Hernia (2023) 27:71–76
https://doi.org/10.1007/s10029-022-02701-y

ORIGINAL ARTICLE

Evaluation of inguinal hernia repair using post-operative pain and quality of life metrics

Michael L Moreton[1] · **André Truter**[1,2]

Received: 26 July 2022 / Accepted: 21 October 2022 / Published online: 5 November 2022

Abstract

Background and purpose Elective inguinal hernia repair is a ubiquitous procedure that carries risks; chronic pain and impacts on quality of life (QoL) must be considered when advising patients around repair. The length of time from surgery date and impacts on quality of life are often limited to only a few years of follow-up and despite hernia repair being quite common, long-term outcomes are not often reported.

Methods A cohort of patients who had received Lichtenstein inguinal hernia repair over the previous 10 years were contacted and surveyed using the Brief Pain Inventory Short Form (BPI) to assess chronic pain and its effects on their QoL. Patient and operative factors were correlated with pain through linear regression and t-test analysis provided statistical significance for mean comparisons ($P < 0.05$).

Results The rate of chronic pain was 17.2% with recurrence of 3.1% at an average post-operative interval of 5.84 years. Of the various metrics compared between groups, age was one of the only significant predictors of chronic pain with younger patients reporting higher pain. Further time from surgery also translated to significantly less pain with a difference of 1.3 years. BPI respondents identified pain that interfered to varying degrees in different aspects of life but had relatively low average magnitudes (range: 1.82/10–2.91/10).

Conclusions These long-term considerations of post-surgical impact should be considered alongside potential benefits when advising patients about surgery and may help moderate post-operative expectations to optimize the outcome of common inguinal hernia repairs.

Keywords Hernia · Chronic pain · Quality of life

Introduction

A groin hernia is typically characterized by the abnormal protrusion of peritoneal-encased tissue through a musculofascial wall into an adjacent cavity [1]. Hernias of the groin are a common health problem in Canada that affect 3–4% of the population ultimately leading to approximately 50,000 repairs each year [2]. While the lifetime occurrence may be especially high for men (~27%), many patients are asymptomatic and whether or not to surgically intervene has been debated [3]. Specific surgical risks are common and it has been reported that 11–30% of patients experience groin pain at least 1–2 years after repair, as well as possible testicular atrophy or dysfunction, inflammation of the pubic symphysis or complications associated with mesh prosthesis [4]. Given these risks, some practitioners consider it prudent that patients whose hernias are asymptomatic proceed with a 'watchful waiting' paradigm, delaying surgical repair until symptoms occur [5].

Inguinal hernias (IH) represent the majority of groin hernias (~94% [6]) and lead to complications including incarceration and strangulation [7]. Complications of IH repair can include infection and hemorrhage, as well as nerve damage, post-operative groin pain (range 0–37% [8]), seroma, and urinary bladder dysfunction. Most post-operative outcomes measure chronic pain (ie. pain beyond 3 months after surgery [9]) within the first few years at most and few track impact on the patient's overall quality of life (QoL). This

✉ Michael L Moreton
mmoreton@student.ubc.ca

[1] Faculty of Medicine, The University of British Columbia, 317 - 2194 Health Sciences Mall, Vancouver, BC V6T 1Z3, Canada

[2] Department of Surgery, Saanich Peninsula Hospital, 2166 Mt Newton X Rd, Saanichton, BC V8M 2B2, Canada

limited view of the long-term impact that surgery can have on pain or QoL represents an important deficit in the literature that should be included when discussing IH repair with patients.

In addition to perioperative concerns, consideration must be given to post-operative recovery and return to function after an elective IH repair. In an analysis of 47 hernia repairs, Wennergren et al. [10] reported an improvement in physical function, body pain, and physical limitations after 1 year versus their pre-operative baseline. The authors noted that patients did not perceive an improvement to their general health likely because elective repairs do not represent a major debilitating burden on their patients' day-to-day experience. There are some conflicting data that consider larger sizes of mesh to predict a higher burden of pain and physical limitation post-operatively [11] but rates of severe disability tend to be low [12]. One study employing the Brief Pain Inventory (BPI) reported 13.6% pain after 4 months and impact to walking, work, mood, personal relationships, and sleep [13]. Chronic pain in this group decreased substantially from 4 months to 2 years (13.6 to 4.0%, respectively); however, QoL measures were not assessed after 4 months.

Our purpose in this work was to determine the outcomes for a cohort of IH repair patients on the West Coast of Canada by assessing rates of chronic pain and QoL measures several years after their initial surgeries. In this cohort, does patient age or sex predict long-term outcomes for recipients? In cases of elective repair, how could data on post-operative pain or long-term QoL outcomes help to inform clinicians and patients about repair expectations given the associated risks?

Methods

Ethics approval

Ethics was approved by the Research Ethics Review Board under the harmonized collaboration between the University of British Columbia and Island Health's minimal risk application (H20-01470).

Participant selection

All potential participants were identified from the general surgeon's private practice records in Sidney, BC of patients who had Lichtenstein tension-free inguinal hernia surgery [14] under local or general anesthetic between the years of 2012–2020 employing Ultrapro™ mesh (decision of anesthetic based on individual patient factors as dictated by the anesthesiologist). No patients were excluded from this initial contact. As per the parameters of the ethics approval, patients were mailed an initial letter of contact along with the Brief Pain Inventory Short Form [15] (BPI; used with permission) two-page pain and quality of life survey with a pre-paid return envelope. Patients were instructed to indicate whether they had pain related to their repaired hernia in the previous week. If so, they were invited to complete the BPI questionnaire. Prospective participants were afforded 2 months to complete and return their questionnaire before compiling the data. No compensation was provided for participation. Return of the survey with accompanied signed informed consent form was required for inclusion into this dataset.

Data analysis

Analysis approach was established prior to collection in collaboration with UBC Department of Statistics. All surveys were deidentified and digitized into REDCap® online software and managed electronically. Means with standard deviation and errors and all subsequent comparison of means were considered statistically significant with alpha of < 0.05 with two sample t-test assuming unequal variances in Microsoft Excel, version 16.55. Correlation analysis was accomplished via linear regression and corresponding R-value evaluation. Power analysis calculated with G*Power [16] reveals required response $n = 128$ for power of 0.8, alpha = 0.05, and effect size of 0.5.

Results

Pain survey

In total, there were 469 surveys sent to patients in our database who had received a repair in the previous 10 years. From this initial mail out, 133 responded and 128 (27.3%) were useable (e.g., had signed the consent or provided legible name). The average age of the 128 respondents was 73.6 years and of those who identified continuing pain, 66.9 years ($n = 22$; 17.2% of respondents). Of the 128, 3.1% (4 patients) reported having a recurrence, though the mean time between initial repair and recurrence was unclear. This group of 22 had an average time from surgery of 4.7 years (range: 2.48–8.31 years) while the average of those who did not identify pain was 6.0 years (range: 2.6–9.9 years; Fig. 1). The difference in average time from surgery between the groups was significant ($P = 0.003$). Delineation between those with and those without chronic pain did not suggest a significant difference based on sex ($P = 0.934$) or type of anesthetic ($P = 0.298$; local vs. general). Neither sex nor anesthetic predicted a difference on any QoL metrics ($P > 0.1$). While there was no correlation of age with severity of average pain or QoL ($R^2 = 0.0001$, $R^2 < 0.1$ respectively), there was a significant difference in age between those with

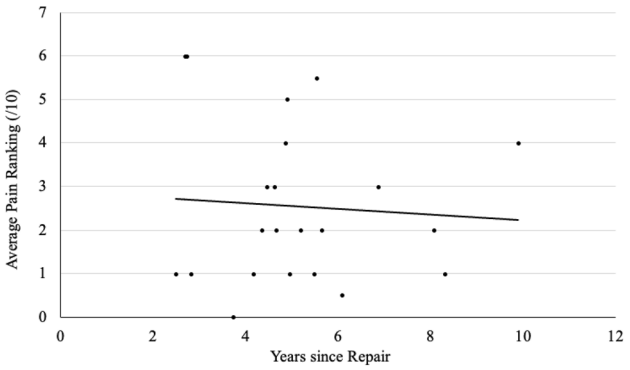

Fig. 1 Rating of average pain from respondents who identified chronic pain associated with their inguinal hernias and their respective time since repair ($n=22$; $R^2=0.0047$)

and those without pain (66.9 vs 74.9, respectively $P=0.01$). The time from surgery to survey varied across all respondents. Those who identified chronic pain after hernia repair had an average time since repair of 5.1 ± 0.4 years and those who did not have pain an average of 6.0 ± 0.2 years.

In the evaluation of the 22 participants who identified chronic pain, their average pain was reported to be 2.6/10 (0—'No pain', 10—'Pain as bad as you can imagine'; Table 1). Their average impact on QoL measured was 2.3/10 (all categories evaluated; Table 1). When considering the most and least intrusive aspects of chronic pain on QoL, the highest average category was disruption to 'enjoyment of life' (2.9/10) and 'relationships' (2.0/10), respectively. The proportion of respondents who complained of impact are as follows: general activity 14.1%, mood 13.3%, ambulation 13.3%, work 14.9%, relationships 7.8%, sleep 11.7%, and enjoyment of life 13.3%.

Discussion

Our main goal in this work was to compare clinical outcomes in this patient sample to what has been reported in the literature, while incorporating data around QoL outcomes and assessing length of time from surgery as a predictor of pain. Of the literature published reviewing post-operative pain from the Lichtenstein repair, those with the largest sample sizes revealed pain varying from 4.7% after 1 year to 28% after 5 years, with an average prevalence beyond 1 year of 19.8% and recurrence of 3.77% [17–20]. Our finding (17.2%) would appear to be in line with these data, especially when considered to be a relatively small sample ($n=128$). Similarly, the rate of recurrence in our study was 3.1%, compared with these studies' average of 3.77%. The time from surgery did not seem to be associated with pain in any way ($R^2=0.0047$ l; Fig. 1) up to almost 10 years post-operatively and pain was significantly higher in younger patients which has previously not been the case when assessing patients under 31 years old (21). Our QoL findings are among few reported in the literature and represent a relatively low but non-trivial presence of post-repair impact on

Table 1 Distribution of survey responses categorized based on report of chronic pain with subsequent report of impacts to quality-of-life metrics using the BPI

	Chronic pain	No chronic pain	*P* value
Sample (*n*)	22	106	–
Average time since surgery (years) average time since surgery [range]	4.7 [2.5–9.9]	6.0 [2.6–9.9]	**0.003 –**
Average age (years)	66.9	74.9	**0.01**
Male:female[a]	17:3	88:8	0.80
Local:general anesthetic[b]	12:3	62:7	0.30
QoL measures for those with chronic pain ($n=22$)			
	Proportion reporting impact (%)	Average magnitude (/10)	
Pain	17.2	2.6	
General activity	14.1	2.3	
Mood	13.3	2.4	
Ambulation	13.3	2.0	
Work	14.9	2.3	
Relationships	7.8	1.8	
Sleep	11.7	2.5	
Enjoyment of life	13.3	2.9	

[a]Data used in this analysis relied on report and the *P* value reports significance of average chronic pain reported

[b]Data used in this analysis were limited by operative report, which was inaccessible for 44 patients; therefore, only what was available were included

up to 17.2% of patients, reported on a longer average follow-up than other published data to date [13].

In our analysis, we considered how patient and procedural factors impacted outcomes. Of the 22 reporting pain, only 3 were female, which is in line with the expected male-skewed prevalence of inguinal hernia [21]. Neither sex nor anesthetic type were predictors of pain outcomes and were not demonstrated to be significant as has been previously reported [22]. However, there was a significant difference in mean age between those identifying pain and those without (66.9 vs 74.9, $P=0.01$), which is in line with younger age being a risk factor [23]. While several factors contribute to whether a patient will experience pain, the fact that older patients reported lower chronic pain rates may be important when discussing post-operative risks. Applying these specific findings to a larger population level would suggest that older patient populations may be at lower risk of chronic pain complications and therefore should not be precluded from repair solely based on age. Direct comparison of this group to the wider population should be done carefully given the possibility of self-selection bias in our collection process and hence needs to be compared with further research. Additionally, this question only addresses the prospect of post-operative pain and does not include consideration of surgical candidacy based on other important perioperative risk factors and comorbidities a patient may have, emphasizing the importance of shared decision-making around surgery.

Chronic pain of any etiology is a common experience in the wider population, affecting some 25–30% of people in Western countries [24]. Relatively little has been published about long-term chronic pain associated with hernias or characterizing its impact on patients. The longest follow-up period seen in our survey of the literature was 5 years in two studies that reported chronic pain of 28% ($n=330$) [19], and 20.3% ($n=59$) [25] with recurrences of 4.2% and 3.4%, respectively. Of those who identified chronic pain in our study, the average was significantly closer to their date of surgery than those who did not identify pain (4.70 vs. 5.99 years, $P=0.003$). We are unaware of a study that has examined post-operative pain rates beyond this range, and though our data are retrospective in nature, they may suggest a trend that early "long-term" pain rates could seem to dissipate beyond the conventional follow-up window seen in the literature, which is often limited to the first few years. This too may be an important consideration when discussing potential complications of repair or reassuring patients in the early post-operative period who may be experiencing pain. Given the wide spectrum of confounding variables associated with chronic pain development and experience paired with limited data in the literature, the long-term pain outcomes beyond this 5–6 year follow-up stands to be a valuable area for future research and may help mitigate negative outcomes.

The BPI tool has been previously used in hernia-associated pain literature and has demonstrated efficacy in assessing post-operative pain and mild-to-moderate disability [26]. Our results are in accordance with 4 month findings from Bande et al. [13], where rates of chronic pain were 18% versus our mean of 17.2% at an average follow-up of 5.83 years. Comparing the QoL categories in their results versus ours (Table 1) showed similarities in that sleep (4.2% vs. 11.7%, respectively) and relationships (9% vs. 7.8%) were among the least affected, while ambulation (15% vs. 13.3%) and work (15.6% vs. 14.9%) were among the most impacted. Based on the stepwise decline of patients reporting pain in their 4-month, 1-year, and 2-year follow-ups (13.6%, 6.2%, and 4%, respectively), we would expect their long-term follow-ups to display smaller proportions of interference from hernia pain. While our findings are retrospective and do not follow a single cohort at defined times, the significant difference in time from surgery in those reporting pain versus those without (4.7 vs 6.0 years; Table 1) may indicate possible resolution of symptoms over longer time intervals than just the acute post-operative period. Alternatively, this finding may represent a plateau effect present where most patients should expect a maximum recovery of QoL-benefit earlier (e.g., 1–2 years post-operatively) than later as seen by Bande et al. [13]. Predicting these kinds of recovery intervals may be especially helpful for patients who have pre-existing difficulty with activities of daily living and need to arrange extra support. Similarly, tempering expectations of further improvement after this time frame may lead to fruitful discussions between patients and their surgeons on how to shift focus and employ community support as needed.

This study provided the opportunity to identify significant long-term pain after IH repair, these data were potentially subjected to recall bias. While we identified patients who had received treatment in the past, there was no way to contact those who had moved in the interim or hear from those who did not wish to participate due to being pain-free, possibly skewing the results from a truly random sample. Similarly, some may have lacked the capacity to respond despite the presence of pain, ultimately causing age or time from surgery to be biased in the dataset. A long-term prospective study would be advisable to remedy these limitations. Additionally, the BPI offers excellent potential quantitative assessment of pre- and post-operative benefit that was not possible in our study design. Use in a model of ongoing enrollment could be employed to allow for pre- and post-operative comparison and to maintain contact more predictably over time. Other future research might focus on the incidence of pain after recurrence or on qualitative aspects of recovery and ongoing

post-operative pain as these areas are underrepresented in the literature.

Conclusion

We surveyed a population of patients who had IH repair within the previous decade. This represents an under-studied population where the years-long consequences of hernia repair are considered and found no association between chronic pain and time from surgery. Although with the caveat that this group is heterogeneous by nature, we found similar rates of pain and recurrence to those represented in the literature with no apparent difference based on sex or age, though pain was significantly less in older patients. 17.2% of patients experienced a mild interruption to daily activities secondary to their repair. Based on our analysis of surveyed patients compared with recent publications, clinicians and patients may reasonably expect a post-operative dip in QoL to improve and peak after 1–2 years and realize that delaying repair does not seem to be predictive of a worse outcome.

Acknowledgements The authors are grateful to the participants who elected to be part of this study and to the UBC Faculty of Medicine for educational resource and support. There was no external funding source associated with this study.

Funding This project was funded by the clinical lead. The authors state there are no potential conflicts of interest.

Declarations

Conflict of interest No conflicts of interest to declare.

Human and Animal Rights There was no use of animals within this study by any of the authors.

Informed Consent A signed informed consent form was collected from each of the participants included in this study.

Data Availability De-identified data remain in the authors' possession and request for access may be made.

References

1. Dabbas N, Adams K, Pearson K, Royle G (2011) Frequency of abdominal wall hernias: is classical teaching out of date? JRSM Short Rep 2(1):1–6
2. Barkun J, Neville A, Fitzgerald GWN, Litwin D, McKenzie M (2008) Canadian association of general surgeons and American college of surgeons evidence-based reviews in surgery. 26. Watchful waiting versus repair of inguinal hernia in minimally symptomatic men. Canadian journal of surgery. Can Med Assoc 51:406–409
3. Fitzgibbons RJ, Giobbie-Hurder A, Gibbs JO, Dunlop DD, Reda DJ, McCarthy M, et al. Watchful waiting vs repair of inguinal hernia in minimally symptomatic men: A randomized clinical trial. J Am Med Assoc [Internet]. 2006 Jan 18 [cited 2020 Apr 22];295(3):285–92. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16418463
4. Fitzgibbons RJ, Jonasson O, Gibbs J, Dunlop DD, Henderson W, Reda D, et al. The development of a clinical trial to determine if watchful waiting is an acceptable alternative to routine herniorrhaphy for patients with minimal or no hernia symptoms. J Am Coll Surg [Internet]. 2003 May 1 [cited 2020 Apr 23];196(5):737–42. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12742207
5. Gong W, Li J. Operation versus watchful waiting in asymptomatic or minimally symptomatic inguinal hernias: The meta-analysis results of randomized controlled trials. Int J Surg [Internet]. 2018 Apr 1 [cited 2020 Apr 23];52:120–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29471159
6. Jenkins JT, O'Dwyer PJ. Inguinal hernias [Internet]. Vol. 336, BMJ. 2008 [cited 2020 Apr 22]. p. 269–72. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18244999
7. Phillips LaPinska M, Blatnik J. Surgical Principles in Inguinal Hernia Repair - A Comprehensive Guide to Anatomy and Operative Techniques. 1st ed. LaPinska MP, Blatnik JA, editors. Springer, Cham; 2018. 15–24
8. Bay-Nielsen M, Perkins FM, Kehlet H. Pain and functional impairment 1 year after inguinal herniorrhaphy: A nationwide questionnaire study. Vol. 233, Annals of Surgery. Lippincott, Williams, and Wilkins; 2001. p. 1–7
9. Schug SA, Lavand'Homme P, Barke A, Korwisi B, Rief W, Treede RD. The IASP classification of chronic pain for ICD-11: Chronic postsurgical or posttraumatic pain. Pain [Internet]. 2019 Jan 1 [cited 2022 Apr 16];160(1):45–52. Available from: https://journals.lww.com/pain/Fulltext/2019/01000/The_IASP_classification_of_chronic_pain_for.6.aspx
10. Wennergren JE, Plymale M, Davenport D, Levy S, Hazey J, Perry KA et al (2016) Quality-of-life scores in laparoscopic preperitoneal inguinal hernia repair. Surg Endosc 30(8):3467–3473
11. Huntington CR, Wormer BA, Cox TC, Blair LJ, Lincourt AE, Augenstein VA et al (2015) Local anesthesia in open inguinal hernia repair improves postoperative quality of life compared to general anesthesia: a prospective, international study. Am Surg 81(7):704–709
12. Jalil O, Rowlands C, Ruddle A, Hassn A, Morcous P. Medium-Term Recurrence and Quality of Life Assessment Using the Hernia-Specific Carolinas Comfort Scale Following Laparoscopic Inguinal Hernia Repair. J Laparoendosc Adv Surg Tech A [Internet]. 2015 Jun 1 [cited 2021 Dec 20];25(6):477–80. Available from: https://pubmed.ncbi.nlm.nih.gov/25946471/
13. Bande D, Moltó L, Pereira JA, Montes A. Chronic pain after groin hernia repair: Pain characteristics and impact on quality of life. BMC Surg [Internet]. 2020 Jul 1 [cited 2021 Dec 19];20(1):1–11. Available from: https://doaj.org/article/a1118004de974d24b5cce41c63b59ebb
14. Amid PK, Lichtenstein IL. Long-term result and current status of the Lichtenstein open tension-free hernioplasty. Hernia 1998 22 [Internet]. 1998 Jun [cited 2022 May 1];2(2):89–94. Available from: https://link.springer.com/article/https://doi.org/10.1007/BF01207492
15. Cleeland C. User guide The Brief Pain Inventory. Pain Res Gr [Internet]. 1991 [cited 2021 Sep 2];143–7. Available from: www.mdanderson.org
16. Erdfelder E, Faul F, Buchner A, Lang AG (2009) Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods 41(4):1149–1160

17. Sevinç B, Damburaci N, Güner M, Karahan Ö (2019) Comparison of early and long term outcomes of open lichtenstein repair and totally extraperitoneal herniorrhaphy for primary inguinal hernias. Turkish J Med Sci 49(1):38–41
18. Sanders DL, Nienhuijs S, Ziprin P, Miserez M, Gingell-Littlejohn M, Smeds S. Randomized clinical trial comparing self-gripping mesh with suture fixation of lightweight polypropylene mesh in open inguinal hernia repair. 2014 [cited 2020 May 15]; Available from: www.bjs.co.uk
19. Eker HH, Langeveld HR, Klitsie PJ, Van't Riet M, Stassen LPS, Weidema WF et al (2012) Randomized clinical trial of total extraperitoneal inguinal hernioplasty vs lichtenstein repair: a long-term follow-up study. Arch Surg 147(3):256–260
20. Eklund A, Montgomery A, Bergkvist L, Rudberg C (2010) Chronic pain 5 years after randomized comparison of laparoscopic and Lichtenstein inguinal hernia repair. Br J Surg 97(4):600–608
21. Bakker WJ, van Hessen C V., Verleisdonk EJMM, Clevers GJ, Davids PHP, Schouten N, et al. Is young age a risk factor for chronic postoperative inguinal pain after endoscopic totally extraperitoneal (TEP) repair? Hernia [Internet]. 2019 Dec 1 [cited 2022 Sep 3];23(6):1053–9. Available from: https://link.springer.com/article/https://doi.org/10.1007/s10029-019-01882-3
22. Weber A, Valencia S, Garteiz D, Burguess A. Epidemology of Hernias in the Female. Abdom Wall Hernias [Internet]. 2001 [cited 2021 Dec 12];613–9. Available from: https://link.springer.com/chapter/https://doi.org/10.1007/978-1-4419-8574-3_90
23. Reinpold W (2020) Risk factors of chronic pain after inguinal hernia repair: a systematic review. Innovative surgical sciences. De Gruyter 2:61–68
24. Dansie EJ, Turk DC (2013) Assessment of patients with chronic pain. Br J Anaesth 111(1):19–25
25. Heikkinen T, Bringman S, Ohtonen P, Kunelius P, Haukipuro K, Hulkko A (2004) Five-year outcome of laparoscopic and Lichtenstein hernioplasties. Surg Endosc Other Interv Tech 18(3):518–522
26. Chung L, Ch MBB, O'dwyer PJ. Clinical Science Pain and its effects on physical activity and quality of life before operation in patients undergoing elective inguinal and ventral hernia repair. [cited 2021 Dec 19]; Available from: http://dx.doi.org/https://doi.org/10.1016/j.amjsurg.2014.02.011