lack of forward progression; frequently stopped operating and seemed unsure of next step*.	
O	O	O	O	O	O
Overall Performance					
5 Excellent	4 Very Good	3 Good	2 Regular	1 Insufficient	NA
O	O	O	O	O	O
Please indicate the weaknesses in this trainee's performance:					
Please indicate the strengths in this trainee's performance:					

DOI: 10.1590/0100-69912016005011

Modified technique for preparation of venous circulation resin casts in the cirrhotic liver

Técnica modificada para preparo do molde de resina da circulação venosa no fígado cirrótico

José Olímpio Maia de Vasconcelos Filho, TCBC-PE[1]; Laécio Leitão Batista[2]; Guilherme Benjamin Brandão Pitta[3]; Cláudio Moura Lacerda, TCBC-PE[3]

ABSTRACT

This study describes two major adaptations for the preparation of resin casts in human cirrhotic liver, harvested at the time of transplantation. The first is the way of fixing the catheter in the ostia of the hepatic and portal veins through a cerclage, so as to prevent displacement of the catheter and / or leakage of the resin during its injection. The second is the extension of corrosion time in the NaOH solution, averaging 6.8 days, with daily replacement the solution until complete removal of parenchymal tissue. We applied the method in 14 cirrhotic livers, with good filling and coloring of the portal and hepatic vein territories, using different colors. This allows an anatomical study of these vessels, able to complement the knowledge of the histopathology in research work, and the planning of therapeutic procedures, such as the Trans-Jugular Intrahepatic Port-Systemic Shunt (TIPS).

Keywords: *Liver circulation. Fibrosis. Corrosion casting. Liver cirrhosis.*

INTRODUCTION

Resin casts have been an important means of anatomical studies[1-4]. Uflacker et al[5] published a preparation technique for vascular casts in normal liver, in which they used cadaver livers, without disease, so that the hepatic vessels were preserved, which greatly facilitated the introduction of catheters and injection of the acrylic resin. Moreover, the lack of fibrosis in the organs studied allowed occurring complete corrosion of the liver parenchyma within 24 hours in 5% NaOH solution.

We reviewed the literature by accessing the database of PubMed, Medline, SciELO and Lilacs, and selecting analytical and descriptive studies that evaluated the hepatic venous anatomy in cirrhotic by preparation with resin injection. We did not find similar studies reported in explanted cirrhotic livers, which display parenchymal hardening and in which vascular section is held next to the parenchyma, hindering the introduction of catheters.

The aim of this paper is to present a modified mold preparation technique in resin for explanted livers affected by cirrhosis.

TECHNICAL NOTE

We studied 14 livers explanted from patients (10 men and 4 women, with a mean age of 47.3 years – range 20 to 69) who underwent liver transplantation, after signing an Informed Consent Form. This study was approved by the Ethics in Research Committee of HUOC / PROCAPE Hospital Complex (UPE) and received the number 85,448. All explants had cirrhosis (alcoholic, C virus, or unknown cause). We did not harvest organs from patients with suspected malignancy (hepatocellular carcinoma or other) or hepatitis B cirrhosis. After removal of the organ and identification of hepatic veins and the portal vein ostia, we introduced a # 12 polyethylene catheter in each branch of the porta and hepatic veins. We fixed the catheter in place through a cerclage of the ostium to prevent displacement of the catheter and / or leakage of the resin during injection (Figure 1A).

We opted for the dental acrylic resin Jet® (Classico Dental Articles – Campo Limpo Paulista – SP) due to fast drying (with gelation after 3-4 minutes), without catalyst after placement of the polymerizer.

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In separate containers, we prepared the resin with red or blue dye in the ratio of one to one between the liquid phase and the polymerizer, injecting immediately after mixing, with to 20ml syringe. In the portal system we injected the red resin, and in the hepatic veins, the blue one.

After injection in all liver veins, the organ was kept in "rest" for a period of 60 minutes. Thereafter, we immersed it in a 7.5% NaOH solution, for complete removal of the parenchyma. Every day, we washed the specimen in running water and replaced the solution with a new one until all the tissue was remove. (Figure 1B).

The organ corrosion time ranged from five to 12 days, with an average of 6.8 days, and venous vascular tree proved to be well filled until the venular territory in all cases. In 12 explants there were three hepatic veins, and in two, four hepatic veins. All accessory veins were related to the territory of the right hepatic vein. There was a partially rechanneled thrombosis in the right branch of the portal vein in one explant.

DISCUSSION

In 1994, Uflacker *et al*.[5] studied the liver anatomy in 24 cadavers without liver disease using the injection of resin through the long stumps of the portal and hepatic veins, prepared for this purpose.

After an extensive literature review, we could not find studies on the venous circulation of the cirrhotic liver in humans with the resin injection technique. Taking into account that this work uses liver explants from patients undergoing liver transplantation, the greatest difficulty for preparation of resin casts was

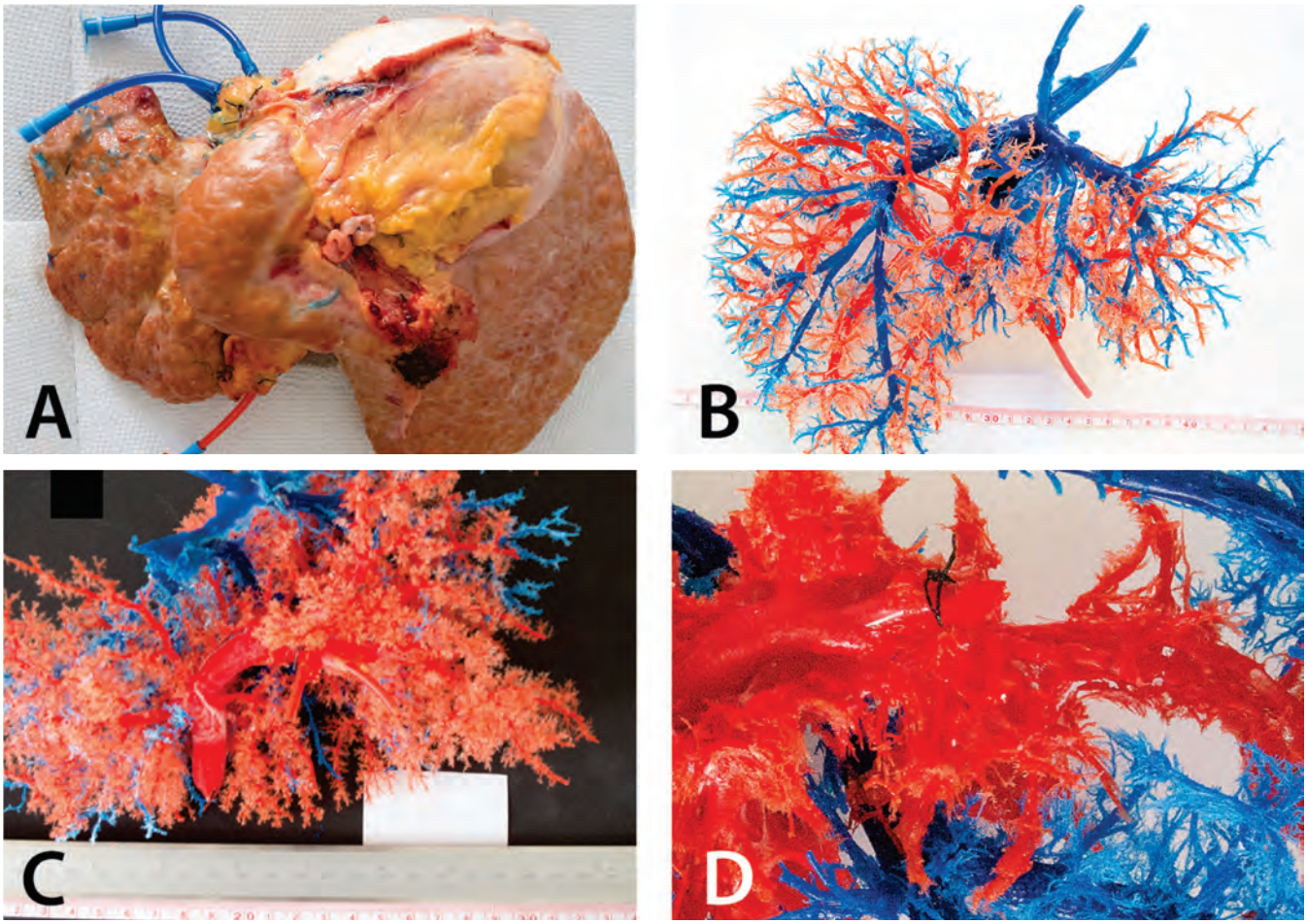

Figure 1. *A) Posterior aspect of the liver, with catheters in the hepatic (blue) and portal (red) veins; B) Hepatic venous bed, after complete removal of the parenchyma. One can observe the catheters in the portal and hepatic veins; C) Important dissociation between the portal circulation and hepatic veins. In the lower field, there is a dilated umbilicus vein (collateral venous circulation); D) Disorganization of the microcirculation and signs of thrombosis (with recanalization) of the right portal branch (right).*

the catheterization of the venous bed, as venous section are made as close as possible to the explanted organ, aiming to leave a greater vascular stump for anastomosis with the graft.

In the absence of studies using cirrhotic liver explant and resin, we proposed ostial cerclage for fixation of the catheter, allowing good filling of the venous bed, preventing displacement of the catheter, the leakage of the resin, as well as the occluding of small branches that drain very close to catheterized ostia. Furthermore, we propose the use a mold daily washing with NaOH until complete disappearance of the parenchyma. The difference in corrosion time found in this work and in the literature, and between different organs in this work, was probably due to the different degrees of fibrotic liver disease, with variable hardening.

The moldings obtained in this study are adequate for venous anatomical studies of the liver, showing the vascular and anatomical variations, occlusion, with or without recanalization, and collateral vessels associated with portal hypertension (Figure 1C and D). The detailed description of the hepatic venous circulation parameters, such as size and length and, above all, the relationship between hepatic and portal veins, including the distance and the spatial relationship between the two (anterior, posterior, superior, inferior), may help greatly in the planning of minimally invasive percutaneous procedures, such as intrahepatic port-systemic shunt performed by transjugular access (TIPS), indicated for the treatment of upper gastrointestinal bleeding, unresponsive to medication and endoscopic therapy.

RESUMO

Este estudo descreve duas importantes adaptações para o preparo de moldes de resina em fígado humano cirrótico, captado no momento do transplante: a primeira, é a maneira de fixação dos cateteres nos "óstios" das veias hepáticas e porta, através de uma "cerclagem" dos mesmos, de modo a evitar o deslocamento do cateter e/ou extravasamento da resina durante sua injeção, e a segunda, é o prolongamento do tempo de corrosão na solução de NaOH, atingindo a média de 6,8 dias, com a substituição diária da solução, até a remoção completa do tecido parenquimatoso. O método foi empregado em 14 fígados cirróticos com bom preenchimento e coloração dos territórios das veias porta e hepáticas, utilizando cores distintas. Isto permite um estudo anatômico desses vasos, capaz de complementar os conhecimentos da histopatologia em trabalhos de pesquisa, e planejar procedimentos terapêuticos como a derivação porto-sistêmica intra-hepática transjugular (TIPS – *Transjugular Intrahepatic Postosystemic Shunt*).

Descritores: Circulação Hepática. Fibrose. Molde Por Corrosão. Cirrose Hepática.

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Received in: 17/06/2016
Accepted for publication: 21/07/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005016

Considerations about gastric cancer proteomics

Considerações sobre proteômica no câncer gástrico

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ABSTRACT

The frequency of molecular studies aimed to analyze promoter methylation of tumor suppressor genes and global proteomics in gastric carcinogenesis is increasing. Nonetheless, only a few considered the different types of stomach cells, the tumor location and the influence of Helicobacter pylori and Epstein Barr virus infection (EBV). Molecular differences relating to anatomical and histological tumor areas were also recently described. The authors propose a molecular classification of gastric cancer, dividing it into four subtypes: tumors positive for EBV; microsatellite unstable tumors; genomically stable tumors and tumors with chromosomal instability.

Keywords: *Stomach Neoplasms. Proteome. Helicobacter pylori. Herpesvirus 4, Human. Methylation.*

Gastric Cancer (GC) is the third leading cause of death from cancer throughout the world[1]. Its incidence varies substantially among different countries. In Brazil, GC corresponds the fifth major cause of cancer mortality among men and the sixth among women. It is estimated that Brazil will have 20,520 new GC cases in 2016, 12,920 in men and 7,600 in women[2].

The stomach is classically divided into four anatomical regions: cardia, fundus, corpus and pylorus. Each has different glands, cells and functions, showing a heterogeneity in the morphological, cytological and molecular levels[3].Based on this heterogeneity, some classification systems have been proposed to evaluate the gastric tumor's pathological characteristics. For gastric adenocarcinoma, the Lauren's classification is one of the most used systems, in which two major histologic subtypes are the intestinal and the diffuse, the indeterminate subtype being an uncommon one[4]. The World Health Organization (WHO) 2010 classification describes four major histologic patterns of gastric adenocarcinoma: tubular, papillary, mucous and poorly cohesive (including signet ring cell carcinoma), plus uncommon histologic variants[5].

GC is considered a multifactorial disease. However, the factors involved in tumor development and progression, especially in the genetic pathways, remain unclear. Among the risk factors involved are: genetic predisposition[6], diet[7], alcohol consumption, smoking[8], and chronic *Helicobacter pylori* or Epstein-Barr virus (EBV) infection.The International Agency for Research on Cancer (IARC) classifies *H. pylori* and EBV as a class-I carcinogen[9,10] , and both are known to up-regulate DNA methyltransferases (DNMT)[11]. GC lesions have shown to display hypermethylation of *CDH1*, which expresses E-cadherin protein, associated with DNMT1 protein overexpression by EBV infection[12].

The frequency of molecular studies aimed to analyze promoter methylation of tumor suppressor genes (TSG) and global proteomics in gastric carcinogenesis is increasing. Nonetheless, only a few[13] consider important characteristics, such as: the different types of stomach cells, the tumor location and the influence of *H. pylori* and EBV infection.

The molecular differences relating to anatomical and histological tumor areas were recently described[14]. The authors propose a molecular classification of gastric cancer, dividing it into four subtypes: tumors positive for EBV; microsatellite unstable tumors; genomically stable tumors and tumors with chromosomal instability. This classification may be important in future proteomics studies.

A meta-analysis[15] revealed differences based on gender and anatomic location in EBV-positive

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gastric cancer compared with EBV-negative ones, and emphasized the importance of investigating the significance of EBV in GC.Another study analyzed the protein profiles of paired surgical specimens from primary gastric tumor with non-tumor mucosa[16]. Aquino *et al*.[17] showed that the non-tumor surgical margins presented several proteins previously correlated with cancer, but also other overexpressed proteins that may be related to tumor nourishment and metastasis. Lima *et al*.[18] observed that gastric carcinogenesis has different pathways depending on the presence of the *H.pylori* or EBV, suggesting a possible involvement of *H. pylori* with the apoptotic process; and the low expression of c-Myc and Bax in the EBV-positive groups suggests that EBV may inhibit the expression of these proteins.

The molecular and cytological heterogeneity of GC indicate that proteomics interpretations should not be generalized. One must consider individual factors such as: genetics and epigenetics, gender, environmental factors and pathological characteristics. In this context, the analysis of individual tumor tissue may show more straight results when compared with a pool of samples as tissues or liquid biopsies, where specific information of some patients can be missed.

R E S U M O

A frequência de estudos moleculares visando a analisar os promotores de metilação de genes supressores de tumor e proteômica globais na carcinogênese gástrica está aumentando. No entanto, apenas alguns consideraram os diferentes tipos de células do estômago, a localização do tumor e a influência da infecção por *Helicobacter pylori* e pelo vírus Epstein-Barr (EBV). Diferenças moleculares relacionadas com áreas tumorais anatômicas e histológicas também foram recentemente descritas. Os autores propõem uma classificação molecular de câncer gástrico, dividindo-o em quatro subtipos: tumores positivos para o EBV; tumores microssatélite instáveis; tumores genomicamente estáveis e tumores com instabilidade cromossômica.

Descritores: Neoplasias Gástricas. Proteoma. Helicobacter pylori. Herpesvirus Humano 4. Metilação.

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Received in: 13/09/2016
Accepted for publication: 19/10/2016
Conflict of interest: none.
Source of funding: CAPES, CNPq and Fundação do Câncer.

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DOI: 10.1590/0100-69912016005005

Splenic artery aneurysm

Aneurisma de artéria esplênica

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A B S T R A C T

Splenic artery aneurysms - the most common visceral artery aneurysms - are found most often in multiparous women and in patients with portal hypertension. Indications for treatment of splenic artery aneurysm or pseudoaneurysm include specific symptoms, female gender and childbearing age, presence of portal hypertension, planned liver transplantation, a pseudoaneurysm of any size, and an aneurysm with a diameter of more than 2.5cm. Historically, the treatment of splenic artery aneurysm has been surgical ligation of the splenic artery, ligation of the aneurysm, or aneurysmectomy with or without splenectomy, depending on the aneurysm location. There are other percutaneous interventional techniques. The authors present a case of a splenic artery aneurysm in a 51-year-old woman, detected incidentally.

Keywords: *Aneurysm. Splenic Artery. Aneurysm, False.*

INTRODUCTION

Aneurysms of the visceral or splanchnic arteries are rare pathologies, but early recognition and treatment are essential, since approximately 25% present with rupture in emergencies, resulting in a mortality of 8.5%. The splenic artery aneurysms (SAA) are uncommon lesions that account for 60% of all visceral aneurysms[1], with an estimated prevalence of 0.8% in the population. Generally asymptomatic, its incidence is four times higher in women than in men. Most aneurysms are small, less than 2cm in diameter, saccular and located at the fork situated in the middle of the splenic artery or in its distal segment[1,2].

CASE REPORT

A female, 51-year-old, single, white patient, native and resident of Rio de Janeiro, sought a private practice medical clinic with cervical lymphadenopathy of one month duration. Two years before, she had Hashimoto's disease that progressed to hypothyroidism requiring hormone replacement. There was also history of rheumatic fever, brucellosis, tonsillectomy and the presence of uterine fibroids. She denied surgery or abdominal trauma. Physical examination showed an increased lymph node, of hard consistency, adhered to deep planes, in the cervical region near the posterior edge of the left sternocleidomastoid. During the investigation of cervical lymphadenopathy we ordered several tests, including an abdominal ultrasound (US). It suggested the presence of a cystic lesion near the splenic hilum. We requested a magnetic resonance angiography of the abdominal aorta (Figures 1 and 2) to further study, which diagnosed a splenic artery aneurysm 2.5cm in diameter. Once established the surgical indication, we proceeded to preoperative vaccination against *Streptococcus pneumoniae* and *Haemophilus influenzae*. The patient underwent splenectomy. The procedure, although started by laparoscopy, needed to be converted due to bleeding. The postoperative course was uneventful, the patient remaining asymptomatic.

DISCUSSION

Splenic artery aneurysms (SAA) are the most common type of arterial visceral aneurysms, accounting for 60% of all cases. The patient in question was female, consistent with the literature[1-5], in which the prevalence of this pathological entity is

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Figure 1. *Angio-MRI image of the abdominal aorta, coronal section, showing the splenic artery aneurysm.*

four times higher in this gender. Although the precise cause of the SAA has not been established, the most common pathologic finding is a defect of the tunica media, with loss of elastic fibers and smooth muscle[3]. Atherosclerosis - commonly observed in this disease - is probably more a post-aneurysm phenomenon than a primary cause of injury[3,4]. The increased blood flow in the splenic artery appears to be a relevant factor in its appearance, which is why these aneurysms are more frequently observed in patients with fibromuscular dysplasia, in portal hypertension, in infections, congenital anomalies, transplanted liver and even pancreatic carcinoma[2]. Its higher prevalence in women, particularly multiparous, is explained by hormonal and hemodynamic changes typical of pregnancy that promote intimal hyperplasia of the vessel and subsequent fragmentation, facilitating the development of aneurysm. Another class of patients is one in which there are inflammatory changes of the arterial wall, as in polyarteritis nodosa, bacterial endocarditis or enzymatic digestion of the wall by a previous pancreatitis episode[2].

The standard of the SAA is its asymptomatic nature at diagnosis, except in cases of rupture that, although being a rare event, is marked by bulky bleeding that occurs inside the peritoneal cavity, into some viscera (causing gastrointestinal bleeding) or into the pancreatic duct, a condition known as *hemossucus pancreaticus*[2]. Rupture is associated with high mortality rates[5]. The patient in this case report was asymptomatic as for the aneurysm.

The absence of clinical signs and symptoms in most cases makes diagnosis difficult, and it is often done when performing routine tests[3]. A very suggestive finding of SAA - cystic lesion in the abdominal US - should be further investigated with other imaging tests, differentiating it from other possible diagnostic hypotheses, such as pancreatic cystic tumor, pancreatic pseudocyst secondary to pancreatitis or, very rarely, a neuroendocrine tumor with this type of radiologic presentation[2]. In general, a computed tomography (CT) or a magnetic resonance angiography are sufficient to clarify the presence of a SAA, as was observed in this patient.

The SAA treatment indications include specific symptoms such as epigastric pain in the left upper quadrant and back, women of childbearing age,

Figure 2. *Image in axial section showing an aneurysm in the topography of the splenic artery.*

presence of portal hypertension, liver transplantation, pseudoaneurysms of any size and SAA with diameter greater than 2.5cm. In patients older than 60 years, follow-up CT scan every six months is advocated[2]. The greatest risk conditions comprise the SAA greater than 2cm, symptomatic and transplant patients, the SAA associated with inflammatory processes and those identified in women of childbearing age and pregnant women, the latter representing a great risk for both the mother and the fetus[2].

Therapeutic alternatives are several, ranging from a simple vascular ligation (by open or laparoscopic route) to the need for splenectomy due to the proximity of the aneurysm with the spleen[1]. Endovascular procedures such as artery embolization or stent placement are also being used, minimizing the risks of surgery and shortening the patient's hospital stay[1,3,5].

Postoperative complications are uncommon and were not observed in this case. Mortality is high in patients with an ongoing episode of pancreatitis.

The follow-up with CT or ultrasonography-Doppler to assess therapeutic efficacy should take place in subsequent months[1].

R E S U M O

Aneurismas da artéria esplênica - os aneurismas arteriais viscerais mais comuns - são encontrados mais frequentemente em mulheres multíparas e em pacientes com hipertensão portal. As indicações para o seu tratamento incluem sintomas específicos, sexo feminino e idade fértil, presença de hipertensão portal, paciente em fila de transplante hepático, um pseudoaneurisma de qualquer tamanho, e um aneurisma com um diâmetro superior a 2,5cm. Historicamente, o tratamento do aneurisma da artéria esplênica tem sido a ligadura cirúrgica da artéria esplênica, a ligadura do aneurisma ou a aneurismectomia, com ou sem esplenectomia, dependendo do local do aneurisma. Existem outras técnicas intervencionistas percutâneas. Os autores apresentam o caso de um aneurisma de artéria esplênica em uma mulher de 51 anos de idade, diagnosticado incidentalmente.

Descritores: Aneurisma. Artéria Esplênica. Falso Aneurisma.

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Received in: 11/02/2016
Accepted for publication: 01/05/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005006

Right hepatic artery aneurysm

Aneurisma de artéria hepática direita

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A B S T R A C T

We report a case of an aneurysm of the right hepatic artery and its multidisciplinary management by general surgery, endoscopy and radiology services. Being a case of extremely low incidence, it is important to show its diagnostic and therapeutic approach.

Keywords: *Aneurysm. Viscera. Hepatic Artery. Hemobilia.*

INTRODUCTION

The first reported case of hepatic artery aneurysm (HAA) is attributed to James Wilson, an anatomist in the year 1809, and the first successful repair was credited to the German surgeon Dr. Hans Kehr in the year 1903[1].

This is a potentially fatal disease when presenting rupture. The rupture rate is controversial and varies between 20% and 80%, clearly determined by the inability to detect asymptomatic aneurysms. The aneurysms of the hepatic artery and its branches are unusual vascular lesions, corresponding to approximately 21% to 44% of all visceral aneurysms[1].

CASE REPORT

A female, 89-year-old patient was hospitalized with a longstanding abdominal pain which had worsened in the days prior to hospitalization, associated with severe anemia and one episode of hematemesis studied with upper endoscopy (UE), which showed no bleeding, whether active or recent. The abdominal computed tomography (CT) showed dilatation of bile ducts, aerobilia, as well as gallbladder with thickened walls. The suggested diagnosis was acute complicated cholecystitis. She was admitted and medical treatment started.

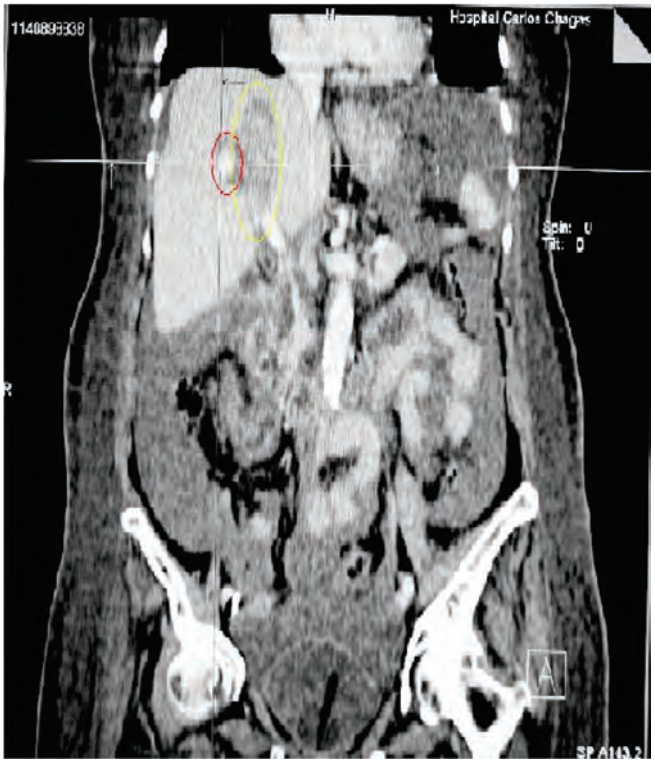

Figure 1. *Abdominal CT scan with contrast showing right hepatic arterial malformation (smaller circle) and intra-parenchymal hematoma (larger circle).*

Three days after admission, the patient persisted with anemia and need for blood transfusion. A new UE showed hemobilia and new abdominal CT without contrast showed: dilatation of intra and extrahepatic bile ducts, especially in the right lobe, with heterogeneous content; intra-pancreatic bile duct of 14 mm in diameter; gallbladder with thickened

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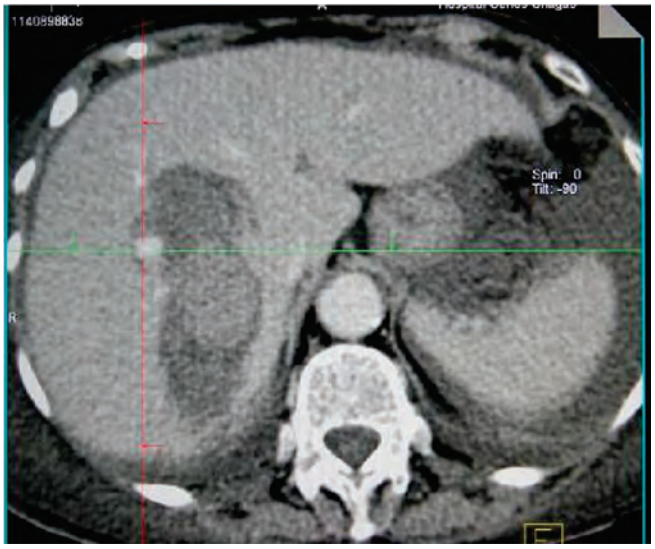

Figure 2. *CT: section showing abundant hemoperitoneum.*

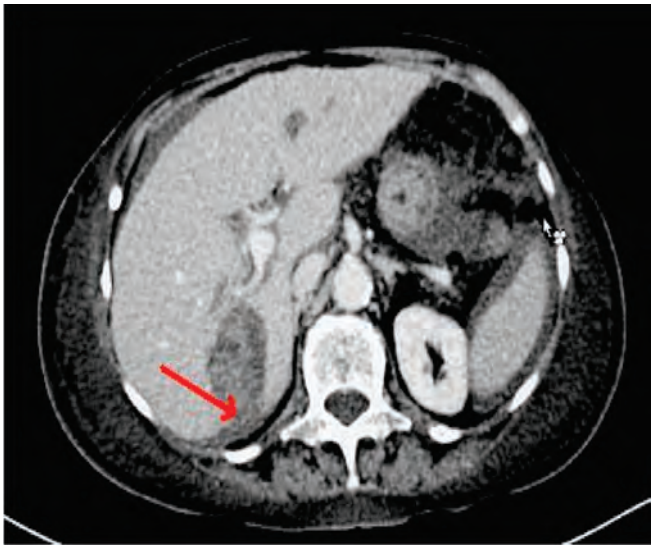

Figure 3. *CT: hematoma rupture and extravasation into the peritoneal cavity (arrow).*

walls and heterogeneous content, with interposed gas focus; free fluid in the peritoneal cavity, of heterogeneous density in the parieto-colic gutters, suggesting hemoperitoneum; and questionable intrahepatic vascular ectasia of the right lobe. The complete CT study, this time with venous contrast, showed hemoperitoneum and a hyperdense formation relative to the hepatic parenchyma in segments VII and VIII measuring approximately 2.32x5.44 cm, suggestive of malformation of the right hepatic artery (Figures 1 and 2). When compared to the previous CT, the hepatic intra-parenchymal hematoma had increased, with rupture of hepatic capsule and extravasation into the peritoneal cavity (Figure 3).

The fall in hematocrit continued, for which she again received transfusion in the same day. Given the impossibility of performing liver angiography and instability of the patient, the emergency service staff decided to perform an exploratory laparotomy. The inventory of the cavity revealed massive hemoperitoneum, hepatomegaly, gallbladder with thickened walls containing multiple calculi, common bile duct with significant dilation and a ruptured hematoma in the hepatic segment VII, with active bleeding.

We evacuated the hemoperitoneum, compressed the hematoma, and dissected the hepatic hilum with identification of the common hepatic artery bifurcation and ligation of the right hepatic artery. We proceeded to cholecystectomy with exploration of the bile duct, from where we removed a large calculus and a large clot.

DISCUSSION

The HAA is clinically important because of its high mortality rate (25% to 70%) when rupture occurs. The most common incidence is between the fifth and sixth decades of life and the most common location is extrahepatic. Hepatic aneurysms compromise the common hepatic artery 70% to 80% of cases. Multiple etiologies have been described including atherosclerosis, abdominal trauma, surgical procedures, degenerative diseases, infections, collagen vascular disease, and congenital anomalies.

Multiple complementary tests are available for diagnosis, such as abdominal ultrasound, CT, angio-CT, MRI, endoscopy and angiography. The latter is not only a diagnostic tool, but also a therapeutic modality of choice in splanchnic aneurysms through embolization. It can also provide evidence of collateral circulation, determine the size and shape of the aneurysm, uncover arterioportal fistulas and provide accurate anatomical information necessary for embolization or surgery.

In general, the location of the aneurysm elects its therapeutic approach: Intrahepatic HAA – preferably treated by selective embolization or partial liver resection; Extrahepatic HAA – can be treated by per-

cutaneous obliteration in patients with high operative risk, but the ideal treatment is resection and arterial reconstruction. When the HAA is located in the common hepatic artery, one may use embolization or aneurysm ligation without arterial reconstruction, but when located in the proper hepatic artery, it requires vascular reconstruction to avoid hepatic ischemia secondary to interruption of the collateral circulation reflowing through the gastroduodenal and right gastric arteries[1-5].

R E S U M O

Relatamos um caso de aneurisma da artéria hepática direita conduzido de forma multidisciplinar pelos Serviços de Cirurgia Geral, Endoscopia e Radiologia. Em se tratando de caso de incidência baixíssima, é importante mostrar o enfoque diagnóstico e terapêutico usado em seu manejo.

Descritores: Aneurisma. Vísceras. Artéria Hepática. Hemobilia.

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Received in: 11/02/2016
Accepted for publication: 01/05/2016
Conflict of interest: none.
Source of funding: none.

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DOI: 10.1590/0100-69912016005007

Rupture of celiac trunk aneurysm in patient with Behçet Disease

Ruptura de aneurisma de tronco celíaco em paciente com Doença de Behçet

Márcio Luís Lucas[1], Tiago Frankini[1], Ângelo Frankini[1], Newton Aerts[2], Tatiana Freitas Tourinho[2].

ABSTRACT

We report a case of a ruptured aneurysm of the celiac trunk in a 32-year-old, male patient with Behçet Disease (BD). Aneurysm resection was performed and the patient is well during a follow up of 32 months. To our knowledge, this is the first reported case of a ruptured celiac trunk aneurysm successfully treated in a patient with BD.

Keywords: *Behcet Syndrome. Aneurysm. Aneurysm, Ruptured. Celiac Plexus. General Surgery.*

INTRODUCTION

Behcet's Disease (BD) is a systemic inflammatory disease of unknown etiology that may affect the venous and arterial systems[1,2]. Celiac trunk aneurysms (CTA) comprise about 4% to 6% of all visceral aneurysms. BD is an extremely rare cause of CTA, and the rupture of these aneurysmsis even less reported[3].

CASE REPORT

A male patient with 32 years of age in clinical treatment for BD for three years with immunosuppressive therapy was brought to the hospital emergency room with abdominal pain and signs of hypovolemic shock, nausea and vomiting. Physical examination showed poor general condition, emaciation and a pulsatile, expansive and tender mass in the epigastrium, besides pallor, sweating, tachycardia, hypotension and 38° C temperature. The leukocyte count was 13,600cells/mm^3 and hemoglobin concentration of 9.1mg/dl. The C-reactive protein level was 193mg/dl and coagulation, renal and liver function tests were normal. After hemodynamic stabilization, he underwent a computed tomography scan of the abdomen, which revealed a voluminous saccular aneurysm of the celiac trunk (4.5cm in diameter), with the presence of hemoperitoneum (Figure 1). Soon after the examination, the patient presented hemodynamic instability, having been urgently submitted to resection of the aneurysm through clamping of the supraceliac aorta and continuous suture at the level of the celiac trunk. There were approximately 1500 mL of blood into the abdominal cavity, and transfusion of 4000 ml of blood and 4500 ml crystalloid solution was required. Histology of an aneurysm wall segment revealed fibrous adipose tissue with areas of hemorrhage, necrosis and inflammation. Neither blood culture nor bacteriological examination of the arterial wall showed bacterial growth. Postoperatively, the patient had respiratory infection, requiring prolonged mechanical ventilation and antibiotics. The scan control after 30 days showed no problems in the aortic suture line (Figure 2). The patient was discharged in 40 days with significant improvement in overall condition. He is currently being followed up 32 months after discharge.

DISCUSSION

There are few reports of BD patients treated for CTA[1,2,4,5]. Moreover, the description of rupture cases is extremely rare[3] and, regardless of the cause, is a very serious situation, with high mortality[3]. It is believed that the first reported case of CTA in patients with BD was in 2001[1] and that the first surgically treated case was published in 2008[3]. Our case seems

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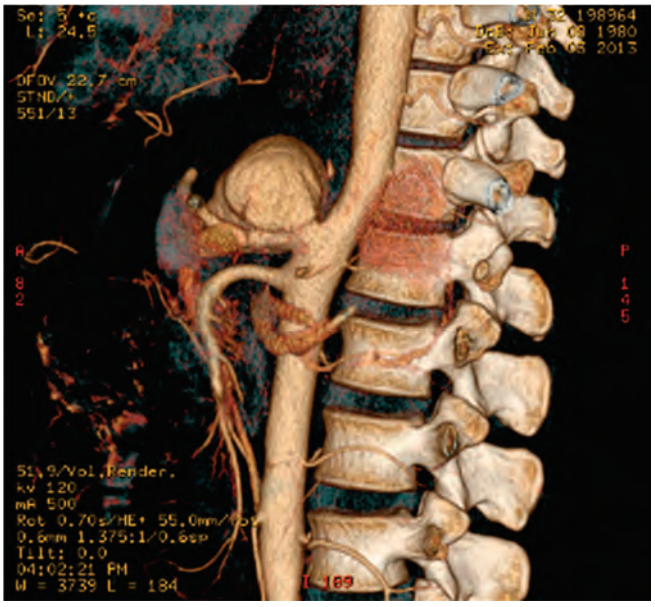

Figure 1. *Reconstruction of CT angiography demonstrating a massive aneurysm of the celiac trunk.*

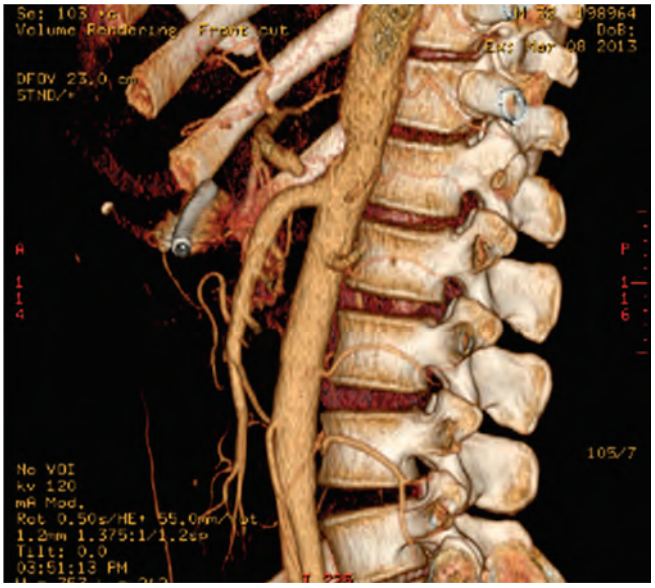

Figure 2. *Reconstruction of postoperative angiography, with complete resection of the aneurysm and distal ligation of the celiac trunk.*

to be the first one of an CTA with free rupture to the abdominal cavity and successfully treated by surgery.

The choice of treatment for the CTA depends on variety of factors such as age, clinical condition and hemodynamic parameters, as well as size, location and multiplicity of aneurysms. For small and asymptomatic aneurysms, clinical follow-up and immunosuppressant treatment may be a good choice[1]. Open surgery with ligation of the aneurysm or vascular reconstruction after resection is a good option for patients with bulky ruptured aneurysms, hemodynamically unstable or anatomy unfavorable for a less invasive treatment[2,5]. Endovascular treatment, with implantation of endoprosthesis, coated stents or coil embolization, can also be used in some cases, especially in elective situations with favorable anatomy[4]. In our case, due to hemodynamic instability, we opted for the emergency open surgery with isolated aneurysm ligation without arterial reconstruction.

In short, the diagnosis of vascular complications, especially aneurysms, should be done as soon as possible in patients with BD. On the other hand, in young patients with aneurysmal disease, BD must be remembered and, in such cases, early treatment is indicated, especially in large and symptomatic aneurysms, since the rupture is the main cause of death in such patients.

R E S U M O

Relatamos o caso de um aneurisma roto do tronco celíaco em um paciente de 32 anos, do sexo masculino, portador de Doença de Behçet (DB). A ressecção do aneurisma foi realizada e o paciente está bem, com acompanhamento de 32 meses. Até onde sabemos, este é o primeiro caso relatado de um aneurisma do tronco celíaco roto tratado com sucesso em um paciente com DB.

Descritores: Síndrome de Behcet. Aneurisma. Aneurisma Roto. Plexo Celíaco. Cirurgia Geral.

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Received in: 11/02/2016
Accepted for publication: 01/05/2016
Conflict of interest: none.
Source of funding: none.

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INSTRUCTIONS FOR AUTHORS

SCOPE AND POLITICS

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Tables and figures should be numbered with Arabic numerals, with captions on the top containing one or two sentences, and explanations of symbols at the bottom. Cite the tables in the text in numerical order including only information necessary for understanding of important points of the text. The data presented should not be repeated in graphs. Tables should follow the above-mentioned Vancouver standards.

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