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Sensory disturbances and neuropathic pain after inguinal hernia surgery

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ABSTRACT

Objectives: The aim of this study was to explore how the handling of nerves affects the risk for developing sensory disturbances (SDs) following groin hernia surgery.
Patients and methods: All patients 18 years or older undergoing surgery for inguinal hernia at Mora Hospital, Sweden, during an eight-month period in 2006, were eligible for inclusion. The surgical procedure was recorded prospectively according to a standardised protocol. One year postoperatively all patients were requested to answer the Inguinal Pain Questionnaire as well as a set of 18 sensory and affective pain descriptors. They were also invited to clinical examination including sensory testing.
Results: Of the 157 hernia repairs in Mora during the period of study, 128 repairs in 116 patients, were registered prospectively according to the study protocol. Laparoscopic total extraperitoneal (TEP) repair was performed in 36 (28%) of the patients. Ninety-two (79%) patients, including five patients operated bilaterally, underwent postoperative examination. SDs were found in 33 (34%) of the groins examined. No descriptor was found that significantly predicted the presence of altered examination findings. No significant association between the intraoperative handling of nerves and SD was seen. In the TEP-group, no SDs were seen. Infiltration of local anaesthetic agents and blockade of the ilioinguinal nerve prior to surgery were found to be significantly associated with SD more than 2 cm away from the scar (both $p < 0.05$). The presence of SD was not associated with significant pain.
Conclusions: SDs are common after open hernia surgery, but are not associated with persistent postoperative pain.

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1. Introduction

Sensory disturbance (SD) due to nerve trauma is a common adverse outcome after inguinal hernia surgery [1–3]. Nerve lesions may also lead to persistent neuropathic pain, although this is not always the main pathogenesis behind persistent postoperative pain. A causal relationship between nerve lesion and persistent pain is often taken for granted, even though clinical signs of nerve lesion are not consistently present alongside pain. Numbness in the groin may be present even in the absence of pain [4,1] and persistent pain after groin hernia repair may be present in the absence of signs of nerve lesion [2]. The development of persistent postoperative pain is complex and involves several mechanisms [5] of which nerve entrapment or transection are two of several causes. The pain may also be caused by nociceptive stimuli such as chronic inflammation due to foreign material reaction to the mesh, tension in the repair or mechanical tissue compression from a folded mesh.

It has been suggested that verbal descriptors of pain such as those used in the McGill Pain Questionnaire [6] may enable identification of patients with neuropathic pain [7]. The value of these descriptors as an instrument to discriminate between pain of different origins, however, depends on the accuracy of the pain language. The pathogenesis of pain may be determined by neurophysiological examination or quantitative sensory testing [8,9], but the predictive ability of verbal pain descriptors has not been fully evaluated.

The aim of the present study on a population-based cohort after hernia surgery was to determine the prevalence of SD after hernia repair, to assess whether questionnaire descriptors can be used to identify patients with neuropathic pain, and to explore how the handling of nerves intraoperatively, and the use of local anaesthesia affect the risk for developing SD.

2. Patients and methods

Patients aged 18 years or older undergoing surgery for inguinal hernia at Mora Hospital, Sweden, between January 30th and August 21st 2006, were included in the study. Laparoscopic TEP operation was performed for bilateral or recurrent hernias and the Lichtenstein procedure for primary unilateral hernia, according to local routines.

Reasons for surgery were for most patients the generally accepted indications, i.e. pain or attacks of incarceration. No attempts were made to distinguish between nociceptive and neuropathic pain or to relive the pain by local anaesthesia before surgery.

The surgical procedure was recorded prospectively according to a standardised protocol, where the operating surgeon stated whether the iliohypogastric nerve, ilioinguinal nerve and genitofemoral nerve was identified and/or divided. The decision to divide or preserve the nerve was at the discretion of the surgeon, based on the individual case. Meshes were fixated by means of non-absorbable sutures in open surgery, and with fibrin glue in laparoscopic procedures. Use of local anaesthesia, administered by the surgeon, as infiltration or ilioinguinal block before, or at the end of surgery, was recorded.

One year postoperatively all patients were contacted by mail and requested to answer the Inguinal Pain Questionnaire (IPQ) prior to the follow-up visit. The questionnaire also included a set of 18 sensory and affective pain descriptors (Table 2), previously suggested for use in characterising pain after hernia surgery [10]. The IPQ has been validated in a similar cohort [11] Two of the items in IPQ are questions about level of pain, rated on a seven-level scale based on its impact on behaviour and daily activities ranging from “no pain” to “Pain present, prompt medical advice sought”. The pain descriptors were answered “yes” or “no”, with no limitation of number of positive answers.

All patients, regardless of questionnaire outcome, were invited to undergo a neurological evaluation of touch sensitivity, pinprick and temperature in the groin region and adjacent areas including the upper and medial aspect of the thigh and the lateral aspect of the scrotum. The contralateral groin was not examined.

Basic clinical equipment was used in order to make the methods easily reproducible in every day practice. A cotton coated ear stick lightly touching the skin was used for testing touch sensitivity. The ability to discriminate between the sharp and blunt end of a needle was used for pinpricking. Warm and cold lumps of metal were used for temperature testing. All tests were interpreted as normal or not without any grading. Hyper- as well as hyposensitivity to any tested modality was interpreted as a positive finding. In order to evaluate inter-observer agreement, the examination was performed independently by two surgeons in 36 cases. Pain in combination with impaired or altered sensory nerve function was interpreted as being neuropathic, whereas pain in combination with normal examination findings was interpreted as nociceptive. Since the anatomic variations make it difficult to link a specific nerve lesion with the distribution of SD [12], no attempts were made to identify which nerves where affected at the examination. Sensory function before surgery was not tested.

The study was approved bye the regional ethical review board (Uppsala, Dnr 2007/101).

2.1. Statistics

For analysis of ordinal data such as pain scale ratings comparing patients with and without altered sensory findings the Mann–Whitney *U*-test was used. Chi-square and Fisher’s exact test was used for testing categorical data. The association between the response to the pain descriptors and the presence of sensory disturbance was also tested chi-square test in patients stating presence of pain, with no a priori hypothesis of which descriptor may predict the presence of neuropathic pain. The inter-observer agreement between the two independent assessments of SD was tested with Kappa statistics [13]. *p*-Values less than 0.05 were considered significant.

3. Results

During the study period, a total of 157 hernia repairs were performed in Mora. Of these, 128 repairs, including 12 bilateral repairs, were registered prospectively according to the study protocol and responded to the questionnaire. There were thus 116 patients, including 10 repairs in 8 women, eligible for inclusion in the study. All of these patients were invited to follow-up examination. Mean age was 60 years, standard deviation 15 years. Thirty-six (28%) of the repairs were performed as laparoscopic total extraperitoneal (TEP) inguinal hernia repair. Ninety-two (79%) patients, including five patients operated bilaterally, underwent postoperative neurological examination.

SDs were found in 33 (34%) of the examinations. In 20 groins (21%) the sensory disturbances extended more than 2 cm away from the scar (Table 1). No descriptor was found that significantly predicted the presence of neuropathic pain (Table 2). No significant association between the intraoperative handling of nerves and SD was seen, although a tendency towards higher prevalence of SD was seen if the ilioinguinal nerve was transected ($p = 0.097$) (Table 3). No SD extending more than 2 cm away from the scar after previous inguinal incision was seen in the TEP-group. Local infiltration of local anaesthetic agent and blockade of the ilioinguinal nerve prior to surgery were found to be significantly associated with SD more than 2 cm away from the scar (both $p < 0.05$). The presence of SD was not significantly associated with pain (Table 4).

Table 1
Sensory disturbances extending more than 2 cm from the scar.

Number of repairs	No sensory disturbance (groins)	Sensory disturbance (groins)
Male	72	19
Female	5	1
Age median (years)	62.2	60.6
Method of repair		
Lichtenstein	50	20
TEP	27	0

Table 2
Affective descriptors. Number of patients stating each descriptor for each operated groin.

	Patients without sensory disturbances (64 groins)	Patients with sensory disturbances (33 groins)
Tender	11	7
Shooting	1	0
Constricting	1	2
Sharp	1	1
Pricking	7	5
Cleaving	0	0
Stabbing	3	0
Pulling	5	5
Drilling	1	0
Hot/burning	5	0
Dull/aching	1	3
Radiating	3	2
Pounding	1	0
Irritating	9	1
Tiring/exhausting	0	0
Sickening	2	0
Frightful	0	1
Punishing	0	0

Table 3
Ilioinguinal nerve identification and handling (open surgery only).

Ilionguinal nerve	No sensory disturbance	Sensory disturbances
Transected	10	7
Preserved	27	9
Not identified	13	4

Inter-observer reliability was found to be 72%. Kappa was 0.71, indicating good agreement.

Presence of pain, when rated according to the IPQ items “pain right now” and “worst pain last week”, was reported by 24 (20%) and 31 (26%) of the patients.

Pain that could not be easily ignored was reported by 8 (6.6%) and 11 (9.2%) of the patients. The pain was predominantly of mild intensity (Table 5).

Table 4
Presence of pain versus presence of sensory disturbance (number of groins). Altogether 92 patients underwent examination, five of whom had undergone bilateral repair.

	Pain present	No pain	Total
Sensory disturbance present	4	16	20
No sensory disturbance	16	61	77
Total	20	77	97

Table 5
The Inguinal Pain Questionnaire pain scale. Pain intensity in each operated groin, based on all patients who answered the two items ($N = 122$ and $N = 119$).

		Pain right now	Worst pain last week
1	No pain	98	88
2	Pain present, easily ignored	16	20
3	Pain present, cannot be ignored but does not interfere with activities	4	7
4	Pain present, cannot be ignored and interferes with concentration and activities	2	2
5	Pain present, interferes with most activities	2	2
6	Pain present, necessitates bed rest	0	0
7	Pain present, prompt medical advice sought	0	0

4. Discussion

SDs are common after open hernia surgery, even in patients not perceiving pain. Conversely pain is often present in patients without signs of SD.

The high prevalence of SD indicates that intraoperative nerve trauma may be quite common, but does not necessarily lead to persistent pain. Numbness of the groin resulting from loss of nerve function without development of pain, is common and has no impact on health-related quality-of-life [9].

None of the verbal pain descriptors was accurate enough to be used to discriminate between neuropathic and nociceptive pain. Single adjectives do not seem to be sufficient to describe the sensations associated with pains of different origins. Although such descriptors may be of help in understanding the quality of the pain, the clinical manifestation of neuropathic and nociceptive pain are too complex to be captured in a few words. Patients with neuropathic pain may also lack the ability to verbally describe the pain. The lack of significant association may, however, also be explained by the relative small number of patients with neuropathic pain, which limits the statistical power. The results also have to be interpreted with some caution since no randomisation was done.

There was a significant difference in the prevalence of SD following open and laparoscopic repair. The fact that nerves are more easily avoided when using the laparoscopic approach compared to an open approach through the groin, is well known and has been confirmed in a randomised controlled trial [14].

In a previous study using quantitative sensory testing, it was found that patients with persistent pain after hernia repair form a heterogeneous group, some perceiving cutaneous hyperalgesia and others hypoalgesia [8]. The vast majority of patients with persistent pain, however, had pain localised to the external inguinal annulus rather than cutaneous structures, indicating a nerve lesion in the inguinal canal. Lesions of cutaneous nerves, on the other hand, do not seem to cause persistent pain.

The weak association between documented intraoperative handling of nerves and the subsequent development of SD may be due to trauma to cutaneous nerves obscuring findings at the clinical examination. There may also have been cutaneous nerve reinnervation of the skin, thereby narrowing the expected area of numbness caused by an injured nerve. A nerve entrapment or a lesion of a branch could lead to neuropathic pain without SD due to cross-connections between the nerves, which may lead to neuropathic pain without SD. Furthermore, an intact nerve may also become affected by the inflammation caused by the foreign body reaction to the mesh, with axon oedema and subsequent development of sensory dysfunction in the area covered by the nerve [15]. Neu-

ropathic pain may also be related to deeper nerves at the level of the myofascial layer, rather than the nerves transversing the surgical field [2]. There are thus several factors that may obscure any association between intraoperative handling of identifiable nerves and the final outcome in terms of sensory disturbances. The only nerve lesion that was associated with a tendency towards increased risk for numbness was transection of the ilioinguinal nerve. This, however, is no argument for not giving attention to surgical technique and careful handling of nerves. The a priori assumption that surgical technique and the experience of the individual surgeon is of crucial importance for the risk of developing long-term pain, is in no sense in conflict with these findings. Long-term pain is not only caused by lesions of the major nerve, but also by nociceptive stimuli. The factors evoking nociceptive pain are intimately associated with surgical technique, e.g. tissue trauma from extensive dissection, compression caused by inaccurately applied mesh material and tension in the tissue from an inadequately performed repair [16]. There may have been patients perceiving neuropathic pain already prior to surgery. No pain analysis was done before the hernia repair.

Since the main issue was to assess the distribution of the sensory disturbance rather than to quantify the neuropathic affection, the examination was done as a sensory mapping with standardised stimuli and not a quantitative sensory testing. Although a sensory mapping does not provide the same understanding of the nerve lesion as a quantitative sensory testing [17], we found that it was reproducible as a method for assessing SD.

The persistent numbness following infiltration of local anaesthetic agents is hard to explain. The pharmacological effect of the local anaesthetic used (bupivacain) should cease within one day. There may be confounding factors explaining this effect, in particular the surgeon performing the procedure. The decision to give infiltration anaesthesia at the end of surgery may also have been affected by how complicated the procedure was and the extent of tissue trauma, which may have caused confounding. There was no uniformly accepted technique for infiltrative anaesthesia and the method used varied between the surgeons.

In conclusion, SD is a common finding after hernia surgery, especially after open repair. We could not, however, find a clear relationship between the intraoperative handling of the three major nerves and the risk for subsequent SD. The development of persistent neuropathic pain is a complex process that only partly depends on how the nerves in the groin are handled intraoperatively.

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