

Surgical techniques preventing chronic pain after Lichtenstein hernia repair: state-of-the-art vs daily practice in the Netherlands

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Abstract

Background Morbidity associated with open inguinal hernia repair (IH repair) mainly consists of chronic pain. The aim of this study was to identify possible disparities between state-of-the-art Lichtenstein repair, and its application in general practice.

Methods A questionnaire was mailed to all surgeons and surgical residents ($n = 1,374$) in the Netherlands in February 2005. The objective was to determine the state of general practice with respect to technical steps

during the Lichtenstein repair that are suggested to be involved in the development of chronic pain, as recently updated by Lichtenstein's successor, Amid.

Results More than half of the respondents do not act according to the Lichtenstein guidelines with respect to surgical steps that are suggested to be involved with the origin of chronic pain of somatic origin. Compliance with Amid's guidelines with respect to the handling of the nerves is variable. Surgeons conducting high numbers of IH repair are more likely to operate according to the key principles of the state-of-the-art Lichtenstein repair.

Conclusion There is a substantial disparity between the state-of-the-art Lichtenstein repair and its application in general practice with respect to steps that are suggested to play a role in the origin of chronic groin pain.

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Introduction

In recent years it has become clear that morbidity associated with open inguinal hernia repair mainly consists of chronic inguinal and scrotal pain of neuropathic and somatic origin [1–3]. There is a discrepancy between the complication rate associated with the Lichtenstein repair, the most frequently performed hernia repair in the Netherlands, reported by the Lichtenstein Hernia Institute and that reported by others [3–8].

Amid described the principles of the operation in 1993 and recently formulated the key principles that may play a role in the origin of chronic pain [5, 9]:

- Fixation of a slightly relaxed mesh, which will be under tension in the upright body position and will be subject to shrinkage
- No fixation of the mesh to periosteum of the pubic bone, which could result in pubic osteitis
- Inversion of (in)direct hernia sacs without ligation or resection
- Identification and protection of the three inguinal nerves
- Avoidance of entrapment of the iliohypogastric nerve during mesh fixation cranially
- Avoidance of unnecessary stripping and excision of cremasteric fibers, which can result in injury of the nerves, small blood vessels, and vas deferens

The aim of this study was to identify possible disparities between the state-of-the-art Lichtenstein repair and its application in Dutch general practice with respect to the surgical key principles described by Amid.

Materials and methods

An anonymous questionnaire (available from the authors on request) was mailed to all members of the Association of Surgeons of the Netherlands, 916 surgeons and 458 surgical residents covering 90–95% of all surgery in the country. The recipients were asked to return the completed questionnaire by means of the enclosed reply postcard. Two reminders were sent. In December 2005 the database was closed.

The primary objective was to determine general practice with respect to technical aspects of the Lichtenstein repair that are suggested to be involved in the development of chronic pain, as recently updated by Lichtenstein's successor Amid [5]: the nerve aspect of inguinal hernia repair, treatment of the hernia sac and cremasteric fibers, and fixation and shape of the mesh. Secondly, outcomes were compared between surgeons and residents. Additionally, outcomes were compared between respondents conducting high numbers of IH repairs and respondents conducting fewer IH repairs. Graded outcomes were compared by means of the Mann–Whitney test. Outcomes in percentages were compared by means of Fisher's exact test. All statistical analyses were performed using Statistical Package for Social Sciences for Windows (SPSS, Chicago, IL, USA).

Results

We received a total of 648 questionnaires: 466 completed by surgeons (response rate 51%) and 182

completed by surgical residents (response rate 40%). After excluding respondents who do not operate on IH, we further narrowed the sample to include only physicians who operated according to the Lichtenstein technique in 75% or more of cases: 524 questionnaires (81% of all the respondents completed by 357 and 167 surgeons and residents, respectively). All subsequent results are based on this group.

The majority of respondents (57%) performed more than 30 hernia repairs on a yearly basis. The remaining 43% performed 1–29 hernia repairs. Forty-two and 11% of surgeons and residents together estimated the incidence of chronic pain to be 0–9 and 10–24%, respectively. The rest of the respondents (47%) indicated that they did not know the exact incidence.

Somatic and visceral aspects

Three steps during the Lichtenstein repair are suggested to play a role in the origin of chronic pain that is somatic or visceral in character (Table 1). Fifty-two percent claimed to employ a laxity during fixation of the mesh. Thirty percent ligated and excised the hernia sac rarely or never. Finally, 45% of the respondents did not fixate the mesh by means of one or more sutures through the periosteum of the pubic bone.

Neurological aspects

Certain surgical steps are suggested to play a role in the origin of chronic pain of neuropathic character (Table 1). The percentage of respondents that intended to identify the ilioinguinal nerve was 84%. The percentage that intended to identify the iliohypogastric nerve and genital branch of the genitofemoral nerve was 32 and 36%, respectively, with no significant difference between surgeons and residents (Table 1). Eighty-seven percent of surgeons and residents indicated that they did not divide any nerve as recommended by Amid.

Sixty percent indicated that they paid attention to the course of the iliohypogastric nerve while suturing the upper leaf of the mesh to the rectus sheath and internal oblique aponeurosis. Additionally, 61% excised cremasteric fibers rarely or never. Seventy-three percent agreed on the importance of further research of nerve handling in IH surgery in view of the frequent chronic pain.

We compared outcomes between surgeons who conducted high numbers of IH repairs (≥ 30 corrections yearly) and surgeons conducting fewer (1–29) hernia repairs. Surgeons who conducted high numbers of IH repairs were more likely to employ a laxity

Table 1 General practice with respect to technical steps during the Lichtenstein repair that are suggested to be involved in the development of chronic pain. Respondents performed at least 75% of IH repairs according to the Lichtenstein technique

Group and characteristics	Surgeons, <i>n</i> (%)	Residents, <i>n</i> (%)	Total, <i>n</i> (%)	<i>P</i> value
Fixation of a mesh with a ripple (dome-shaped)				
Yes	185 (52)	90 (54)	275 (52)	0.707 ^a
No	172 (48)	77 (46)	249 (48)	
Missing data	0	0	0	
Mesh fixation to periosteum of pubic bone				
Yes	188 (53)	100 (60)	288 (55)	0.132 ^a
No	169 (47)	67 (40)	236 (45)	
Missing data	0	0	0	
Ligation and resection of hernia sac				
Always	103 (30)	39 (4)	142 (28)	0.612 ^b
Usually	138 (40)	80 (25)	218 (43)	
Rarely	80 (23)	41 (48)	121 (24)	
Never	23 (7)	6 (24)	29 (6)	
Missing data	13	1	14	
Intention to identify the ilioinguinal nerve				
Yes	293 (83)	144 (86)	437 (84)	0.35 ^a
No	62 (17)	23 (14)	85 (16)	
Missing data	2	0	2	
Intention to identify the iliohypogastric nerve				
Yes	110 (31)	58 (35)	168 (32)	0.45 ^a
No	245 (69)	109 (65)	354 (68)	
Missing data	2	0	2	
Intention to identify the genital branch				
Yes	130 (37)	58 (35)	188 (36)	0.75 ^a
No	225 (63)	109 (65)	334 (64)	
Missing data	2	0	2	
Nerve resection in principle				
No	297 (86)	146 (88)	443 (87)	0.244 ^a
Ilioinguinal	19 (6)	17 (10)	36 (7)	
Iliohypogastric	5 (1)	0	5 (1)	
Genital	10 (3)	0	10 (2)	
Two or more nerves	13 (4)	2 (1)	15 (3)	
Missing data	13	2	15	
Attention to iliohypogastric nerve during mesh fixation				
Yes	226 (63)	90 (54)	316 (60)	0.044 ^a
No	131 (37)	77 (46)	208 (40)	
Missing data	0	0	0	
Excision of cremasteric muscle fibers				
Always	32 (9)	11 (7)	43 (8)	0.105 ^b
Usually	119 (33)	41 (25)	160 (31)	
Rarely	146 (41)	90 (54)	236 (45)	
Never	60 (17)	25 (15)	85 (16)	
Missing data	0	0	0	
Total	357	167	524	

^a Outcomes in percentages were compared between surgeons and residents by means of Fisher's exact test

^b Graded outcomes were compared between surgeons and residents by means of the Mann–Whitney test

during fixation of the mesh (59 vs. 44%, respectively; $P = 0.001$), more likely to intend to identify the genital branch (44 vs. 25%, respectively; $P < 0.000$) and more likely to pay attention to the course of the iliohypogastric nerve during mesh fixation (70 vs. 48%, respectively; $P < 0.0001$). No significant difference was found for those intending to identify the ilioinguinal or iliohypogastric nerve, intending to divide any nerve, and fixing the mesh to the periosteum of the pubic bone.

Discussion

Although chronic pain after IH repair is a frequent and serious complication, little is known about diagnosis and treatment. The results of this questionnaire show that performance of general surgeons and residents needs improvement. Some issues need discussion:

Probably the response rate is underestimated since only 7% of the responding surgeons claimed not to

operate IH at all and the questionnaire was sent to all surgeons including pediatric, thoracic, vascular and trauma surgeons. Furthermore respondents could have completed the anonymous questionnaire on behalf on the entire surgical staff.

Since a substantial percentage of the surgeons and residents (42%) estimated the incidence of chronic pain to be 0–9%, this problem seems to be highly underestimated in the Netherlands [3]. However, 47% indicated that they did not know the exact incidence of chronic pain. It is likely that estimation and not a formal investigation gives an underestimation of the true complication rate.

No randomized controlled trials have been conducted investigating the influence of a slightly relaxed mesh, mesh fixation through the perosteum of the pubic bone and hernia sac resection on postoperative chronic pain.

According to Poobalan et al. [2] and Kehlet et al. [10], chronic pain is predominantly neuropathic in character. Recently, Alfieri et al. [11] reported that failure to identify the inguinal nerves is significantly correlated with chronic pain, with the incidence of chronic pain increasing with the number of undetected nerves. Additionally, nerve division (intentionally or after accidental nerve injury) would be correlated with a higher incidence of chronic pain. However, Lik-Man Mui et al. [12] reported significantly less chronic pain after division of the ilioinguinal nerve compared to preservation. So the best evidence available is “expert opinion,” level 4.

More than half of the respondents did not act according to the Lichtenstein guidelines with respect to surgical steps that are suggested to be involved with the origin of chronic pain of somatic origin. Additionally, compliance with Amid’s guidelines for neurological aspects was variable. A previous Dutch national survey in 1995 already showed many modifications to the Bassini repair and Shouldice technique [13].

It is remarkable that respondents indicated that they intended to identify the genital branch more often than the iliohypogastric nerve since identification of the genital branch is more comprehensive than identification of the iliohypogastric nerve. This suggests an inadequate knowledge of neurological inguinal anatomy. A previous United Kingdom survey by Ravindran et al. [14], investigating intra-operative handling of structures in the inguinal canal, suggested confusion over anatomy as well. Therefore, identification of the three inguinal nerves should be included in the operative notes. Our data suggest the same trend as Ravindran et al. with respect to intention to identify nerves.

In their study the ilioinguinal, iliohypogastric nerve and genital branch were not routinely visualized in 7, 42 and 56% corresponding to the trend in our findings of 16, 68 and 64%, respectively. Surgeons who conducted high numbers of IH repair were more likely to operate according to the key principles of the state-of-the-art Lichtenstein repair.

Obviously, there is a discrepancy between the state-of-the-art Lichtenstein repair and its application in surgical practice in the Netherlands. A wide variety of personal interpretations are employed and are being taught. However, it is not clear to what extent widely different interpretations of a standardized technique negatively influence outcome. At the same time, because of lack of uniformity of interpretation and training, any results of the Lichtenstein technique in the Netherlands can never be scientifically evaluated. Furthermore, the theoretical merits of the surgical steps with regard to the Lichtenstein technique as reported by Amid should be investigated in a standardized randomized setting. This national survey will provide us with information for preparation of new studies regarding chronic pain and discomfort after IH repair.

References

1. Cunningham J, Temple WJ, Mitchell P, Nixon JA, Preshaw RM, Hagen NA (1996) Cooperative hernia study. Pain in the postrepair patient. *Ann Surg* 224:598–602
2. Poobalan AS, Bruce J, King PM, Chambers WA, Krukowski ZH, Smith WC (2001) Chronic pain and quality of life following open inguinal hernia repair. *Br J Surg* 88:1122–1126
3. Poobalan AS, Bruce J, Smith WC, King PM, Krukowski ZH, Chambers WA (2003) A review of chronic pain after inguinal herniorrhaphy. *Clin J Pain* 19:48–54
4. Lichtenstein IL, Shulman AG, Amid PK, Montllor MM (1988) Cause and prevention of postherniorrhaphy neuralgia: a proposed protocol for treatment. *Am J Surg* 155:786–790
5. Amid PK (2004) Lichtenstein tension-free hernioplasty: its inception, evolution, and principles. *Hernia* 8:1–7
6. Neumayer L, Giobbie-Hurder A, Jonasson O, Fitzgibbons R Jr, Dunlop D, Gibbs J, Reda D, Henderson W (2004) Open mesh versus laparoscopic mesh repair of inguinal hernia. *N Engl J Med* 350:1819–1827
7. Bay-Nielsen M, Nilsson E, Nordin P, Kehlet H (2004) Chronic pain after open mesh and sutured repair of indirect inguinal hernia in young males. *Br J Surg* 91:1372
8. Koninger J, Redecke J, Butters M (2004) Chronic pain after hernia repair: a randomized trial comparing Shouldice, Lichtenstein and TAPP. *Langenbecks Arch Surg* 389(5):361–365
9. Amid PK, Shulman AG, Lichtenstein IL (1993) Critical scrutiny of the open “tension-free” hernioplasty. *Am J Surg* 165:369–371
10. Kehlet H, Jensen TS, Woolf CJ (2006) Persistent postsurgical pain: risk factors and prevention. *Lancet* 367:1618–1625
11. Alfieri S, Rotondi F, Di Giorgio A, Fumagalli U, Salzano A, Di Miceli D, Ridolfini MP, Sgarari A, Doglietto G (2006) Influence of preservation versus division of ilioinguinal,

- iliohypogastric, and genital nerves during open mesh herniorrhaphy: prospective multicentric study of chronic pain. *Ann Surg* 243:553–558
12. Lik-Man Mui W, Ng CS, Ming-Kit Fung T, Ka Yin Cheung F, Wong CM, Ma TH, Bn MY, Kwok-Wai Ng E (2006) Prophylactic ilioinguinal neurectomy in open inguinal hernia repair: a double-blind randomized controlled trial. *Ann Surg* 244:27–33
 13. Simons MP, Hoitsma HF, Mullan FJ (1995) Primary inguinal hernia repair in the Netherlands. *Eur J Surg* 161:345–348
 14. Ravindran R, Bruce J, Debnath D, Poobalan A, King PM (2006) A United Kingdom survey of surgical technique and handling practice of inguinal canal structures during hernia surgery. *Surgery* 139:523–526