

Feasibility study of three-nerve-recognizing Lichtenstein procedure for inguinal hernia

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Background: Inguinal nerve identification during open inguinal hernia repair is associated with less chronic postoperative pain. However, most Dutch surgeons do not identify all three inguinal nerves when carrying out this procedure. The aim of this study was to evaluate the feasibility of a nerve-recognizing Lichtenstein hernia repair and to measure the extra time required for surgery

Methods: Forty patients with primary inguinal hernia were operated on following the nerve-recognizing Lichtenstein hernia repair by four experienced hernia surgeons from four different Dutch teaching hospitals. The additional time needed to identify each individual nerve was recorded, and iatrogenic nerve injuries and anatomical characteristics were registered.

Results: Identification of the iliohypogastric and ilioinguinal nerves was each performed within 1 min. Identification of the genital branch of the genitofemoral nerve was notably more difficult but could usually be performed within 2 min. Identification of the cremasteric vein, running parallel to the genital branch, was less comprehensive. The incidence of major anatomical variations was low. Twenty-five per cent of ilioinguinal nerves, however, could not be identified. In five patients inguinal nerves were damaged iatrogenically during standard manoeuvres of the Lichtenstein hernia repair.

Conclusion: Three-nerve-recognizing Lichtenstein hernia repair is feasible and non-time consuming if the surgeon has appropriate anatomical knowledge. In view of the low incidence of major anatomical variations, knowledge of standard inguinal nervous anatomy should be adequate. This procedure could enable the surgeon to prevent or recognize iatrogenic nerve damage and offer an opportunity to perform deliberate neurectomy as an alternative to accidental nerve injury.

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Introduction

In inguinal hernia surgery the use of open mesh repair is associated with a reduction in recurrence rate of between 50 and 75 per cent compared with open repair without mesh¹. In this respect the inguinal hernia guideline of the Association of Surgeons of the Netherlands recommends the Lichtenstein procedure for primary unilateral inguinal hernia repair (grade of recommendation B)².

As the recurrence rate is reduced to less than 5 per cent after mesh repair, nowadays long-term morbidity associated with open inguinal hernia repair is mainly related to chronic pain^{3,4}. It is difficult to estimate the true incidence of chronic pain as the type of pain assessment

differs among studies. A review by Poobalan *et al.*³ of studies of inguinal hernia repair between 1987 and 2000 showed the incidence of chronic pain to be up to 53 (range 0–53) per cent. However, probably only 2–4 per cent of patients are adversely affected by chronic pain in daily life⁵. The most common types of chronic postoperative pain are of somatic or neuropathic origin^{5–7}. Two prospective cohort studies reported the incidence of chronic pain to be significantly less after identification of all three inguinal nerves compared with no identification at all^{8,9}. This suggests that all three inguinal nerves should be identified during open inguinal hernia repair, as recommended by Amid^{10,11}.

Although the genital branch of the genitofemoral nerve is not specifically referred to, the Dutch guideline for inguinal hernia repair mentions damage to one or all three inguinal nerves as an important cause of chronic postoperative pain. However, a questionnaire among Dutch surgeons and residents reported that only 84, 32 and 36 per cent of respondents plan to identify the ilioinguinal nerve (IIN), iliohypogastric nerve (IHN) and genital branch of the genitofemoral nerve (GB) respectively, when carrying out Lichtenstein hernia repair¹². Thus, the majority of respondents do not plan to identify the inguinal nerves, as advocated by Amid, resulting in a discrepancy between the state-of-the-art three-nerve-identifying Lichtenstein procedure and its application in Dutch surgical practice. Furthermore, unpublished data from this questionnaire indicate that the majority of respondents assume a low feasibility of identification of all three inguinal nerves, assuming identification of all nerves to be too time consuming.

The objective of this study was to evaluate the feasibility of a nerve-recognizing Lichtenstein hernia repair and to measure the extra time required for surgery.

Methods

Forty consecutive adult men with a primary inguinal hernia were included in this study. Four experienced hernia surgeons (from two high-volume teaching hospitals, one university hospital and one specialized hernia clinic) participated in the study. Each of them conducted ten nerve-recognizing Lichtenstein hernia repairs. Four series (four surgeons) of ten consecutive patients with a total of 40 Lichtenstein repairs were included in this study.

With over 60 accumulated years of inguinal hernia surgery all four surgeons were classified as experienced.

They had all conducted more than 250 Lichtenstein hernia repairs in accordance with other studies regarding the proficiency of surgeons¹³. All types of anaesthesia were used (local, epidural and general anaesthesia). All patients gave informed consent.

The aim was to identify the IHN, IIN and GB after incising the aponeurosis of the external oblique muscle. Each identified nerve was photographed by the operating theatre nurse as proof (*Fig. 1*). The photographs were used as a control by the surgeon and the assisting resident, and were also used for drawing the anatomical course of the nerve in a schematic diagram after surgery. The photographs and drawings were also reviewed by an anatomist. The time measurements was conducted as follows: after incising the aponeurosis of the external oblique muscle the surgeon gave the theatre nurse a sign to start measuring the time needed to identify each nerve, and the extra time needed to identify each individual nerve was recorded. Each nerve was also scored after surgery as 'for sure', 'probably', 'maybe', or 'probably not' representing the appropriate nerve. In case of 'probably', 'maybe' or 'probably not' the operator made a note of the discussion. Although the participating surgeons were experienced hernia surgeons, the study committee concluded that a preceding meeting discussing variations on the 'classical course' of the three inguinal nerves, led by an anatomist, would be preferable¹⁴. Additionally, several dissections were performed on embalmed human cadavers.

The focus of the study was on the 'standard anatomy' of all three inguinal nerves (*Fig. 2*). The IHN normally runs approximately horizontally and ventrally to the internal oblique muscle at a mean of 2.4 (range 1.5–4.4) cm cranially to the internal ring, after which it perforates the aponeurosis of the external oblique muscle at a mean of 3.8 (range 2.5–5.5) cm cranially to the external ring. In 11 per cent of patients the nerve runs within the fibres

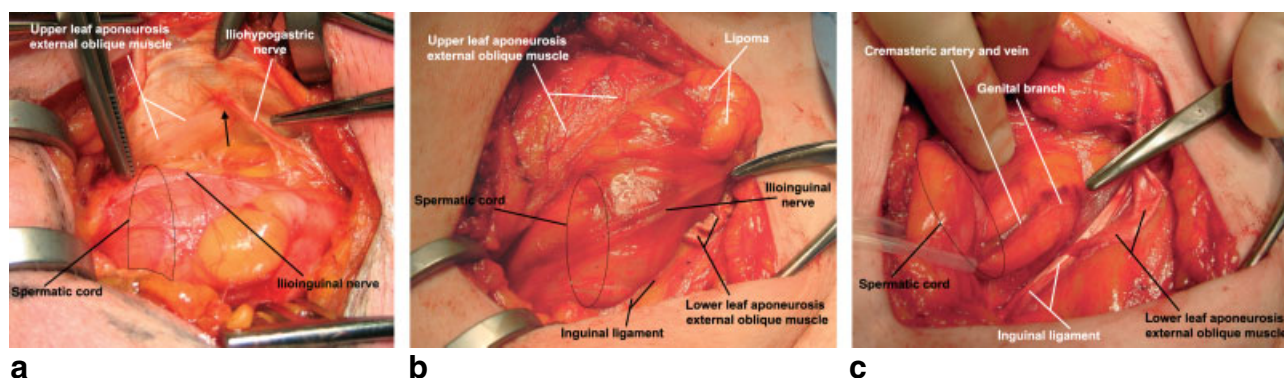


Fig. 1 Photographs of the inguinal nerves taken during the course of hernia surgery showing **a** the iliohypogastric nerve, **b** the ilioinguinal nerve and **c** the genital branch of the genitofemoral nerve

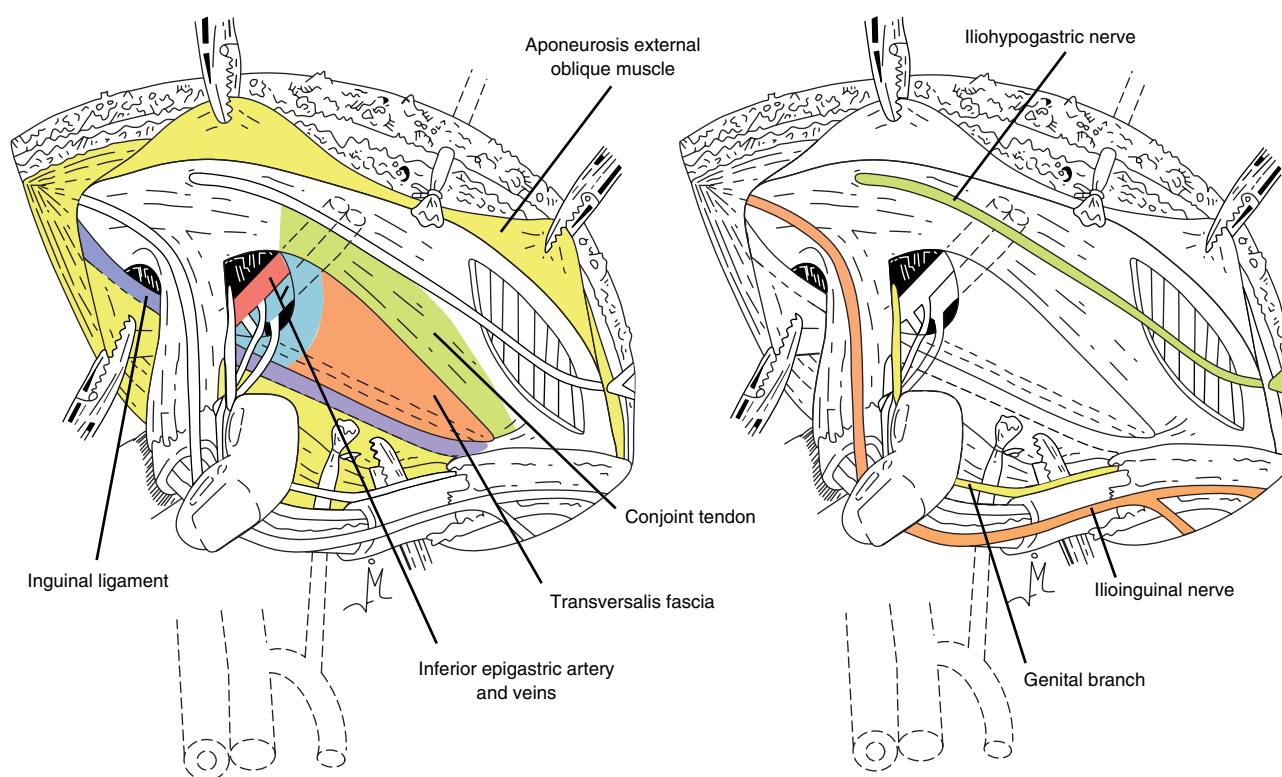


Fig. 2 Schematic diagram of the 'standard anatomy' of the three inguinal nerves

of the internal oblique muscle at the level of the internal ring and therefore is invisible. The IIN, when present, is commonly identifiable running ventrally and parallel to the spermatic cord, dorsally to the aponeurosis of the external oblique muscle. The GB in general runs in a zone laterocaudally to the internal ring at which level the variability of its course is least prominent; more distally it runs parallel to the cremasteric artery and vein, also known as the 'blue line'¹⁰.

Results

The course of the IHN was recognized in 38 of the 40 patients within a mean of less than 1 (range 0–5) min (Table 1). After operation all 38 IHNs were described as piercing the internal oblique muscle laterally to the inguinal incision and following its track as described in anatomy textbooks. All were reported to be 'for sure' the IHN.

The IIN was visualized in 30 patients (Table 1), the mean time needed to recognize it being less than 1 (range 0–4) min. After operation in 24 patients its course was drawn and recognized as described in anatomy textbooks. In six patients the nerve branched over the spermatic cord, dividing into one or more branches. The surgeons

Table 1 Characteristics of the three inguinal nerves noted during hernia surgery in 40 patients

Nerve	Nerve detected	Extra time needed to identify nerve (min)	Iatrogenic injury to nerve	Nerve interfering with mesh
Iliohypogastric nerve	38	< 1 (0–5)	1	3
Ilioinguinal nerve	30	< 1 (0–4)	2	0
Genital branch	35	1.5 (1–6)	2	0

Values in parentheses are ranges.

were never in doubt that the identified structure indeed represented the IIN. In the ten patients in whom the IIN could not be identified the search was stopped after 6 min.

The GB was identified in 35 patients (Table 1). In ten the identified structure could not be classified as 'for sure' the GB (probably, $n = 3$; maybe, $n = 5$; probably not, $n = 2$). The different reasons for doubt were based on the course of the nerve (laterocaudal entrance through internal ring but not following blue line, $n = 3$) or the macroscopic features of the structure (structure might be vessel or muscle fibre, $n = 4$). In three patients no reason for doubt

was given. In the five patients in whom the GB could not be identified, the blue line was also not identified. The mean identification time was 1.5 (range 1–6) min.

One IHN was damaged during surgery after being retracted behind the wound retractor (*Table 1*). In three patients the IHN was prophylactically neurectomized as proximally and distally as possible, as recommended by the Dutch guidelines, because the course of the nerve was found to be interfering with the upper edge of the mesh. In two patients the IIN was damaged iatrogenically during incision of the external oblique aponeurosis. Prophylactic neurectomy was then performed as proximally and distally as possible. Two GBs were damaged during luxation of the spermatic cord.

Discussion

Long-term morbidity associated with open inguinal hernia repair mainly consists of chronic pain. Amid¹⁰ advocates recognition of all three inguinal nerves to prevent injury causing chronic postoperative pain. However, only a minority of surgeons in the Netherlands follow a policy of nerve-recognizing inguinal hernia surgery. The fact that Dutch surgeons traditionally have not specifically been trained in nervous inguinal anatomy may well be responsible for this. As several studies point out, a nerve-recognizing Lichtenstein procedure is a logical step for minimizing postoperative groin pain^{8,9}. Such an approach can be advocated for two reasons: identification of the nerves for preservation or for performing standard neurectomy in case of interference with the position of the mesh. Either way, all inguinal nerves should always be identified. However, most Dutch surgeons believe that identification of all three inguinal nerves is too difficult and time consuming¹².

This study shows that nerve damage during the Lichtenstein hernia repair is not uncommon. Although all 40 hernia repairs were of a nerve-recognizing character, there were five iatrogenic nerve lesions. It might be argued that these lesions were inflicted as a result of trying to identify the nerves, but in fact they were not caused during the identifying stages of the operations, but during standard manoeuvres during the Lichtenstein hernia repair (spreading of wound with retractor, opening of aponeurosis of external oblique muscle, or luxation of the spermatic cord). It could even be suggested that these lesions were identified because the mind of the participating surgeon was focused on the nerves, and subsequently neurectomy could be performed. In this respect it is thought that neurectomy is a better alternative than nerve injury, because neurectomy causes only numbness instead

of pain^{15,16}. This is also why neurectomy of the IHN was performed deliberately when the nerve was interfering with the mesh, because mesh involvement of the IHN is considered a common reason for postoperative pain.

In a non-nerve-identifying approach more trauma could be inflicted to the nerves, for example by nerve entrapping sutures of the IHN cranially to the internal ring, at which level the nerve runs within the fibres of the internal oblique muscle in 11 per cent of the male population. Furthermore, the GB could be injured when bluntly luxating the spermatic cord when not having identified the 'blue line' as a landmark for the cremasteric vein, to which the GB is almost always adjacent^{10,14}.

Twenty patients showed a standard anatomical pattern with regard to all three inguinal nerves. The anatomical variations in the other half were based on subtle details (such as branched IIN or GB not adherent to 'blue line'), and mostly involved absence of the IIN (ten of 40 patients). This is in accordance with human cadaver studies, which also show that one-quarter of people do not have an IIN¹⁴. This suggests that a thorough knowledge of standard inguinal anatomical features is necessary to carry out this procedure.

The extra time needed to recognize the course of the nerves appeared to be minimal, with only seconds for the IHN and IIN. The GB was unanimously considered to be the hardest nerve to identify, but the mean identification time was only 1.5 min. The specific problem with identification of the GB was doubt regarding the exact character of the structure found, resulting from its small diameter. Nevertheless, the 'blue line' (cremasteric vein) as a landmark for the GB could easily be identified in the vast majority of patients (35 of 40). This study shows that identifying all three inguinal nerves will only add 3–4 min to the operating time.

The additional time spent during the surgical procedure should not be a reason to avoid a nerve-recognizing Lichtenstein hernia repair. It is technically feasible provided that surgeons are experienced in inguinal hernia repair and anatomically trained. It might not be possible to avoid all iatrogenic nerve lesions caused by standard manoeuvres during Lichtenstein hernia repair by means of nerve-recognizing inguinal hernia surgery; however, the technique offers an opportunity to detect perioperative nerve lesions, facilitating nerve resection as a better alternative to nerve injury.

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