

Surgical management of chronic pain after inguinal hernia repair

E. Aasvang and H. Kehlet

Section of Surgical Pathophysiology 4074, The Juliane Marie Centre, Rigshospitalet, Blegdamsvej 9, DK-2100 Copenhagen, Denmark
Correspondence to: Dr E. Aasvang (e-mail: eske.aasvang@rh.dk)

Background: Chronic pain after inguinal hernia repair is an adverse outcome that affects about 12 per cent of patients. Principles of treatment have not been defined. This review examines neurectomy and mesh or staple removal as possible treatments.

Method: A literature search was carried out using the Medline and Ovid databases. Keywords were 'pain; chronic', 'herniorrhaphy; inguinal', 'neurectomy' and similar words. Article references were cross-checked for additional references. Articles were reviewed for data on surgical treatment of chronic pain after hernia repair.

Results: Neurectomy of the ilioinguinal, iliohypogastric, genitofemoral or lateral femoral cutaneous nerve was described in 14 papers. Overall, a favourable outcome was reported. However, the methodological quality was poor in all studies in respect of preoperative diagnostic criteria and treatment, intraoperative success in identifying a pathological lesion or nerve and quality of follow-up; this hindered interpretation of the data. Insufficient information is available at present on the effect of removal of mesh or staples.

Conclusion: Chronic pain after hernia repair is a significant problem and there is a need for a definitive assessment of its surgical treatment

Paper accepted 26 April 2005

Published online in Wiley InterScience (www.bjs.co.uk). DOI: 10.1002/bjs.5103

Introduction

Chronic pain is a frequent and sometimes debilitating consequence of various types of surgery, including repair of inguinal hernia¹⁻³. The precise incidence of chronic pain after hernia repair is unknown, but well conducted, large, unselected epidemiological studies suggest that about 20 per cent of patients are affected and that in about 12 per cent the intensity of pain is sufficient to impair some aspects of daily activity⁴⁻⁷. Patients are classified as having chronic pain if postoperative pain lasts for more than 3 months⁸. The underlying pathogenesis is poorly understood and, although a nerve lesion may be a prerequisite, it is not the only factor as many patients have postoperative sensory abnormalities but no pain^{2,9}. An inflammatory response due to mesh repair may also cause chronic pain, but no method exists to distinguish between the various causes of chronic discomfort. Concomitant with the increased awareness of the problem an increasing number of studies have suggested that surgical management might be an option.

This review assessed the role of surgery in management of chronic pain after inguinal hernia repair.

Methods

Studies of surgical treatment of chronic pain after inguinal hernia repair were identified using the Pubmed and Ovid search engines. Both databases were searched in July 2004. The term 'pain' was combined with the term 'hernia, inguinal' and 'treatment' or 'division' or 'neurectomy'. Other words associated with pain were explored, such as 'neuropathic', 'neuropathy' and 'neuralgia', and 'groin' was used instead of 'hernia' in a cross-search. Articles on meralgia paraesthetica were checked for inclusion of patients with a previous inguinal hernia repair. In addition, papers published during the writing process were included, as were those known by the authors but not found in the databases. References were cross-checked for literature not found in the database search. Reviews were not included, but were checked for additional

studies. Letters to the editor, abstracts and studies on acute pain (less than 3 months) were not included. Only English language articles were reviewed. The following data were abstracted: number of patients, preoperative pain, neurophysiological assessment, type of surgery, additional non-surgical treatment, follow-up period and type of assessment.

Search results

Thirty-five articles regarding surgical treatment for groin pain were identified. Ten^{10–19} were excluded as they did not contain data on *chronic* pain. Six^{20–25} were excluded as data from patients with pain after hernia operation could not be distinguished from those of patients with pain after other types of surgery. Two articles^{26,27} could not be retrieved through the internet or from the Danish National Scientific library. This left 17 articles for review, eight^{28–35} containing solely patients with pain after hernia repair and nine^{36–44} with patients who had various types of primary surgery (such as inguinal hernia repair, hysterectomy, appendectomy and nephrectomy), but which allowed data on those who had hernia operations to be analysed separately (*Table 1*). The two articles by Starling *et al.*^{37,38} were almost identical; five more patients were included in the 1989 version but it was not stated if that paper was an extension of the 1987 one. In the articles by Amid^{31,32} it was unclear if patients included in the 2002 article were also included in the 2004 paper, as the latter did not describe the period in which patients were operated.

Methodological aspects of studies

Study design

No study was randomized. Nine were descriptive (observational studies of usual clinical practice without a comparison group)^{28,30–33,37,38,40,42}, and the remaining eight were case reports^{29,34–36,39,41,43,44}.

Patient demographics and primary surgical technique

The patient populations were heterogeneous in all the studies with regard to previous surgery, especially in respect of sequelae after laparoscopic *versus* open surgery. Only one³³ of the eight articles that included solely patients with chronic pain after hernia repair gave patient-specific data that allowed interpretation despite a heterogeneous patient population. The other seven studies^{28–32,34,35} did not contain generally accepted criteria for comparison of patients (for example specific data on surgical intervention,

patient data such as age, sex, primary hernia type, duration of symptoms, and type of medical or surgical intervention before neurectomy) (*Table 1*).

Pain measurement

None of the articles described preoperative pain intensity by means of a visual analogue scale, its specific social consequences or a standardized questionnaire. Fanelli *et al.*³³ noted a mean reduction in preoperative pain of 77.5 per cent, when postoperative pain was assessed on a 0–100 linear percentile scale; however, the preoperative pain score was not given.

Neurological examination

Neurological examination was described only in general terms without specific findings in all articles. Amid^{31,32} stated that of a total 225 patients, 125 had 'non-neuropathic pain' or some kind of combination of neuropathic and non-neuropathic pain, and that 100 patients had 'neuropathic pain' alone. Apparently an evaluation of the hernia operation, localized groin tenderness and computed tomography findings led to these diagnoses, but no specific information was available on the results of these tests.

Preoperative nerve block

The use of preoperative nerve block to aid the decision of which nerve to excise varied. Deysine *et al.*⁴² used an ilioinguinal nerve block if the neurological examination suggested involvement of the ilioinguinal nerve, and recommended ilioinguinal neurectomy if the block relieved pain. Nevertheless, five patients had total pain relief after nerve blockade and non-steroidal anti-inflammatory drugs and were discharged, whereas the remaining 22 patients had neurectomy, without information on the response to nerve blockade. Starling *et al.*^{37,38} used a preoperative ilioinguinal nerve block, and if this relieved pain the patient underwent ilioinguinal neurectomy. In situations of continuous pain after an ilioinguinal block, a L1–L2 plexus block was performed and, if successful, led to genitofemoral neurectomy. If pain was partially relieved by both blocks a staged surgical exploration of both nerves was performed. However, data on the effectiveness of the selective blocks were not presented nor was any correlation with the effect of surgery on postoperative pain described. Heise and Starling³⁰ diagnosed 11 of 16 patients by selective, unspecified nerve blocks, but only nine had a neurectomy with five patients described as having a good or excellent outcome. Nahabedian and Dellon⁴⁰ found that an

Table 1 Studies on surgical treatment of chronic pain after repair of inguinal hernia

Reference	No. of patients treated with neurectomy and/or mesh removal	Surgery	Follow-up (range)	Results	Comments
36	2	II neurectomy and unspecified	No data	No patient pain free after neurectomy	Temporary pain relief after neurectomy. Subsequent treatment with ilioinguinal blocks provided minor pain relief
44	2	Resection of GF and/or II	18 months and not described	Both pain free	No objective pain measurement before operation or during follow-up; no description of side-effects. No follow-up described in one patient
37	26	Resection of II or GF	No data	15 of 17 pain free after II resection	No definition of neuralgia. Identification of nerves via selective nerve blocks. In GF resection group it was not possible to differentiate between patients with pain after hernia repair and those with pain after other operations. No data on percentage of nerves identified
38	31	Resection of II or GF	No data	17 of 19 pain free after II 8 of 12 pain free after GF resection	Follow-up on previous study ³⁷ , with five additional patients. In GF resection group, patients with pain after hernia repair could be distinguished. See above for other comments
39	1	Resection of II and IH	No data	No data	No data on follow-up, or preoperative or postoperative pain assessment
35	1	Removal of staple	No data	Pain free	Staple penetrating the femoral nerve causing numbness, weakness and groin/leg pain. After removal only numbness persisted
34	2	Removal of staples/mesh	12 and 6 months respectively	Both pain free	In both patients a staple had penetrated the LFC, resulting in pain, sensory disturbances and dyspareunia. After removal numbness persisted
28	15	Ligation and division of II, IH, GF or LFC	Mean 66 months	12 pain free 3 less but persistent pain	Three patients had no relief from nerve block, but were operated, and had improved but persistent pain; in two of these a nerve could not be identified and one had a hernia. Three patients also had alcohol injected into nerve, and two had nerve decompression
40	2	Resection of II, IH or GF	21 months (9–45 months)	Both rated good	Symptoms for 1–18 years before surgery. In one of the two patients with pain after hernia repair a nerve was not identified histopathologically, but the patient improved anyway
41	2	Laparoscopic neurectomy of II and/or GF	3 months	Both pain free	Described nerve entrapment as inclusion criterion in all, but no data on how this was diagnosed before surgery. No sensory testing. No data on percentage of nerves identified
30	20	Mesh removal with or without II or IH neurectomy	16 months (1 week to 40 months)	10 of 16 with mesh removal and neurectomy and 2 of 4 with mesh removal only; excellent or good outcome	15 patients examined by telephone or direct contact, 5 by chart review. No difference in outcomes in those who had relief from nerve blocks and those who did not
29	1	Removal of staples/mesh	No data	Pain free	One patient with pain for more than 5 months after laparoscopic hernia repair. Total pain relief after removal of tackers and part of mesh laparoscopically aided by fluoroscopy
42	22	Division of II	No data	Pain relief in all	No sensory testing. No description of follow-up or side-effects
31	49	Resection of II, IH and GF	1 month (6 months by telephone)	39 patients pain free 8 patients improved 2 patients unchanged	No data on duration of pain before ablation. No data on percentage of nerves identified. No data on sensory changes before or after surgery, or pain intensity

(continued overleaf)

Table 1 (Continued)

Reference	No. of patients treated with neurectomy and/or mesh removal	Surgery	Follow-up (range)	Results	Comments
33	10	Inguinal exploration and cryoanalgesic ablation of II and/or GF	8 months (no data)	7 patients pain free 2 patients less pain 1 patient unchanged	No definition of neuralgia. Postoperative pain reduction assessed by VAS, but no preoperative VAS scores. No sensory testing. No sensory side-effects. No data on percentage of nerves identified.
43	3	GBGFN resection with or without II resection	9 months	All pain free	One patient had previously unsuccessful GF resection, and another had previously unsuccessful II resection
32	225	Resection of II, IG and GF	1 month (6 months by telephone)	80 percentage pain free 15 percentage transient pain 5 percentage no improvement	56 percentage diagnosed as having non-neuropathic pain and 44 percentage with neuropathic pain, but all treated the same way. No objective preoperative or postoperative pain measurement or sensory testing. No description of pain evaluation or side-effects. No diagnostic nerve block. Some patients had CT (MRI?) but no data on criteria or findings

II, Ilioinguinal nerve; GF, Genitofemoral nerve; IH, Iliohypogastric nerve; LFC, lateral femoral cutaneous nerve; GBGFN, genital branch of the genitofemoral nerve; VAS, visual analogue scale; CT, computed tomography; MRI, magnetic resonance imaging.

unspecified nerve block relieved pain in two patients, with a successful outcome after genitofemoral or ilioinguinal neurectomy. Harms *et al.*⁴⁴ reported a patient with a genitofemoral block following an unsuccessful ilioinguinal block who had a subsequent successful genitofemoral neurectomy. Another patient had an earlier ilioinguinal block that led to an unsuccessful ilioinguinal neurectomy and a subsequent successful genitofemoral neurectomy. Hameroff *et al.*³⁶ reported two patients with an ilioinguinal block, but with unsuccessful ilioinguinal neurectomy. Bower *et al.*²⁸ stated that 13 of 15 patients had relief after an unspecified nerve block and 12 of these had a successful neurectomy of the ilioinguinal, iliohypogastric and/or lateral femoral cutaneous nerve. The patient treated by Wong and Anvari²⁹ had a positive response to ilioinguinal nerve block, and was pain free after removal of staples and part of the previously inserted mesh. The patient treated by Seid *et al.*³⁵ had no effect from injections (type not stated) but had pain relief after removal of staples. None of the studies had a methodological evaluation and/or protocol for medical treatment of pain before or after neurectomy, except for that by Deysine *et al.*⁴², who used failure of non-steroidal anti-inflammatory therapy as an inclusion criterion for neurectomy.

Follow-up

Insufficient information was available on the exact method and results of follow-up. Five studies^{36–39,42} did not

describe duration of follow-up. Amid^{31,32} used follow-up assessment at 3 days, 1 week and 1 month, and a telephone call at 6 months after operation, but his articles did not contain information on how pain was evaluated, or if any patients were lost to follow-up. Deysine *et al.*⁴² did not describe follow-up but noted that ‘to their knowledge none of these patients sought legal resolution to their complaints’.

Results of surgical treatment of chronic pain

Neurectomy

One article considered laparoscopic neurectomy⁴¹, whereas the rest described open procedures (Table 1). In 1989 Starling and Harms³⁸ reported 19 patients with ‘ilioinguinal neuralgia’ who underwent ilioinguinal neurectomy; 16 had total and permanent pain relief, although three underwent subsequent genitofemoral neurectomy, which relieved pain in two. Twelve patients with ‘genitofemoral neuralgia’ underwent genitofemoral neurectomy. Eight operations resulted in considerable or complete pain relief, but the remaining four were unsuccessful.

Bower *et al.*²⁸ operated on 15 patients, carrying out 11 ilioinguinal, two iliohypogastric and three lateral femoral cutaneous neurectomies; some patients had two neurectomies and in two the nerves could not be identified. Ligation and division of the nerve was the most common procedure. Three patients also had neural alcohol injection, and two had mobilization and decompression of the nerve.

The indication for the different procedures and how they correlated with outcome was not explained.

Amid^{31,32} reported that 80 per cent of 49 and 225 patients respectively had complete pain relief after a month, and that 15 per cent had transient incisional pain for a few months, but without functional impairment. However, no details of number of patients or assessment at follow-up were presented.

No paper contained any description of the consequences of surgery on pain with respect to social life, sexual function or physical activity. The only variable that was briefly mentioned was worker's compensation. In the studies by Amid, patients with worker's compensation (numbers not shown) were able to return to work, except in two³¹ and four³² instances. Heise and Starling³⁰ found that four of seven patients receiving worker's compensation had non-defined favourable outcomes.

Mesh or staple removal

Apart from four patients in the article by Heise and Starling³⁰, the search revealed no other description of the effect of mesh removal alone on chronic pain. Three articles described removal of staples after laparoscopic hernia repair. Wong and Anvari²⁹ removed helical tackers (staples) and part of the mesh from a patient who had experienced 5 months of postoperative pain, which resulted in complete pain relief. Sampath *et al.*³⁴ treated two patients by removing staples. In one a staple had pierced the lateral femoral cutaneous nerve and its removal along with part of the mesh led to reduced pain and dyspareunia, but there was persistent numbness at 12 months' follow-up. The other patient had removal of mesh and a staple piercing the lateral femoral cutaneous nerve and was pain free at 6-month follow-up. Seid and Amos³⁵ described one patient in whom removal of a staple penetrating the femoral nerve resulted in pain relief, although numbness of the anterior thigh persisted.

Adverse outcomes

Starling *et al.*^{37,38} reported that some patients (numbers not given) had numbness of the scrotum, femoral triangle and loss of the cremaster reflex. Nahabedian and Dellon⁴⁰ also reported that patients (number not given) had hypoaesthesia of the region supplied by the excised nerve(s). Harms *et al.*⁴⁴ described no side-effects except for a superficial wound infection. Heise and Starling³⁰ found that one patient had a wound haematoma and another mild testicular pain and atrophy. Fanelli *et al.*³³ noted wound infection in one patient as the only

adverse outcome. Eight articles made no comment on the incidence of adverse outcome, sensory side-effects or other disturbances^{28,31,32,36,39,41-43}. The persistent numbness described after removal of staples^{34,35} was also present before remedial surgery and no other side-effects were noted.

Discussion

The number of patients with chronic pain after hernia repair^{2,4-7} suggests that many are left untreated or allocated to treatments other than surgery; this would be compatible with the scarce literature on operative management. Thus, Hindmarsh *et al.*⁴⁵ found that only 1 per cent of patients after inguinal hernia repair were referred for further treatment at a regional pain clinic.

As far as surgery is concerned, neurectomy results seem impressive at a first glance, with 60-100 per cent of patients apparently being cured or improved. However, meaningful interpretation of the data is barely possible for the following reasons: lack of objective assessment of pain before operation, previous treatment, lack of neurophysiological examination to achieve a specific diagnosis, no standardized surgical procedure in a well defined patient population, lack of randomization and control group, and absence of detailed follow-up.

In addition, the literature does not contain any well defined description of diagnostic methods; nerve blocks were used in some studies, but in a random fashion. The correlation between the effectiveness of nerve block and the effect of neurectomy was not assessed systematically, although Heise and Starling³⁰ found no correlation as only five of nine patients who had a positive response to a nerve block were improved after neurectomy. Isotonic saline as a placebo nerve block was not used in any study. Only one paper described the need for analgesics before operation, drugs that would seem necessary for a pain intense enough for neurectomy to be indicated. This paper contained a protocol that mentioned the lack of effect of non-steroidal anti-inflammatory agents as an indication for neurectomy⁴², but these drugs are not generally regarded as an effective treatment for neuropathic pain⁴⁶.

All articles were either descriptive studies or case reports. Three studies were prospective^{31,32,42}, but only one of them presented an algorithm for treatment (which its authors failed to follow)⁴². All studies had a heterogeneous patient population with respect to previous surgery and in several series there was a mix of open and laparoscopically treated patients^{30-33,42}. As noted above, preoperative and postoperative pain and neurophysiological assessment were

never described, variables that are crucial if we hope to improve understanding of the effectiveness of neurectomy in controlling pain. Non-defined sensory changes were used in many of the articles to imply that a nerve was damaged and should be excised, but there were no systematic or detailed sensory data in any of the papers. Furthermore, there is no evidence that well defined sensory changes correlate with damage to a specific nerve, owing to the pronounced anatomical variability of innervation in the inguinal area⁴⁷.

In some patients pain may have been of inflammatory or nerve entrapment origin from the mesh, suggesting the need for mesh removal or nerve decompression. However, there were no data on how to diagnose these conditions and few on the success of mesh removal; only four patients with mesh removal alone were reported³⁰.

Future strategies to improve knowledge on the pathogenetic mechanisms and thereby the treatment and prevention of chronic pain after hernia operations have been described previously⁴⁸. They include: preoperative pain, neurophysiological and psychological assessment, with exclusion of a recurrent hernia or other diseases in the region; intraoperative description of the surgical approach, findings and handling of nerves and muscles; early postoperative pain intensity, character, treatment modality and neurophysiological assessment; and late postoperative pain intensity, character and psychosocial consequences, and neurophysiological assessment. Until further investigations have proven the efficacy of a well defined treatment to relieve chronic pain after surgery, the authors propose that if neurectomy or other surgical intervention is considered, the preoperative and postoperative investigations outlined in *Table 2* should be performed as a minimum. In addition, multidisciplinary and multicentre collaboration is desirable as each centre will treat only a few patients.

Table 2 Assessment before surgical intervention for chronic pain after repair of inguinal hernia

Description of previous surgery
Exclusion of recurrent hernia
Pain scores at rest and during activity, and social consequences
Neurophysiological examination of pain area (e.g. hypoaesthesia, allodynia)
Psychological assessment
Current evidence-based medication for neuropathic pain ineffective
Diagnostic nerve block
Exclusion/description of other chronic pain syndromes (e.g. low back pain, hip disease, migraine)
Ultrasonography/magnetic resonance imaging

Acknowledgements

Supported by the Lundbeck Foundation and the Danish Research Council (22-01-0160).

References

- Perkins FM, Kehlet H. Chronic pain as an outcome of surgery. A review of predictive factors. *Anesthesiology* 2000; **93**: 1123–1133.
- Aasvang E, Kehlet H. Chronic postoperative pain – the case of inguinal herniorrhaphy. *Br J Anaesth* 2005; at press.
- Macrae WA. Chronic pain after surgery. *Br J Anaesth* 2001; **87**: 88–98.
- Bay-Nielsen M, Perkins FM, Kehlet H. Pain and functional impairment 1 year after inguinal herniorrhaphy: a nationwide questionnaire study. *Ann Surg* 2001; **233**: 1–7.
- Poobalan AS, Bruce J, Smith WC, King PM, Krukowski ZH, Chambers WA. Chronic pain and quality of life following open inguinal hernia repair. *Br J Surg* 2001; **88**: 1122–1126.
- Hair A, Duffy K, Mclean J, Taylor S, Smith H, Walker A *et al*. Groin hernia repair in Scotland. *Br J Surg* 2000; **87**: 1722–1726.
- Bay-Nielsen M, Nilsson E, Nordin P, Kehlet H. Chronic pain after open mesh and sutured repair of indirect hernia in young males. *Br J Surg* 2004; **91**: 1372–1376.
- International Association for the Study of Pain. Classification of chronic pain. Descriptions of chronic pain syndromes and definitions of pain terms. Prepared by the International Association for the Study of Pain, Subcommittee on Taxonomy. *Pain* 1986; **Suppl 3**: S1–226.
- Mikkelsen T, Werner MU, Lassen B, Kehlet H. Pain and sensory dysfunction 6 to 12 months after inguinal herniotomy. *Anesth Analg* 2004; **99**: 146–151.
- Choi PD, Nath R, Mackinnon SE. Iatrogenic injury to the ilioinguinal and iliohypogastric nerves in the groin: a case report, diagnosis, and management. *Ann Plast Surg* 1996; **37**: 60–65.
- Benes J, Nadvornik P, Dolezel J. Abdominal pain syndrome treated by centrocentral anastomosis. *Acta Neurochir* 2000; **142**: 887–891.
- Lyon EK. Genitofemoral causalgia. *Can Med Assoc J* 1945; **53**: 213–216.
- Koppel HP, Thompson WA, Postel AH. Entrapment neuropathy of the ilioinguinal nerve. *N Engl J Med* 1962; **266**: 16–19.
- O'Brien MD. Genitofemoral neuropathy. *BMJ* 1979; **i**: 1052.
- Hahn L. Clinical findings and results of operative treatment in ilioinguinal nerve entrapment syndrome. *Br J Obstet Gynaecol* 1989; **96**: 1080–1083.
- Stark E, Oestreich K, Wendl K, Rumstadt B, Hagemüller E. Nerve irritation after laparoscopic hernia repair. *Surg Endosc* 1999; **13**: 878–881.
- Grosz CR. Iliohypogastric nerve injury. *Am J Surg* 1981; **142**: 628.

- 18 Liszka TG, Dellon AL, Manson PN. Iliohypogastric nerve entrapment following abdominoplasty. *Plast Reconstr Surg* 1994; **93**: 181–184.
- 19 Schliack H, Schramm J, Neidhardt J. Selective rhizotomies for spinal root pain and neuralgia of the inguinal region. *J Neurol* 1986; **233**: 115–117.
- 20 Lee CH, Dellon AL. Surgical management of groin pain of neural origin. *J Am Coll Surg* 2000; **191**: 137–142.
- 21 Kennedy EM, Harms BA, Starling JR. Absence of maladaptive neuronal plasticity after genitofemoral–ilioinguinal neurectomy. *Surgery* 1994; **116**: 665–670.
- 22 Rabow L. Nerve crush – a possible treatment of peripheral neuralgia 2. *Pain* 1987; **31**: 93–98.
- 23 Stulz P, Pfeiffer KM. Peripheral nerve injuries resulting from common surgical procedures in the lower portion of the abdomen. *Arch Surg* 1982; **117**: 324–327.
- 24 Purves JK, Miller JD. Inguinal neuralgia: a review of 50 patients. *Can J Surg* 1986; **29**: 43–45.
- 25 Racz G, Hagstrom D. Iliohypogastric and ilioinguinal nerve entrapment: diagnosis and treatment. *Pain Digest* 1992; **2**: 43–48.
- 26 Gatt MT, Chevrel JP. The treatment of neuralgias following inguinal herniorrhaphy: a report of 47 cases. *Postgrad Gen Surg* 1992; **4**: 142–147.
- 27 Pappalardo G, Guadalaxara A, Illomei G, d’Orta C, Frattaroli FM. Prevention of postherniorrhaphy persistent pain: results of a prospective study. *Int Surg* 1999; **84**: 350–353.
- 28 Bower S, Moore BB, Weiss SM. Neuralgia after inguinal hernia repair. *Am Surg* 1996; **62**: 664–667.
- 29 Wong J, Anvari M. Treatment of inguinalgia after laparoscopic herniorrhaphy: a combined laparoscopic and fluoroscopic approach to the removal of helical tackers. *Surg Laparosc Endosc* 2001; **11**: 148–151.
- 30 Heise CP, Starling JR. Mesh inguinodynia: a new clinical syndrome after inguinal herniorrhaphy? *J Am Coll Surg* 1998; **187**: 514–518.
- 31 Amid PK. A 1-stage surgical treatment for postherniorrhaphy neuropathic pain: triple neurectomy and proximal end implantation without mobilization of the cord. *Arch Surg* 2002; **137**: 100–104.
- 32 Amid PK. Causes, prevention, and surgical management of postherniorrhaphy neuropathic inguinalgia: Triple neurectomy with proximal end implantation. *Hernia* 2004; **8**: 343–349.
- 33 Fanelli RD, DiSiena MR, Lui FY, Gersin KS. Cryoanalgesic ablation for the treatment of chronic postherniorrhaphy neuropathic pain. *Surg Endosc* 2003; **17**: 196–200.
- 34 Sampath P, Yeo CJ, Campbell JN. Nerve injury associated with laparoscopic inguinal herniorrhaphy. *Surgery* 1995; **118**: 829–833.
- 35 Seid AS, Amos E. Entrapment neuropathy in laparoscopic herniorrhaphy. *Surg Endosc* 1994; **8**: 1050–1053.
- 36 Hameroff SR, Carlson GL, Brown BR. Iliohypogastric pain syndrome. *Pain* 1981; **10**: 253–257.
- 37 Starling JR, Harms BA, Schroeder ME, Eichman PL. Diagnosis and treatment of genitofemoral and ilioinguinal entrapment neuralgia. *Surgery* 1987; **102**: 581–586.
- 38 Starling JR, Harms BA. Diagnosis and treatment of genitofemoral and ilioinguinal neuralgia. *World J Surg* 1989; **13**: 586–591.
- 39 Melville K, Schultz EA, Drury N. Iliohypogastric–iliohypogastric nerve entrapment. *Ann Surg* 1990; **19**: 925–929.
- 40 Nahabedian MY, Dellon AL. Outcome of the operative management of nerve injuries in the ilioinguinal region. *J Am Coll Surg* 1996; **184**: 265–268.
- 41 Krähenbuhl L, Striffeler H, Baer HU, Buchler MW. Retroperitoneal endoscopic neurectomy for nerve entrapment after hernia repair. *Br J Surg* 1997; **84**: 216–219.
- 42 Deysine M, Deysine GR, Reed WP. Groin pain in the absence of hernia: a new syndrome. *Hernia* 2002; **6**: 64–67.
- 43 Ducic I, Dellon AL. Testicular pain after inguinal hernia repair: an approach to resection of the genital branch of genitofemoral nerve. *J Am Coll Surg* 2004; **198**: 181–184.
- 44 Harms BA, DeHaas DR Jr, Starling JR. Diagnosis and management of genitofemoral neuralgia. *Arch Surg* 1984; **119**: 339–341.
- 45 Hindmarsh AC, Cheong E, Lewis MP, Rhodes M. Attendance at a pain clinic with severe chronic pain after open and laparoscopic inguinal hernia repairs. *Br J Surg* 2003; **90**: 1152–1154.
- 46 Dworkin RH, Backonja M, Rowbotham MC, Allen RR, Argoff CR, Bennet GJ *et al*. Advances in neuropathic pain: diagnosis, mechanisms, and treatment recommendations. *Arch Neurol* 2003; **60**: 1524–1534.
- 47 Akita K, Niga S, Yamoto Y, Muneta T, Sato T. Anatomic basis of chronic groin pain with social reference to sports hernia. *Surg Radiol Anat* 1999; **21**: 1–5.
- 48 Kehlet H, Bay-Nielsen M, Kingsnorth A. Chronic postherniorrhaphy pain – a call for uniform assessment. *Hernia* 2002; **6**: 178–181.