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Outcomes of laparoscopic inguinal hernia repairs: an 11-year experience in a private surgical practice

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Background: Inguinal hernia repairs are among the most common surgeries worldwide, with laparoscopic techniques being increasingly popular due to benefits like reduced pain, faster recovery, and better cosmetic outcomes. This study evaluated the outcomes of laparoscopic inguinal hernia repairs performed by a single surgeon in private practice.
Methods: A retrospective audit was conducted on adults who underwent laparoscopic inguinal hernia repair between January 2010 and December 2020. Data on patient and procedural characteristics and outcomes were collected from hospital records and following telephonic contact with patients. The study was approved by the Biomedical Research Ethics Committee of the University of KwaZulu-Natal (BREC/00005605/2023).
Results: The study included 188 patients (91.5% male, median age 49 years). All repairs were performed using the total extraperitoneal (TEP) approach for unilateral and bilateral hernias. Conversion to open surgery occurred in 13.8% of cases. The median procedure time was 94.9 minutes, the postoperative hospital stay was two days, and the return to work was two days. The median operative time was shorter in the latter study period (2015–2020) than the former (2010–2014): 81 minutes (IQR: 70–102) minutes versus 131 minutes (IQR: 108–148 minutes), $p < 0.01$. At the end of the follow-up period in 2024, 20.2% (38/188) were lost to follow-up. Of the remaining 150 patients who were contactable, 88.7% had no further complications, 4.7% had hernia recurrence, 4.0% reported inguinodynia, and 2.7% had demised.
Conclusion: This study provides valuable insights into laparoscopic hernia repair performed by a single surgeon over an 11-year period. Laparoscopic inguinal hernia repair, even for primary cases, is feasible with shorter operative times and low complication and hernia recurrence rates when performed by an experienced surgeon.
Keywords: inguinal hernia, laparoscopic surgery, TEP repair, outcomes

Introduction

Hernias have been a historical concern since ancient times, with inguinal hernias being described as abdominal organs protruding through a defect in the inguinal region.[1] Understanding the embryology and anatomy of the inguinal region is crucial for managing inguinal hernias, as it facilitates understanding of their development, surgical techniques for repair and recurrence, and preventing associated perioperative complications.[1] Inguinal hernia can be classified as medial or direct versus lateral or indirect depending on its location relative to the inferior epigastric vessels.[2]

The exact causes of hernias are not fully understood, but risk factors include male gender, advancing age, a patent processus vaginalis, connective tissue disorders, and a low body mass index (BMI).[3,4] Lifestyle factors like smoking and heavy lifting have been shown to increase recurrence rates.[3,5]

Inguinal hernia repairs are a common daily general surgical procedure. Around 20 million people undergo groin hernia repair annually, with varying repair rates across countries.[6] The United Kingdom reports rates of 10 per 100 000, while America reports 28 per 100 000.[6] In sub-Saharan Africa, it is estimated that only 25 inguinal hernia surgeries are performed per 100 000 population per year.[7,8] In South Africa, inguinal hernia repair rates are not well-documented.[9]

With technological advancements, inguinal hernia repairs have progressed from essential scrotal incisions to groin incisions and now to minimally invasive laparoscopic surgery.[1] Early tissue repair techniques by Edoardo Bassini and later modifications, such as the Shouldice technique, have greatly reduced recurrence rates from 10–30% to < 1%.[10,11] The Lichtenstein (tension-free mesh) hernioplasty has become the preferred standard of care by most general surgeons due to its ease and effectiveness, comparable to other tissue repair techniques.[1,3]

Laparoscopic repair, introduced by Ger in 1982, has resulted in two main techniques: transabdominal pre-peritoneal repair (TAPP) and total extraperitoneal repair (TEP), the latter avoiding the need to enter the abdomen.[1] Three recent systematic reviews have shown that laparoscopic hernia repair is associated with shorter hospital stays, shorter return to work, decreased early postoperative pain, reduced incidence of inguinodynia (pain or discomfort lasting greater than 3 months after surgery), and low recurrence rates and should be the gold standard when dealing with primary or bilateral inguinal hernia.[12-14] Despite these advantages,

the adoption of laparoscopic techniques in South Africa is limited, partly due to the extensive training required and the availability of laparoscopic equipment.[1,3] Studies indicate that mastering laparoscopic hernia repair requires 20 to 100 procedures, with newer surgeons benefiting from improved training and simulation tools.[14] Studies have also shown that the number needed to master this technique to achieve acceptable complication rates has decreased due to the frequency of laparoscopic surgeries being performed.[15]

A recent systematic review and meta-analysis of sub-Saharan Africa showed that only 3.3% of groin hernia repairs were repaired laparoscopically.[8] There is limited data about laparoscopic inguinal hernia surgery performed in South Africa, with some centres reporting laparoscopic hernia repair rates of up to 23%.[9] Although laparoscopic hernia surgery was introduced in 1982, the South African Society of Endoscopic Surgery (SASES) was only established in 1991, and its first workshop was held in 1994 to introduce and improve minimal access surgery techniques.[16] Laparoscopic inguinal hernia repair has subsequently been slow to be adopted, particularly in the public sector, with some centres only establishing minimal access units in 2011 and others still in the process of doing so.[15]

In 2015, an update was made to the guidelines by the Hernia Interest Group of South Africa (HIGSA), resulting in a more widespread practice of laparoscopic hernia repair, including primary unilateral hernia repairs.[17] The current international HerniaSurge guidelines recommend that laparoscopic inguinal hernia repair be the preferred procedure for "primary unilateral and bilateral hernias, recurrences where the initial repair was open, all femoral hernias, and all females with groin hernias".[3] This study aimed to explore the indications, complications, and outcomes of laparoscopic hernia repair performed as part of an 11-year experience by a surgeon in private practice in Durban, South Africa.

Methods

Study design, population, and setting

A retrospective clinical audit was conducted on 188 consecutive adult patients (≥ 18 years) who had undergone a laparoscopic groin hernia repair between January 2010 and December 2020 at a private surgical practice. The surgical practice is based in a 201-bed hospital located northwest of the centre of Durban. A single surgeon performed all laparoscopic hernia repairs using the TEP method. The surgeon has been in specialist practice for the last 30 years and received training in minimal-access surgery. He has been performing laparoscopic hernia surgery for the last 20 years. All patients received a scheduled follow-up two weeks postoperatively. In 2024, patients were contacted telephonically, and information on long-term outcomes (such as chronic pain, recurrence, and return to work) was obtained at this time point.

Data collection

The first author, who was not the operating surgeon, extracted data from the surgical theatre and patients' hospital records. Data on demographic characteristics such as age, gender, and BMI; preoperative comorbidities (obesity, diabetes mellitus, hypertension, chronic kidney disease, human immunodeficiency virus (HIV), smoking; and characteristics of the surgery (indications for inguinal hernia repair, operative time, conversion to open surgery, duration of hospital stay, and perioperative outcomes) were collected for each patient. Where additional information was required, patients and/or their caregivers were contacted telephonically by the first author, who had no affiliation with the practice. All data were entered and managed using the Microsoft Excel programme. All data entered in the spreadsheet were de-identified.

Statistical analyses

Data analysis was conducted using the R Statistical computing software of the R Core Team (2020), version 3.6.3, and results were presented in the form of descriptive and inferential statistics. Descriptive statistics such as frequencies and percentages were used to summarise categorical variables. Central tendency and dispersion of data were measured using means and standard deviations for normally distributed variables and medians and interquartile ranges for skewed variables. Inferential statistics included either a t-test (for normally distributed continuous data) or a Wilcoxon test (for non-normally distributed continuous data). The results were presented either in the form of tables or graphically as simple bar charts. A p-value of < 0.05 was considered statistically significant.

Results

Demographic and hernia characteristics

We identified 188 adult patients with laparoscopic hernia repairs that met the inclusion criteria for the study (Table I). The median age of patients was 49 years, with an interquartile range (IQR) of (37–64 years). The study group had a predominantly male distribution of 91.5% (172/188). Patients' BMI was categorised into normal, overweight, and various obesity classes according to the World Health Organization (WHO) classification of obesity.[18] Most patients had a primary hernia repair, 92.0% (173/188). Of these, the proportion of unilateral versus bilateral primary

Table I: Baseline demographic and hernia characteristics (n = 188)

Sex	Distribution (n, %)
Male	172 (91.5%)
Female	16 (8.5%)
Body mass index	
Normal (18.5–24.9)	45 (23.9%)
Overweight (25.0–29.9)	42 (22.3%)
Class I obese (30.0–34.9)	42 (22.3%)
Class II obese (35.0–39.9)	43 (22.9%)
Class III obese (≥ 40)	16 (8.5%)
Primary hernia repair	
Yes	173 (92.0%)
No	15 (8.0%)
Hernia type*	
Unilateral	104 (55.3%)
Bilateral	84 (44.7%)
Previous abdominal surgery	
Yes	37 (19.7%)
No	151 (80.3%)

* Includes those with previous hernia repair

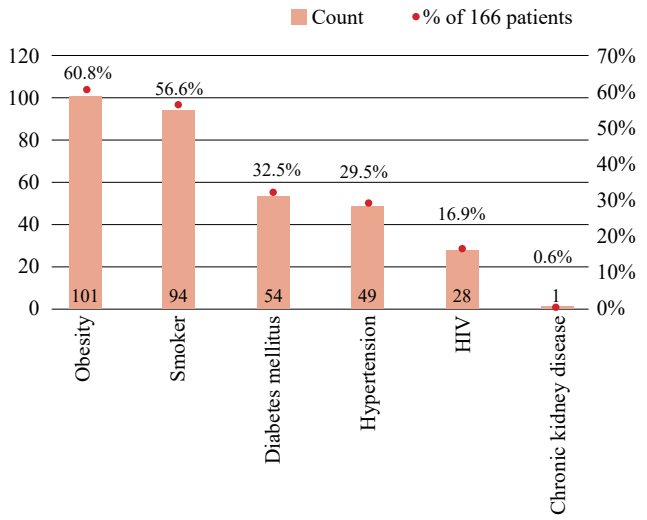

Figure 1: Distribution of comorbidities

hernia repair surgery was 52.6% (91/173) *vs*. 47.4% (82/173), respectively. Of the 15 patients who had surgery for a recurrent hernia, 13 had a previous open hernia repair (either ipsilateral or contralateral), and two had a previous laparoscopic hernia repair.

Most patients, 88.3% (166/188) in our study, had comorbidities. Overall, obesity was the most prevalent comorbidity identified in 60.8% (101/166) of the patients, while chronic kidney disease was the least common, affecting only one patient (Figure 1).

Characteristics of the surgery

All procedures were performed laparoscopically using the TEP approach. Polypropylene mesh was used to reinforce every hernia repair. Laparoscopic tackers were used to hold meshes in place during the TEP procedure. Most patients had elective surgery, 85.6% (161/188). The 11-year study period was split into two periods, i.e. 2010–2014 and 2015–2020. In 2015, the South African hernia guidelines were updated and recommended that laparoscopic repair be the management of choice for all inguinal hernias, including primary unilateral hernias.[17] Fourty-four laparoscopic hernia repairs were performed from 2010–2014, and 144 in the latter period between 2015 and 2020 (Table II). More patients in the latter period underwent laparoscopic unilateral hernia

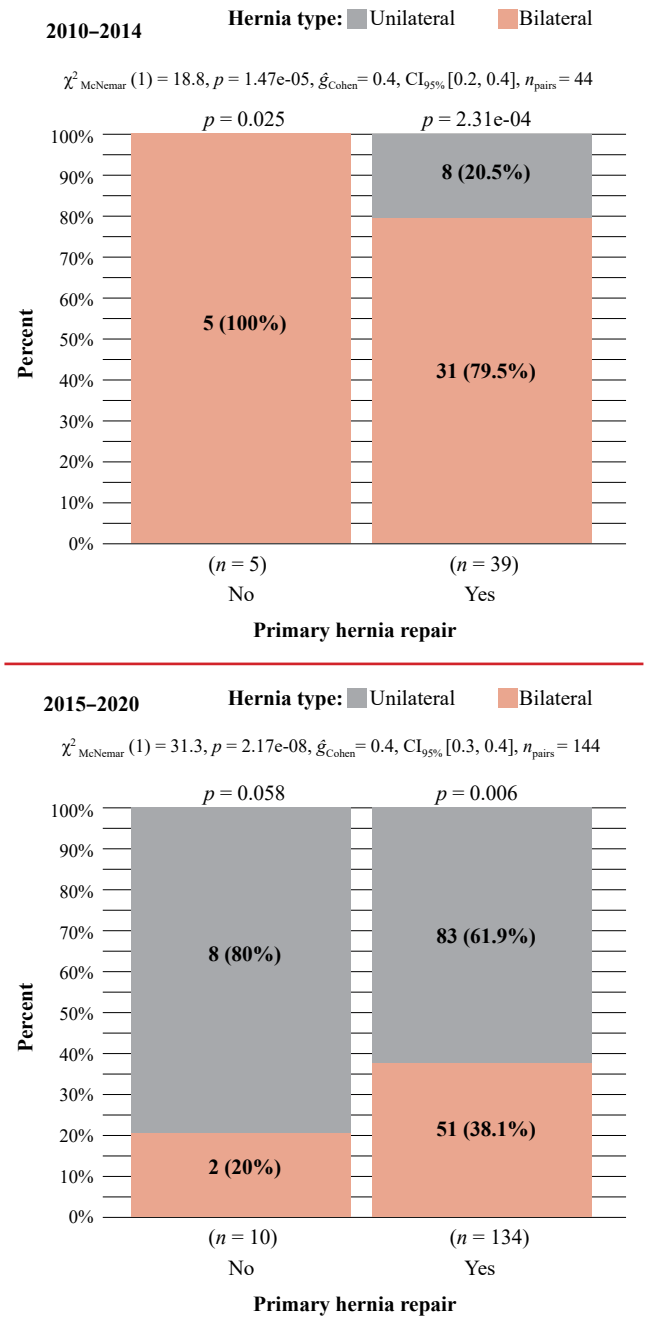

Figure 2: Distribution of primary hernia repairs by study period

Table II: Characteristics of the surgery by period

Period	2010–2014 (n = 44)	2015–2020 (n = 144)	p-value	Overall (n = 188)
Hernia type				
Unilateral	13 (29.5%)	91 (63.2%)	**< 0.001**	104 (55.3%)
Bilateral	31 (70.5%)	53 (36.8%)	**< 0.001**	84 (44.7%)
Surgery				
Laparoscopic	33 (75.0%)	129 (89.6%)	**0.046**	162 (86.2%)
Laparoscopic converted to open	11 (25.0%)	15 (10.4%)	**0.046**	26 (13.8%)
Operative time in minutes				
Median (Q1–Q3)	131 (108–148)	81.1 (70.0–102)	**< 0.001**	94.9 (73.1–117)
Days admitted				
Median (Q1–Q3)	2.00 (2.00–3.00)	2.00 (1.75–2.00)	0.076	2.00 (2.00–3.00)
Number of days before returning to work				
Median (Q1–Q3)	2.00 (2.00–3.00)	2.00 (2.00–3.50)	0.571	2.00 (2.00–3.00)

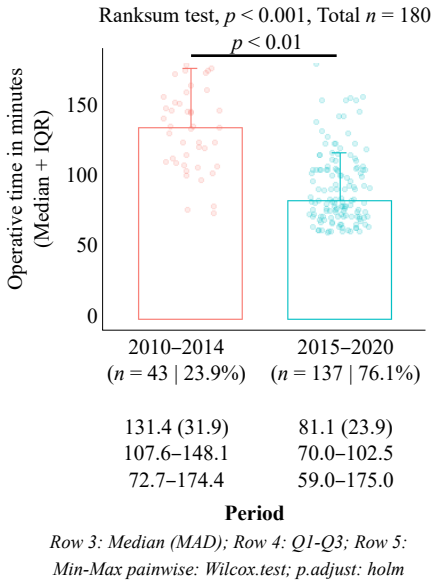

Figure 3: Duration of surgery by study period

repair; 63.2% (91/144) versus 29.5% (13/44) between 2010 and 2014, $p < 0.01$ (Table II).

Figure 2 shows that in the study period 2010–2014, there were more primary, bilateral hernia repairs compared to primary, unilateral hernia repairs: 79.5% versus 20.5%, respectively, $p < 0.001$. In contrast, between 2015 and 2020, more primary unilateral hernia repairs were performed compared to primary bilateral hernia repairs: 61.9% versus 38.1%, $p = 0.006$.

Twenty-six cases were converted to open surgery, resulting in an overall conversion rate of 13.8% (26/188) as shown in Table II. Reasons for conversion to open surgery were due to access-related issues brought on by bleeding (no major vessels were injured), loss of preperitoneal space, or adhesions from prior abdominal surgery. More conversions occurred in the earlier period compared to the latter: 25.0% (11/44) versus 10.4% (15/144), $p = 0.046$ (Table II). The median duration of the procedure was 94.9 minutes (IQR: 73–117 minutes). Figure 3 shows the duration of surgery by study period. The median operative time in the latter 6-year study period was shorter than the former: 81 minutes (IQR: 70–102) minutes versus 131 minutes (IQR: 108–148 minutes), $p < 0.01$.

The median length of the postoperative hospital stay was two days (IQR: 2–3 days), with a median return to work of two days (IQR: 2–3 days). The length of hospital stay and time to return to work were similar in both periods (Table II).

Postoperative outcomes

Table III summarises the postoperative complications experienced by patients within two weeks of the index surgery. Most patients (55.5%, 81/146 – missing information for 42 patients) did not experience any complications during the postoperative period. The reported postoperative complication rate at two weeks was 44.5% (65/146).

Regarding complications by period, 61.3% (19/31 – missing information for 13 patients) occurred in the first period (2010–2014) versus 40.0% (46/115 – missing information for 29 patients) in the period 2015–2020. However, the difference was not statistically significant. Among the 146 patients with complete data available in the two-week postoperative period, the median operative time in those who did not experience any complications versus those who did was 81 minutes (IQR: 70–102) *vs* 100 minutes (IQR: 74–121), respectively ($p = 0.028$).

Table III: Postoperative outcomes at two weeks post-surgery ($n = 146$)[a]

	Distribution (n, %)
No complications	81 (55.5%)
Postoperative pain	27 (18.5%)
Haematoma	21 (14.4%)
Seroma	13 (8.9%)
Wound sepsis	4 (2.7%)

[a]Missing information for 42 patients

At the end of the long-term follow-up period in 2024, 20.2% (38/188) were lost to follow-up (not contactable). Of the remaining 150 patients and/or their caregivers who were contactable, 88.7% (133/150) had no further complications. Four point seven per cent (7/150) had hernia recurrence; four recurrences occurred in the first year, two at two years, and one at three years postoperatively. Of the seven patients with hernia recurrence, two had no comorbidities; one was obese, and the other four had a combination of risk factors, such as smoking, diabetes mellitus, hypertension, obesity and previous abdominal surgery. Four per cent (6/150) of patients reported inguinodynia (all these patients were male, and one had re-do surgery). Two point seven per cent (4/150) had demised by the end of the study period in 2020; none of the deaths were related to the surgery.

Discussion

A retrospective clinical audit was conducted on all consecutive adult patients who had undergone a laparoscopic inguinal hernia repair between January 2010 and December 2020. One hundred and eighty-eight patients met the inclusion criteria from a single private surgical practice in Durban, KwaZulu-Natal, South Africa. The most common indication for surgery was primary unilateral hernia repair. A single surgeon performed all laparoscopic hernia repairs using the TEP method. Laparoscopic inguinal hernia repairs have been practised for more than 40 years but initially were not widely practised due to high rates of conversion (56%), recurrence (15–30%), and inguinodynia (25%); therefore, it became reserved as a procedure of choice in patients with recurrent inguinal hernias or bilateral primary inguinal hernia.[19,20] However, advancing laparoscopy skillset has led to declining complication rates. There was an update to the South African guidelines in 2015, resulting in a more widespread practice of laparoscopic hernia repairs, including primary unilateral hernias.[17] This change in practice is reflected in our study in Figure 2, where between 2015 and 2020, more primary unilateral hernia repairs were performed compared to primary bilateral hernia repairs; 61.9% versus 38.1%, $p = 0.006$.

Our study's overall conversion rate from laparoscopic to open surgery was 13.8%. It is interesting to note that more conversions occurred in the earlier period than the latter: 25.0% versus 10.4%, $p = 0.046$ and is likely related

to the surgeon's experience over time. The TEP procedure is known to have higher conversion rates than the TAPP procedure and is associated with a higher learning curve.[21] The reasons for conversion in this study were primarily due to difficult access related to loss of preperitoneal space, bleeding, or adhesions from previous abdominal surgery. These are common challenges associated with laparoscopic hernia repairs, with previous lower abdominal surgery being the most common risk factor.[21,22] Studies have shown conversion rates ranging from < 1% up to 7%, but these were multi-surgeon studies at varying levels of experience in laparoscopic hernia repairs.[20,21]

The median operative hernia repair time in this study was 94.9 minutes (IQR: 73–117 minutes). In a similar South African study, authors reported shorter mean operative times as 67.4 ± 27.2 minutes (IQR 45–80 minutes).[9] This could reflect the surgeon's experience and the complexity of the hernia repair.[9] Of note, over the 11-year study period, the median operative time in the latter 6-year study period (2015–2020) was shorter than the former (2010–2014), which could be explained by the increased case volume, improved surgeon proficiency and competence over time. Furthermore, the surgeon in our study has been in specialist practice for over 30 years, has attended advanced laparoscopic surgery courses both locally and internationally, and has received one-on-one training by a local proctor for laparoscopic hernia repairs.

Laparoscopic surgery has its advantages over open surgery as it lends itself to shorter recovery times, better cosmesis, and reduced postoperative pain.[23] This has led to laparoscopic hernia repair becoming the method of choice in many centres.[3,17] Our study showed a median length of postoperative hospital stay of two days and a median return to work of two days. Studies have shown that the TEP was associated with a length of hospital stay of one day and a return to work of three days.[24,25] While this suggests a generally rapid recovery, certain patients experienced more prolonged admissions in our study. This was because some patients were admitted under other medical or surgical disciplines before being referred to the surgeon for definitive management, which naturally extended their overall hospital stay. Also, in patients who were converted to open surgery or those who experienced complications, their postoperative hospital stay was longer.

Two weeks following the index surgery, a postoperative complication rate of 44.5% (65/146 – missing information for 42 patients) was observed. These included minor complications like pain, seromas, and hematomas. Regarding complications by period, 61.3% occurred in the first period (2010–2014) versus 40.0% in 2015–2020. However, the difference was not statistically significant and can be explained by the small sample size. In surgical practice, seroma formation is recognised as a complication that can be influenced by factors such as the surgical technique used, and the learning curve associated with new procedures.[15] Seroma rates have declined with increasing surgeon experience with the TEP technique.[26] We also noted a substantial variation in the duration of surgery between patients with postoperative complications (median 100 minutes) and those without (median 81 minutes, $p = 0.028$). This aligns with previous research, which indicates that more prolonged procedures are frequently linked to increased postoperative complications, especially in more complex cases or those requiring conversions to open surgery.[27]

In 2024, approximately 20% of patients in our study were not contactable (lost to follow-up). Regarding the long-term outcomes (among patients who were contactable), most patients, 88.7%, reported no ongoing concerns. The overall hernia recurrence rate was 4.7%, within the range reported in the literature.[3,15,17] A South African study by Moodie et al.[15] observed recurrence rates of 5.6%, and the HerniaSurge International Guidelines for Groin Hernia Management reported recurrence rates of between 0–16%.[3,15] At long-term follow-up in our study, 4.0% of patients complained of inguinodynia. Similar rates were found by Moodie et al.[15] of 3.2% and in the HerniaSurge International Guidelines for Groin Hernia Management of between 0.5–6%.[3]

The limitations identified in this study include its retrospective nature and the fact that, with telephonic follow-up, a substantial number of patients were not contactable. Due to the low number of hernia recurrences reported, we could not report on the associations between risk factors and hernia recurrence in this study. It is a single-centre study with a relatively small sample size, with predominantly male patients, thus limiting the generalisability of findings. This study utilised a single surgeon cohort, which adds to the strength of this study as it lends itself to a clearer understanding of how individual experience impacts patient outcomes, a key differentiator from most studies analysing multi-surgeon data sets. It also aids in a better understanding of the learning curve, which varies from study to study (about 20–100 cases) to achieve acceptable outcomes.[15] Other strengths of this study include the longitudinal data collection over 11 years, focusing on outcomes following laparoscopic repairs for primary and recurrent hernias.

Conclusion

This study provides valuable insights into laparoscopic hernia repair performed by a single surgeon over an 11-year period. Findings showed that laparoscopic inguinal hernia repair, even for primary cases, is feasible with shorter operative times and a low proportion of complications and hernia recurrence when performed by an experienced surgeon. The findings support the adoption of laparoscopic techniques as a primary option for inguinal hernia repair according to international best practices. Despite its limitations, this study provides valuable insight into the benefits and outcomes of laparoscopic repair in South Africa. Furthermore, it is recommended that surgeons participate in the HIGSA registry. This initiative will allow for systematic documentation and follow-up of hernia surgeries nationwide, fostering collaboration and expanding hernia surgery research in sub-Saharan Africa. The era of robotic surgery is on the rise, which may lead to further research into the outcomes and cost-effectiveness of laparoscopic and robotic inguinal hernia repair. Further qualitative studies should evaluate patient satisfaction after laparoscopic inguinal hernia repair.

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Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

The study was approved by the Biomedical Research Ethics Committee of the University of KwaZulu-Natal, South Africa (BREC/00005605/2023). Patients contacted telephonically were informed about the study and provided verbal consent for participation.

Declaration of the use of generative AI and AI-assisted technologies in the writing process

No Generative AI and AI-assisted technologies were used during the preparation of this work.

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