Impact of postoperative complications on the risk for chronic groin pain after open inguinal hernia repair

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Background. *Chronic pain is common after inguinal hernia repair and has become one of the most important outcome measures for this procedure. The purpose of this study was to determine whether or not there is a relationship between specific postoperative complications and risk for chronic pain after open inguinal hernia repair.*
Methods. *A prospective cohort study was designed in which participants responded to the Inguinal Pain Questionnaire regarding postoperative groin pain 8 years after inguinal hernia repair. Responses to the questionnaire were matched with data from a previous study regarding reported postoperative complications after open inguinal hernia repair. Participants were recruited originally from the Swedish Hernia Register. Response rate was 82.4% (952/1,155). The primary outcome was chronic pain in the operated groin at follow-up. Grading of pain was performed using the Inguinal Pain Questionnaire.*
Results. *A total of 170 patients (17.9%) reported groin pain and 29 patients (3.0%) reported severe groin pain. The risk for developing chronic groin pain was greater in patients with severe pain in the preoperative or immediate postoperative period (odds ratio 2.09; 95% confidence interval 1.28–3.41). Risk for chronic pain decreased for every 1-year increase in age at the time of operation (odds ratio 0.99, 95% confidence interval 0.98–1.00).*
Conclusion. *Both preoperative pain and pain in the immediate postoperative period are strong risk factors for chronic groin pain. Risk factor patterns should be considered before operative repair of presumed symptomatic inguinal hernias. The problem of postoperative pain must be addressed regarding both pre-emptive and postoperative analgesia. (Surgery 2016;■:■-■.)*

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Hernia repair is one of the most common operative procedures.[1] The lifetime risk for an inguinal hernia operation in Western countries is estimated to be 27% in men and 3% in women.[2] As a consequence of the decrease in risk for recurrence after modern mesh repair, chronic pain has become one of the most important outcome measures after an inguinal hernia operation. Reoperation due to recurrence within 2 years after operation has a frequency of <2%.[3,4] Chronic pain is defined generally as pain lasting >3 months, but the studies on postoperative chronic pain often address the presence of pain several years after inguinal herniorrhaphy.[5-7] The prevalence of groin pain after inguinal hernia repair has been reported to be 20–30%.[8,9]

In a cohort from the Swedish Hernia Register (SHR), 30% of the patients reported pain in the operated groin 2 to 3 years after inguinal hernia repair, and 6% had severe pain that limited their ability to perform daily activities.[10] In a

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cross-sectional cohort study on patients from the same register, the proportion of patients with postoperative groin pain continued to decrease 7 years after operation. Nevertheless, pain persists in 14% of patients 7 years after operation.[11]

When addressing risk for chronic pain, patient- and operation-related risk factors may be identified. Several patient-related risk factors are already known. The risk for developing chronic postoperative pain is increased in younger patients, women, and patients with preoperative pain either in the area of planned operation or in another part of the body.[10,12] Some genotypes have also been shown to be associated with an increased risk for chronic postoperative pain.[13,14]

Operative technique, handling of nerves, choice of mesh, and choice of mesh fixation are among the operation-related risk factors that have been explored in previous studies. Open operative techniques have been associated with an increased risk for chronic pain.[8,10,15] Regional anesthesia has also been suggested to be associated with an increased risk for pain compared to other forms of anesthesia. Severe, short-term pain after inguinal hernia repair has been shown to increase the risk for pain one year after the procedure.[12] Furthermore, an association between postoperative complication and pain some years after operation has been suggested.[10,16]

There are, thus, reasons to believe that chronic postoperative pain in many cases is triggered during the immediate postoperative period. Patient-perceived, long-term outcome after postoperative surgical complications after inguinal hernia repair, however, has been evaluated poorly. Such an investigation is lengthy and requires reliable and defined data gathered during the immediate postoperative period and at the end of follow-up.

The aim of this longitudinal cohort study was to explore the long-term effects of postoperative surgical complications with the hypothesis that the occurrence of a complication increases the risk for chronic pain.

MATERIAL AND METHODS

The present study is based on a cohort defined in a previous study on patient-reported operative complications.[17] This cohort was assembled by requesting all patients who had undergone inguinal hernia operation during November and December 2002 and were registered in the SHR to respond to a questionnaire regarding operative complications during the first postoperative month. The SHR is a national, adult, groin hernia surgery register including 95 clinics with 98% coverage of all Swedish inguinal hernia operations in adults.[18,19] Of the 1,643 patients operated in this 2-month period, 1,448 (88.1%) completed the questionnaire. Postoperative complications within the first month after operation were reported by 391 (23.8%) patients.

Responders who had had an open repair with mesh or suture technique were considered eligible for this study. The complication pattern differs between open and laparoscopic hernia repairs, and 98% of the repairs during the inclusion period were performed with the open technique. The small proportion of patients undergoing laparoscopic repair was considered irrelevant in this context and was excluded from this analysis. After exclusion of deceased patients and those who had emigrated, 1,155 patients remained eligible (Fig) and were contacted 8 years after the index operation. They were asked to complete the Inguinal Pain Questionnaire (IPQ), a validated tool assessing the functional impact of groin pain after inguinal hernia operation.[20] One reminder was sent to nonresponders.

The questionnaire assesses the intensity of pain on a 7-grade ordinal scale (0—no pain, 1—pain can be ignored, 2—pain cannot be ignored but does not affect everyday activities, 3—pain cannot be ignored and affects everyday activities, 4—pain prevents most activities, 5—pain necessitates bed rest, 6—pain requires immediate medical attention). The IPQ also comprises questions (yes/no) regarding difficulties in performing 6, specified, everyday activities due to pain in the operated groin and, for men, presence of testicular pain on the operated side. Data from the IPQ were matched individually against responses to the complication questionnaire from the initial study.

Ethical approval for the study was granted by the Regional Ethics Review Board in Stockholm (no. 2010/583-31/2).

Statistical analysis. Statistical analyses were performed using Stata software (SE 12.1; StataCorp LP, College Station, TX). Separate logistic regression models were used for the outcomes "pain in the operated groin" and "testicular pain on the side of hernia surgery." The IPQ item on "pain intensity past week" was divided into "no pain" versus all other levels of pain intensity.

The outcomes were analyzed against the following possible risk factors: sex; age at time of operation; preoperative pain (retrospectively reported in the IPQ on a 7-grade ordinal scale); mode of anesthesia (local/regional/general); method of repair (anterior mesh/posterior mesh/plug repair/suture repair); suture material for fixation (nonabsorbable suture/slowly absorbable suture/rapidly absorbable

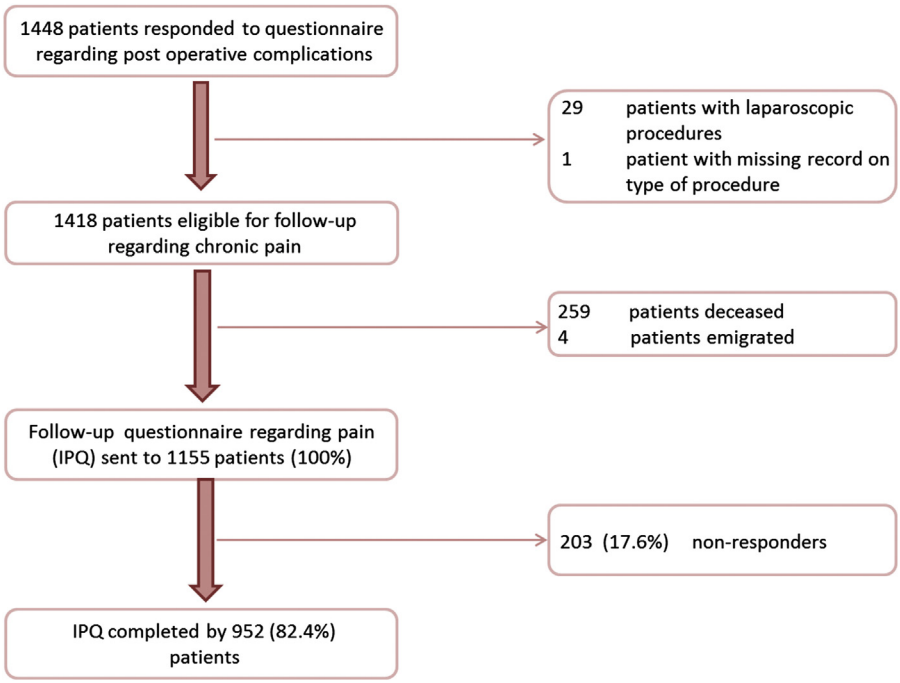

Fig. Flow chart of recruitment and participation. (Color version of this figure is available online.)

suture); and each of the patient reported complications (hematoma, infection, wound dehiscence, severe pain, thrombosis, testicular pain [for men], complication to the anesthetic procedure, urinary tract complication or voiding problem, and constipation). Previously known risk factors were brought into the multivariate analyses together with predictor variables having statistical significance ($P < .05$) in the univariate analyses.

RESULTS

Patient recruitment, reasons for nonparticipation, and response rates are accounted for in the Figure. The IPQ was completed by 82.4% (952/1,155) patients. Of the responders, 894 (93.9%) were men. Median age at time of operation was 58 years (interquartile range 48–67 years). General anesthesia was used in 583 (61.2%) procedures, regional anesthesia in 121 (12.7%) procedures, and local anesthesia in 248 (26.1%) procedures. Among the responders, 35.7% (340/941) had reported ≥1 complication in the complication questionnaire completed a few months after hernia repair.

Groin pain at long-term follow-up was reported by 170 (17.9%) patients, of whom 29 (3.0%) had pain limiting their ability to perform daily activities (reported intensity grades 3–6). Among the 894 male responders, 77 (8.6%) reported testicular pain on the ipsilateral side.

Table I presents the results regarding risk factors for chronic pain in the operated groin. In the multivariate analyses, an increased risk (expressed in terms of odds ratio) for developing chronic pain in the operated groin was seen for patients who reported severe pain in the operated groin postoperatively as well as for those who reported preoperative groin pain. The more severe the pain prior to operation, the stronger the risk factor. Age was negatively associated with chronic pain; the risk for pain decreased for every 1-year increase in age at the time of operation. Patients whose repair was performed with rapidly absorbable suture (in a suture repair or as fixation of mesh) were at a greater risk for chronic pain than those whose repair was performed with nonabsorbable suture.

In the univariate analyses, an association between urinary tract complication and chronic groin pain was seen; this association, however, did not remain in the multivariate analyses. Testicular pain in the postoperative period predicted chronic groin pain in the univariate analyses but was not included in the multivariate analyses, because adding this to the model would exclude the women.

Analyses of the association of each factor with chronic testicular pain on the side of the hernia repair are shown in Table II. Postoperative testicular pain and a urinary tract complication predicted testicular pain on the operated side at follow-up.

Table I. Logistic regression analyses for chronic groin pain after open inguinal herniorrhaphy

	Frequencies	*Univariate analysis*		*Multivariate analysis*	
	Patients with chronic pain, n/*no. at risk (%)*	*OR (95% CI)*	P *value*	*OR (95% CI)*	P *value*
Sex					
Male	156/894 (17.5)				
Female	14/58 (24.1)	1.53 (0.82–2.88)	.18	1.76 (0.88–3.49)	.11
Age		0.99 (0.97–1.00)	.009	0.99 (0.98–1.00)	.05
Anesthesia					
Local	40/248 (16.1)				
Regional	28/121 (23.1)	1.53 (0.89–2.64)	.12		
General	102/583 (17.5)	1.06 (0.71–1.59)	.77		
Preoperative groin pain*					
0	12/163 (7.4)	Ref		Ref	
1	22/164 (13.4)	1.94 (0.92–4.06)	.08	2.02 (0.95–4.30)	.07
2	37/186 (19.9)	3.13 (1.57–6.23)	.001	3.14 (1.55–6.36)	.001
3	54/266 (20.3)	3.17 (1.64–6.14)	.001	3.11 (1.59–6.11)	.001
4	29/103 (28.2)	4.83 (2.33–10.01)	<.001	4.50 (2.13–9.53)	<.001
5	6/21 (28.6)	4.93 (1.62–15.04)	.005	5.29 (1.66–16.90)	.005
6	9/34 (26.5)	4.63 (1.76–12.15)	.002	3.49 (1.25–9.75)	.02
Method of repair					
Anterior mesh	118/687 (17.2)	Ref		Ref	
Posterior mesh	0/2 (0)	—		—	
Plug repair	27/133 (20.3)	1.26 (0.79–2.01)	.34	1.15 (0.69–1.93)	.60
Suture repair	25/130 (19.2)	1.14 (0.71–1.84)	.59	1.11 (0.66–1.88)	.69
Fixation/suture					
Nonabsorbable suture	153/896 (17.1)	Ref		Ref	
Slowly absorbable suture	5/19 (26.3)	1.97 (0.68–5.68)	.21	1.45 (0.48–4.42)	.51
Rapidly absorbable suture	12/37 (32.4)	2.37 (1.16–4.83)	.02	2.40 (1.10–5.25)	.03
Hematoma					
No	136/777 (17.5)				
Yes	31/148 (21.0)	1.24 (0.80–1.93)	.33		
Infection					
No	151/860 (17.6)				
Yes	14/68 (20.6)	1.20 (0.65–2.22)	.56		
Wound dehiscence					
No	160/901 (17.8)				
Yes	8/38 (21.1)	1.24 (0.56–2.78)	.60		
Severe postoperative pain in the groin					
No	135/832 (16.2)				
Yes	33/104 (31.7)	2.48 (1.57–3.91)	<.001	2.09 (1.28–3.41)	.003
Thrombosis					
No	162/924 (17.5)				
Yes	4/10 (40.0)	3.66 (0.97–13.78)	.06		
Testicular pain postop (only men)				Omitted	
No	130/797 (16.3)				
Yes	23/84 (27.4)	1.98 (1.18–3.33)	.01		
Complication to anesthesia					
No	160/911 (17.6)				
Yes	7/26 (26.9)	1.68 (0.69–4.06)	.25		
Urinary tract complication					
No	153/897 (17.1)				

(*continued*)

Table I. (*continued*)

	Frequencies	*Univariate analysis*		*Multivariate analysis*	
	Patients with chronic pain, n/*no. at risk (%)*	*OR (95% CI)*	P *value*	*OR (95% CI)*	P *value*
Yes	14/40 (35.0)	2.65 (1.34–5.21)	.005	1.94 (0.94–4.00)	.07
Constipation					
No	159/911 (17.5)				
Yes	6/26 (23.1)	1.53 (0.60–3.93)	.37		

*For preoperative groin pain: 0—no pain, 1—pain can be ignored, 2—pain cannot be ignored but does not affect everyday activities, 3—pain cannot be ignored and affects everyday activities, 4—pain prevents most activities, 5—pain necessitates bed rest, 6—pain requires immediate medical attention. Showing frequency, odds ratio (OR), and 95% confidence interval (95% CI). Laparoscopic hernia repairs not included, and no patient underwent a no-fixation or "glue-based" mesh fixation repair.

Report of preoperative groin pain as well as postoperative severe groin pain was associated with an increased probability of testicular pain in their respective univariate analyses, but that association did not remain in the multivariate analyses. Older age at operation was associated with a decreased probability of persisting testicular pain.

DISCUSSION

There was a strong association between patient-perceived occurrence of the postoperative surgical complication "severe postoperative pain in the groin" and chronic groin pain in this long-term follow-up cohort study. There was also a strong association between chronic testicular pain and the complications "postoperative testicular pain" and "urinary tract complication."

Groin or testicular pain within 1 month of operation was a strong predictor for developing chronic pain. The observation that immediate, severe postoperative pain increases the risk for chronic pain has been made by several other studies,[21-23] which suggests that operative technique, whenever possible, should be modified in order to minimize immediate postoperative pain. The choice of a less traumatic operative technique, such as endoscopic hernia repair, is to be recommended. TEP (totally extraperitoneal repair) has been shown to decrease the risk for postoperative groin pain as well as persistent groin pain up to 1 year after operation.[24,25]

In this study, where only open repairs were included, there was no difference in risk of chronic pain depending on the type of repair (anterior mesh, posterior mesh, plug repair, or suture repair); we were not able to compare open versus laparoscopic hernia repair, because too few patients in this time period underwent laparoscopic repair.

Another way of addressing the impact of postoperative pain on risk for chronic pain is to have a vigilant attitude toward postoperative pain relief. For open hernia repair, a systematic review advocates the administration of local anesthetics, even if the patient is operated under general anesthesia, as well as the use of acetaminophen and nonsteroidal anti-inflammatory drugs/COX-2 inhibitors.[26]

Data from the questionnaires in this study do not allow classification of reported pain as nociceptive or neuralgic; most likely, both components are present within the group. While a study such as this cannot prove that better control of perioperative analgesia really diminishes chronic pain, a significant effect of perioperative pain management regimen on the risk for chronic pain has been shown for limb amputation.[27] Conclusive evidence regarding the benefit of pre-emptive techniques of postoperative pain control and the impact of good postoperative analgesia on chronic postoperative pain is still lacking, and the area needs further investigation. Whether use of pre-emptive techniques of postoperative pain control are of benefit remains unknown.

Previous studies that suggest an association between postoperative complications have not made a distinction between specific complications.[10,16] Our study investigated the association between several different types of postoperative surgical complications and chronic groin pain; we could not demonstrate any association with long-term groin pain for any specific complications other than severe pain in the immediate postoperative period.

The initial study provided a valid, population-based patient cohort for studying the association between postoperative complication and chronic pain.[17] The complication questionnaire combined with data from the SHR gave a more complete understanding of the postoperative complication panorama than data solely assembled from the SHR.

In the present study with patients answering the IPQ >8 years after inguinal herniorrhaphy, 17.9%

Table II. Logistic regression analyses for chronic testicular pain

	Frequencies	*Univariate analysis*		*Multivariate analysis*	
	Patients with testicular pain, n/no. at risk (%)	*OR (95% CI)*	P *value*	*OR (95% CI)*	P *value*
Age		0.97 (0.96–0.99)	<.001	0.97 (0.95–0.98)	<.001
Anesthesia					
Local	15/233 (6.4)				
Regional	13/113 (11.5)	1.89 (0.87–4.12)	.11		
General	49/548 (8.9)	1.42 (0.78–2.60)	.25		
Preoperative groin pain*					
0	4/163 (2.5)	Ref		Ref	
1	11/164 (6.7)	2.69 (0.84–8.66)	.10	2.53 (0.76–8.43)	.13
2	13/186 (7.0)	2.87 (0.92–9.00)	.07	2.63 (0.81–8.51)	.11
3	28/266 (10.5)	4.48 (1.54–13.04)	.006	2.84 (0.94–8.62)	.06
4	18/103 (17.5)	7.46 (2.43–22.93)	<.001	5.24 (1.63–16.83)	.01
5	3/21 (14.3)	6.75 (1.39–32.89)	.02	4.69 (0.78–28.12)	.09
6	1/34 (2.9)	1.33 (0.14–12.39)	.80	—	—
Method of repair					
Anterior mesh	57/660 (8.6)	Ref		Ref	
Posterior mesh	0/1 (0)	—		—	
Plug repair	12/111 (9.8)	1.14 (0.59–2.20)	.69	1.27 (0.62–2.61)	.51
Suture repair	8/110 (7.3)	0.83 (0.38–1.79)	.63	0.82 (0.35–1.93)	.65
Fixation/suture					
Nonabsorbable suture	69/845 (8.2)	Ref			
Slowly absorbable suture	2/18 (11.1)	1.39 (0.31–6.13)	.67		
Rapidly absorbable suture	6/31 (19.4)	2.28 (0.92–5.66)	.08		
Hematoma					
No	56/730 (7.7)				
Yes	19/139 (13.7)	1.91 (1.09–3.32)	.02	1.25 (0.62–2.53)	.54
Infection					
No	66/807 (8.2)				
Yes	9/65 (13.9)	1.80 (0.85–3.81)	.12		
Wound dehiscence					
No	70/847 (8.3)				
Yes	6/35 (17.1)	2.30 (0.92–5.72)	.07		
Severe postoperative pain in the groin					
No	62/784 (7.9)				
Yes	14/97 (14.4)	1.96 (1.05–3.66)	.03	0.76 (0.33–1.74)	.51
Thrombosis					
No	73/871 (8.4)				
Yes	2/7 (28.6)	4.37 (0.83–22.93)	.08		
Testicular pain postop					
No	49/797 (6.2)				
Yes	27/84 (32.1)	7.23 (4.21–12.43)	<.001	5.77 (2.97–11.22)	<.001
Complication to Anesthesia					
No	72/856 (8.4)				
Yes	4/24 (16.7)	2.18 (0.72–6.54)	.17		
Urinary tract complication					
No	66/842 (7.8)				
Yes	10/39 (25.6)	4.05 (1.89–8.68)	<.001	2.67 (1.06–6.73)	.04
Constipation					
No	73/855 (17.5)				
Yes	3/26 (11.5)	1.40 (0.41–4.77)	.59		

*For preoperative groin pain: 0—no pain, 1—pain can be ignored, 2—pain that cannot be ignored but does not affect everyday activities, 3—pain cannot be ignored and affects everyday activities, 4—pain prevents most activities, 5—pain necessitates bed rest, 6—pain requires immediate medical attention.
Showing frequency, odds ratio (OR), and 95% confidence interval (95% CI).

of the patients claimed chronic pain. This proportion was less than in studies with shorter follow-up,[8,10,15,28] which is in accordance with previous findings on the natural course of long-term postoperative groin pain.[11] The prevalence of pain interfering with the ability to perform daily activities was 3.0% which is similar to previous reports.[15,28] Given the ubiquity of inguinal repair, this represents a substantial number of patients that experience a decreased quality of life. Another risk factor present in this study as well as in previous studies was young age.[10,29]

Notably, preoperative pain was a very strong predictor of chronic pain. This observation should be interpreted with some caution, because the degree of preoperative pain was based on retrospective reporting. Nevertheless, the finding is in line with several studies on risk for chronic postoperative pain after various operative procedures.[30,31] The fact that preoperative pain was such a strong predictor of persisting pain >8 years after herniorrhaphy emphasizes the importance of being diligent in the preoperative assessment in order to assure that a hernia preoperative assessment in order to assure that the hernia or the, on good grounds, suspected hernia is the cause of the patient's discomfort. The preoperative information given to the patient should be tailored according to his or her risk factors. Patients with severe preoperative pain should be advised that there may be an increased risk for chronic pain after hernia repair.

Urinary tract complication was seen to be a significant predictor of testicular pain. This association cannot be investigated further from the data at hand, and we cannot explain the reason for this association. It is possible that both the urinary tract complication and testicular pain at the time of follow-up are manifestations of a urologic complaint not necessarily related to the hernia repair.

Suture material used in the repair (for suturing the tissue layers or for fixating the mesh, depending on type of repair) was evaluated as a risk factor for chronic pain. Repairs with rapidly absorbable suture were associated with an increased risk for chronic groin pain. To determine causality is not possible in this study. A possible confounder may be that these types of rapidly absorbable sutures are associated with a greater risk for recurrence.[32] It is also possible that the use of this kind of suture (knowing of the poorer results regarding recurrence) is a marker for substandard surgery. We should acknowledge that we were unable to compare suture repair versus a no suture or "glue-based" repair, because all patients had suture fixation of the mesh.

In the study population operated in 2002, 97.4% of the hernias were repaired with an open procedure—the dominating procedure at that time. The small proportion of patients operated with a laparoscopic technique was, therefore, excluded. Our conclusions on complications and chronic pain are thus applicable to patients operated with an open operative technique.

In conclusion, the results of this study emphasize the importance of maintaining a strict indication for inguinal herniorrhaphy and individualized preoperative information. Surgeons should choose operative techniques with a lesser risk for pain in the immediate postoperative period and be very active in addressing severe postoperative pain.

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