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A Review of Chronic Pain After Inguinal Herniorrhaphy

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Abstract:
Background: Chronic pain was believed to be a recognized but infrequent complication after inguinal hernia repair. Evidence suggests that patients with chronic pain place a considerable burden on health services. However, few scientific data on chronic pain after this common elective operation are available.
Objectives: To review the frequency of chronic pain and to discuss etiological theories and current treatment options for patients with chronic post herniorrhaphy pain.
Materials and Methods: All studies of postoperative pain after inguinal hernia repair with a minimum follow-up period of 3 months, published between 1987 and 2000, were critically reviewed.
Results and Discussion: The frequency of chronic pain after inguinal hernia repair was found to be as high as 54%, much more than previously reported. Quality of life of these patients is affected. Chronic pain is reported less often after laparoscopic and mesh repairs. Recurrent hernia repair, preoperative pain, day case surgery, delayed onset of symptoms, and high pain scores in the first week after surgery, however, were identified to be risk factors for the development of chronic pain. Definition of chronic pain was not explicit in the majority of the reviewed studies. Accurate evaluation of the frequency of chronic pain will require standardization of definition and methods of assessment. Prospective studies are required to define the role of risk factors identified in this review.
Key Words: Chronic pain—Hernia repair—Inguinal herniorrhaphy.

Inguinal hernia repair is a common surgical procedure performed worldwide, with an annual procedural rate of 2,800 per million people in the United States alone.[1] In England and Wales, 70,322 primary inguinal herniorrhaphies were performed in National Health Service hospitals between 1998–1999.[2] Inguinal herniorrhaphy is often performed as a day case procedure with minimal postoperative morbidity. After inguinal hernia repair, patients can return to work early and enjoy a good quality of life.

Since modern surgical thinking concerning inguinal hernia repair was established by Bassini in 1884, various modifications have been developed to improve outcome. Many studies have compared different surgical techniques and type of anesthesia; however, there remains a lack of consensus among surgeons concerning the optimal operative procedure. Despite the fact that recent meta-analyses have suggested that laparoscopic surgery is associated with less postoperative pain and more rapid return to normal activity,[3,4] open mesh repair is recommended by the National Institute for Clinical Excellence.[2] Although most studies of inguinal herniorrhaphy include postoperative pain as an outcome measure,

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assessment of pain tends to be limited to the acute postoperative period rather than over the long term.

Chronic pain or persistent neuralgia has been recognized as a complication after inguinal hernia repair but was reported in the 1980s as a rare and infrequent condition.[5] Studies from the mid 1990s have reported a higher frequency, with up to 50% of patients reporting pain after herniorrhaphy more than 1 year after surgery.[6–8] Chronic pain after hernia repair can be disabling, with considerable impact on quality of life,[9] and there is evidence to suggest increased use of health services by patients who have chronic pain.[10] The identifiable health service cost is likely to be a considerable underestimate because it fails to include the societal cost of time off work and possible reduced overall performance of patients with chronic pain.

This article presents a comprehensive review of published findings on chronic pain after inguinal hernia surgery. Within this review, we summarize the frequency of chronic pain reported in recent studies of hernia surgery and discuss etiological theories and current treatment options for patients with chronic postherniorrhaphy pain.

MATERIALS AND METHODS

A search for English-language literature published between 1987 and 2000 was undertaken on *MEDLINE, EMBASE, The Cochrane Library, CINAHL* and *HealthSTAR* bibliographic databases. The search was conducted using the following medical subject headings and key words: *inguinal hernia* or *hernia repair* or *herniorrhaphy* or *hernioplasty* [and] *postoperative pain* or *chronic pain* or *neuralgia* or *neuropathic pain*. To increase the sensitivity of the search process, study design terms were excluded from the strategy. Strict inclusion and exclusion criteria were developed for those studies where reported data on chronic pain was extracted. The case definition of chronic pain was "*pain lasting for 3 months or more,*" as per the International Association of the Study of Pain (IASP).[11] Any study (e.g., randomized controlled trials, cohort, longitudinal, follow-up studies) that assessed patients for more than 3 months after surgery were eligible for inclusion in the review. Studies with follow-up for less than 3 months after surgery and studies of children younger than 16 years were excluded. Data extracted from individual studies included: study details, surgical approach, sample size, duration of postoperative follow-up, outcome measures, details of pain assessment, and reported prevalence of chronic pain. Reference checking of included studies was undertaken to identify other relevant papers.

RESULTS

A total of 527 abstracts were identified from electronic bibliographic searching, and 101 studies were obtained for full critical appraisal. Forty studies were subsequently eligible for inclusion postoperatively. The remaining studies were excluded because follow-up was less than 3 months or the reporting of postoperative pain was unclear. The majority of reviewed studies were randomized controlled trials (RCTs) comparing laparoscopic and open surgical techniques, or comparing types of open and laparoscopic repairs (n = 21; Tables 1 and 2). The remaining studies were comparative studies of either open or laparoscopic surgery (n = 19; Table 3).

Definition of chronic pain

The definition of chronic pain was not explicit in the majority of reviewed studies, with only eight studies including a definition of chronic pain within their methods section. Two studies used pain severity grades that incorporated activities of daily living. In the Cooperative Hernia Study, Cunningham et al.[6] clearly defined mild, moderate, and severe pain. Mild pain was defined as an occasional pain or discomfort that did not limit activity, with a return to prehernia lifestyle; moderate pain, as pain preventing return to normal preoperative activities (i.e., inability to continue with prehernia activities such as golf, tennis, or other sports, and inability to lift objects without pain, that patients had been lifting before the hernia occurrence); and severe pain, as pain that incapacitated the patient at frequent intervals or interfered with activities of daily living (i.e., a pain constantly present, or intermittently present but so severe as to impair normal activities, such as walking). Gillion et al.[7] used the same three grades with similar descriptions (moderate: pain interfering with some of usual preoperative activities; severe: pain that seriously incapacitated the patient, for example, for work).

Other studies defined chronic pain as "that persisting for year postoperatively."[12–14] One Dutch study defined pain as pain in the groin or scrotum lasting more than 1 month after surgery.[15] Our study used the IASP definition of pain beyond 3 months.[16] A range of pain descriptors was used (e.g., tenderness, inguinal pain, groin pain, numbness, neuralgia; Tables 1–3).

Frequency and intensity of chronic pain

Overall, the frequency of chronic pain reported in the 40 studies ranged from 0% to 53%. Six of the 40 studies reviewed were specific to the measurement of chronic postoperative pain, where pain was the primary outcome of interest after inguinal herniorrhaphy.[6–8,16–18] The overall frequency of chronic pain was higher in these

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TABLE 1. *Frequency and reporting of chronic pain: randomized controlled trials of open versus laparoscopic herniorrhaphy*

First author	Year	Surgery	Sample size	Details of assessment	Follow-up (mo)	Follow-up rate (%)	Description of chronic pain	Chronic pain: Open N (%)	Chronic pain: Laparoscopic N (%)
Khoury	1999	Mesh vs. TEP	292	PE	17 (median)	89	Prolonged inguinal pain	5 (4)	3 (2)
Juul	1999	Nonmesh vs. TAPP	268	PE and patient questionnaire	12	91	Pain for >1 month	12 (9)*	10 (7)
Johansson	1999	Nonmesh vs. TAPP	613	PE	12	96	Long-term pain or tenderness	2 (0.3)	5 (0.8)
MRC group	1999	Various laparoscopic and open repairs	928	PE and patient questionnaire	12	91	Groin pain at 1 year	133 (37)	113 (29)
Dirksen	1998	Nonmesh vs. TAPP	175	PE or telephone interview	24 (mean)	41	Wound pain	12 (12)	17 (15)
							Hyperthesia	8 (8)	1 (1)
Dirksen	1998	Mesh vs. TAPP	79	PE	21 (mean)	—	Chronic neuralgia	0	0
Tanphiphat	1998	Nonmesh vs. TAPP	120	PE and interview	32 (mean)	96	Neuralgia	1 (2)	1 (2)
Wellwood	1998	Mesh vs. TAPP	400	Assessment by research nurse or surgical SHO	3	—	Persistent groin or thigh pain	40 (20)	27 (14)
Zieren	1998	Mesh vs. TAPP	240	PE	25 (mean)	—	Persistent pain	6 (4)	3 (4)
Liem	1997	Nonmesh vs. TEP	994	PE	24	97	Chronic pain at 6 months	70 (14)	10 (2)
Leibl	1997	Nonmesh vs. TAPP	102	VAS	70 (median)	89	Postoperative pain	0	0
Filipi	1996	Mesh vs. TAPP	53	PE	11 (mean)	—	Persistent pain in groin	2 (7)	2 (8)
							Persistent pain in leg	1 (3)	0 (0)
Tschudi	1996	Nonmesh vs. TAPP	87	PE	7 (mean)	22	Neuralgia	1 (2)	1 (2)
							Painful cord or testicle	3 (7)	1 (2)
Barkun	1995	Various open and laparoscopic repairs	92	Interviews, MPQ	14	—	Neuralgia	0	1 (1)
Maddern	1994	Nonmesh vs. TAPP	86	—	8 (median)	—	Postoperative pain	0	0
Payne	1994	Mesh vs. TAPP	100	—	10 (median)	98	Persistent groin pain	4 (8)	0
Stoker	1994	Nonmesh vs. TAPP	150	PE	7 (mean)	—	Persistent wound pain	6 (8)	3 (4)

*Pain at 1 year.
TEP, totally extraperitoneal; PE, physical examination; TAPP, transabdominal preperitoneal; SHO, senior house officer; VAS, visual analog scale; MPQ, McGill Pain Questionnaire.

studies, ranging from 15% to 53% (excluding two studies with smaller sample sizes[17,18]). Cunningham et al.[6] reported a prevalence of mild, moderate, or severe pain of 63% at 1 year postoperatively, which reduced to 54% after 2 years. Those patients who reported moderate to severe pain at 1 year (12%) continued to report persistent pain at 2 years (11%). Callesen et al.[8] reported a prevalence of 19%, 6% of whom had moderate or severe pain. Our follow-up study identified a cumulative prevalence of 30% at 3 years postoperatively, one third of whom continued to report moderate to unbearable pain at the time of survey.[16] A similar study by Gillion and Fagniez[7] reported a 23% prevalence of pain at 3 years postoperatively, and 5% of patients reported the discomfort more troublesome than the pre-existing hernia. Overall, moderate to severe pain was experienced by up to 10% of patients after herniorrhaphy and pain was found to restrict daily activities in up to a quarter of patients.[8,16]

Surgical technique

Of the 17 RCTs comparing laparoscopic and open repair, 8 reported less chronic pain in the laparoscopic group, 4 reported more chronic pain in the laparoscopic group, and 5 studies reported no difference between patient groups. The MRC Laparoscopic Hernia Trial Group[12] reported that all serious and rare complications occurred in patients undergoing the transabdominal preperitoneal (TAPP) laparoscopic approach. In a cohort

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TABLE 2. *Frequency and reporting of chronic pain: randomized controlled trials of open or laparoscopic herniorrhaphy*

First author	Year	Surgery	Sample size	Details of assessment	Follow-up (mo)	Follow-up rate (%)	Description of chronic pain	Surgical group	Chronic pain N (%)
McGillicuddy	1998	Shouldice vs. Lichtenstein	672	PE	60	65	Chronic pain at 1 year	Shouldice Lichtenstein	1 (0.2) 4 (1.1)
Mills	1997	Mesh–staples vs. sutures	50	Questionnaire survey	3	92	Persistent groin pain	Suture Staples	1 (2) 0
Cunningham	1996	Bassini; McVay; Shouldice	818	PE	24	36	Pain and numbness at 1 year Pain and numbness at 2 years	Unspecified	63% 53%
Fitzgibbons	1995	TAPP, IPOM, TEP	686	PE and postal survey	23 (mean)	—	Persistent groin pain Persistent leg pain Persistent testicular pain	Unspecified	14 (1.6) 11 (1.3) 5 (0.6)

PE, physical examination; TAPP, transabdominal preperitoneal; IPOM, intraperitoneal only mesh; TEP, totally extraperitoneal.

study, Fielding[19] reported higher frequencies of chronic pain with the TAPP repair compared with the totally extraperitoneal approach.

Four trials compared types of open or laparoscopic repair.[6,13,20,21] Although Cunningham et al[6] reported the highest prevalence of chronic pain and numbness (54%) after different open repairs, no details were given for pain frequency by type of repair. Fitzgibbons

TABLE 3. *Frequency and reporting of chronic pain nonrandomized studies*

First author	Year	Surgery	Sample size	Details of assessment	Follow-up (mo)	Follow-up (%)	Description of chronic pain	Chronic pain N (%)
Gianetta	2000	Mesh and plug	141	—	60	68	Chronic pain	0
Callesen	1999	Mesh	466	Questionnaire survery	12	93	Chronic pain	80 (19)
Rose	1999	Mesh	200	Questionnaire survey	12	90	Occasional ache or pain Numbness	13 (7) 4 (2)
Kark	1995	Mesh	1,103	—	6	98	Neuritic-type pain	10 (1)
Rutkow	1994	Mesh plug	2,403	—	72	—	Long-term pain	0
Rutkow	1993	Mesh and nonmesh	3,897	PE or telephone interview	64	82	Long-term pain	5 (0.2)
Gillion	1999	Mixed open vs. laparoscopic	545	Questionnaire survey	36	90	Chronic pain	110 (23)
Amid	1996	Mesh and nonmesh	2,953	PE	78	89	Neuralgia	59 (2)
Kiruparan	1998	TAPP	200	Questionnaire or telephone interview	30 (median)	100	Neuralgia	4 (2)
Marappan	1996	TAPP	94	Questionnaire survey	8 (median)	80	Groin hyperesthesia	1 (1)
Sandbichler	1996	TAPP	192	PE	18 (mean)	—	Transient numbness Permenant pain	3 (1.6) 1 (0.5)
Topal	1996	Stoppa repair	403	PE	12	—	Neuralgia	3 (0.7)
Davies	1995	TAPP	265	PE or telephone interview	36	98	Complication rate	0
Fielding	1995	TAPP and TEP	375	PE	20.5	—	Neuralgia	6 (1.6)
Cornell	1994	TAPP	60	Office visit or telephone interview	9 (mean)	—	Anterior thigh numbness or pain	9 (15)
Panton	1994	TAPP	79	—	1–12	—	Chronic pain	1 (1)
Kieturakis	1994	Laparoscopic balloon dissection	113	Mail or telephone interview	6.3		Persistent neuropathy	1 (0.8)
Geis	1993	TAPP	364	Office visit or telephone interview	6–30	—	Chronic pain	3 (0.8)
Horton	1993	Marlex hernia repair	91	Senior surgeon	18	—	Inguinal or genitofemoral neuralgia	5 (5)
Poobalan	2001	Mesh and nonmesh	351	Questionnaire survey	36 (median)	65	Pain for >3 months after surgery	67 (30)

PE, physical examination; TAPP, transabdominal preperitoneal; TEP, totally extraperitoneal.

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et al.[21] reported more chronic neuralgia with intraperitoneal only-mesh repair.

Three studies compared mesh with nonmesh repair; two of these reported less chronic pain with mesh repair.[22,23] Gillion and Fagniez[7] followed up patients by questionnaire and found that sensory changes was less after laparoscopic repair, prosthetic repair, and using a posterior rather than inguinal approach.

Risk of developing chronic pain

Three studies reported that patients undergoing reoperative surgery for recurrent hernia on the same side as their first surgery were at risk of developing chronic neuralgia.[8,16,24] The Danish study[8] and our study on a Scottish population[16] found a fourfold higher rate of moderate or severe chronic pain in patients with recurrent hernia. Patients with preoperative pain[16] and those with absence of a visible bulge before surgery[6] were at a risk of developing chronic pain after surgery. Other reported risk factors for the development of chronic pain included: the delayed onset of symptoms after surgery, presence of numbness in the surgical area postoperatively,[24] high pain scores 1 week postoperatively,[8] and patients who required 4 or more weeks before returning to work.[6,8] Higher frequencies of chronic pain have been reported after day case surgery when compared with patients undergoing surgery as inpatients.[16] Few studies looked at patients' premorbid or psychological state preoperatively, and none had examined whether or not patients with chronic pain after inguinal hernia had chronic pain after other surgeries.

DISCUSSION

Chronic pain after inguinal hernia repair is more common than previously reported. This review found that prevalence ranged from 0% to 63% at 1 year after surgery. Such variation is partly due to differences in the definition, measurement, and timing of assessment of chronic pain. Pain assessment was conducted using various methodologies, for example, questionnaire surveys, telephone interviews, and physical examination by medical or research personnel. Level of assessment also varied from simple questioning (e.g., do you have pain?), to grading of pain severity, visual analog scales, and use of standard quantitative pain measurement tools (e.g., McGill Pain Questionnaire). Timing of assessment also ranged from 3 to 78 months postoperatively.

Postoperative pain was often only one of many outcomes measured after inguinal herniorrhaphy. Although studies followed up patients for longer than 3 months and reported overall morbidity, few clearly specified the timing of measurement of pain in relation to period of follow-up. For example, Winchester et al.[25] reported early pain outcome and assessed recurrence and other outcomes at 1 year. Owing to the measurement and reporting of multiple outcomes, it was unclear whether pain was assessed at the end of the study period. The issue of quality of reporting of postoperative complications, particularly chronic pain, has been highlighted by others.[26] The EU Hernia Trialists Collaboration highlighted the difficulty in conducting meta-analyses using peri- and post-operative complications because of poor description of primary outcome data.[27,28] Clearly, estimation of the true prevalence is difficult given such variation in reporting and differences in the definition and measurement of chronic pain after herniorrhaphy.

Etiology and characteristics of chronic pain

From our review of the literature, three chronic pain syndromes after herniorrhaphy have been described: somatic, neuropathic, and visceral pain. Cunningham et al.[6] reported the most common type of chronic posthernia pain syndrome is somatic, which is localized to common ligamentous insertion to the pubic tubercle. Somatic pain may be due to damage to the pubic tubercle during the stapling of mesh prosthesis or from deep muscle layers.[14,29] Incorporation of the periosteum of the pubic tubercle into the most medial suture is widely advocated during open hernia repair.

Neuropathic pain is probably attributable to damage to the ilioinguinal or genitofemoral nerve.[8,24,29–32] Neuropathic pain usually develops in the sensory distribution of an injured nerve. Chronic residual neuralgia occurs as a result of surgical handling of sensory nerves.[9] The nerve trauma can be due to partial or complete division, stretching, contusion, crushing, electrical damage, or sutures compression.[6,9,33] Secondary nerve damage can occur due to irritation or compression by an adjacent inflammatory process such as granuloma.[9,31,34,35] Nerves are at risk of adherence to or abrasion against mesh used for hernia repair compared with a conventional sutured repair. Descriptors of neuropathic pain include pulling, tugging, tearing, throbbing, stabbing, shooting, numbing, and dull.[6,31] The onset of neuropathic pain is often delayed, occurring after a latent period of days to weeks.[30] Pain is often aggravated by ambulation, stooping, or hyperextension of hip and sexual intercourse; and alleviated by recumbent position and flexion of the hip and thigh.[16,30,31] In laparoscopic hernia repair there is a risk that, when stapling the mesh, it can penetrate the wall of the inguinal canal entrapping and irritating the sensory nerves. Kinking of the nerves can cause chronic irritation.[19] Tanphiphat et al.[17] speculated that thermal injury from intraoperative cautery was the cause of neuralgia rather than nerve entrapment.

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The third pain syndrome described in the literature is visceral—for example, pain encountered only on ejaculation due to dysfunction of periurethral structures involved in ejaculation.[6,7,29] One possible mechanism is the injury to either somatic sacral or sympathetic nerves, resulting in dys-synergia of the ejaculatory effector muscles.[6] It can also be due to stricture in the spermatic duct from the scar tissue or twisting of the cord.[29]

Prevention of chronic pain

Knowledge of the anatomy of cutaneous nerves and their aberrant courses may help avoid nerve injury.[24] Care must be taken to avoid suture insertion at the medial insertion of the inguinal ligament and that undue tightness of the inguinal ligament should be avoided at the pubic tubercle.[6] Staples should not be placed below the level of iliopubic tract when stapling lateral to the internal spermatic vessels.[21] Kiruparan et al.[35] suggested that helical titanium tacks should be used, rather than staples, to anchor the mesh. Other authors have suggested that neuralgia can be avoided if mesh is kept in place by intra-abdominal pressure alone and use of staples is avoided. Sensory nerves should be preserved, but this is not always possible, and some very small nerves are invariably divided.

Overall, a lower prevalence of chronic pain was found after laparoscopic repair compared with open repair. Of those studies comparing laparoscopic techniques, higher rates of chronic pain were reported after TAPP repair. The recent National Institute for Clinical Excellence guideline[2] highlighted that the evidence on chronic pain after laparoscopic hernia repair remained unclear, although there is evidence to suggest a reduction in the incidence of persistent numbness using this technique. Our review found that mesh repair was found to be better than the nonmesh repair, but surgeons must be aware that factors related to the securing and stapling of mesh are reported to be a main cause of neuralgia. Suggestions to avoid staples or to use tacks and to avoid nerve entrapment while stapling have been made to prevent neuralgia, although there are no randomized data to support these hypotheses. Other than avoiding damage to the sensory nerves by sutures or staples, intentional division of sensory nerves in the groin is thought to prevent chronic neuralgia at the expense of an area of anesthesia above the pubis.

CONCLUSIONS

Despite postherniorrhaphy chronic pain being a relatively common adverse event, good scientific data on prevention and management are lacking. Prospective studies would be required to investigate the preventive measures identified in this review and future research should take into consideration the risk factors identified for the development of chronic pain. Agreement on a standard definition and clarity of reporting of postoperative outcomes will aid estimation of prevalence and lead to better understanding of the epidemiology of chronic postherniorrhaphy pain.

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