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REVIEW

Does quality of life improve after complex incisional hernia repair? A systematic review

D. L. C. de Jong[1,2] · J. A. Wegdam[2] · E. H. M. Berkvens[2] · T. S. de Vries Reilingh[2] · S. W. Nienhuijs[1]

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Abstract

Introduction Health-related quality of life (QoL) is an essential patient-reported outcome in abdominal wall surgery. The aim of this systematic review was to evaluate short term outcome of QoL after complex incisional hernia repair (IHR), focusing on open surgery.

Methods A multi-database systematic search was performed on patients treated for complex IHR. Studies evaluating the outcome in terms of QoL using validated questionnaires, at least three months postoperatively, were included. The methodology was graded, and patients' operative and outcome details were extracted.

Results Seven studies were included, encompassing 729 patients, all of whom underwent an open approach. A significant increase in QoL was found in all types of questionnaires (Short Form-36 (SF-36), Carolinas Comfort Scale, Hernia Related QoL, and Numeric Rating Scale). SF-36 was used most frequently. A pooled standardized mean difference (SMD) of 0.70 (95% CI: 0.08–1.47 $p < 0.00001$) was yielded, indicating a moderate to large effect of the intervention compared to preoperative scores.

Conclusion A limited number of studies have included QoL measurement after incisional hernia repair. In all studies, a significant increase was seen in QoL postoperatively. This review highlights the substantial benefits of open surgery in improving QoL, while emphasizing the need for further research to standardize outcome measurement and explore long-term results.

Keywords Quality of Life · Abdominal Wall Surgery · Patient reported outcomes · incisional hernia repair

Introduction

An incisional hernia impairs abdominal wall function to varying degrees, depending on size and location of the defect. As a consequence, a range of physical and emotional factors, including pain, limited mobility, gastrointestinal issues, cosmetic concerns, psychological stress, and anxiety about potential complications may lead to a reduced quality of life (QoL) in a patient [1–6]. Surgically restoring the abdominal wall anatomy and function prevents strangulation of hernia contents and enhances truncal stability, both improving QoL [6–8]. Given the fact that a patients' primary goal of a surgical intervention for any incisional hernia is ultimately improving one's quality of life, this outcome measurement requires more attention [9, 10].

While traditional clinical measures like complication and recurrence rates are the most commonly reported outcome measurements after IHR, these metrics fail to fully capture patients subjective experience [9, 11, 12]. Although some authors have already documented IHR to be beneficial in terms of QoL, variations in measurement instruments and surgical techniques still lead to inconsistent evidence due to non-comparability of questionnaires, patients' groups and surgical techniques [12]. Due to large heterogeneity of available instruments, determination or standardization of instruments is preferred [13]. Therefore, recent hernia guidelines unambiguously highlighted the need of more argumentative research for QoL after incisional hernia repair in terms of the abovementioned categories [14].

QoL after IHR is assessed with patient-reported outcome measures (PROMs) mostly described by questionnaires. Two frequently used *general* health surveys that evaluate overall physical and mental health and depict a

✉ D. L. C. de Jong
dite.d.jong@catharinaziekenhuis.nl

1 Department of Surgery, Elkerliek Hospital, Helmond, The Netherlands

2 Department of Surgery, Catharina Hospital, Eindhoven, The Netherlands

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broad view of patient's well-being and functioning in daily life, are the Short-Form 36 (SF-36) and EQ-5D-5L [15, 16]. Two commonly used *hernia-specific* health surveys that measures discomfort, pain, physical function, emotional distress, caused by the hernia during rest, movement and daily activities, are the Hernia-Related Quality of Life Survey (HerQLes), and The Carolinas Comfort Scale (CCS) [13, 17]. Other available questionnaires encompass the Ventral Hernia Pain Questionnaire (VHPQ) and the Activities Assessment Scale (AAS), and the EuraHS QoL [13, 14, 18]. These health surveys should be applied at well-defined points in time before and after IHR to ensure that evidence remains consistent and that all results are interpreted uniformly [8, 19].

As mentioned before, incisional hernia can reduce QoL due to pain, mobility issues, and psychological stress. While IHR aims to enhance QoL, current studies often rely on complication and recurrence rates, which overlook patients' subjective experiences. Inconsistent measurement tools and techniques further complicate the evidence proving an increase in QoL after IHR, revealing a significant gap in standardized, patient-centered QoL data.

When comparing techniques, it could be hypothesized that laparoscopic surgery promotes recovery and body image due to minimally invasive scars, which might suggest that PROMs improve more significantly after laparoscopic surgery, when compared to open surgery. However, open surgery might be more beneficial in more complex cases, due to an increased liberty in the form of intraoperative visualization [15]. However, recent literature does not support a conclusion on differences between open and laparoscopic surgery [20].

The aim of this systematic review was to assess the improvements in quality of life (QoL) in patients undergoing elective incisional hernia (IH) mesh repair within one year post-surgery.

Methods

A systematic literature search was conducted under the guidance of a medical librarian, covering PubMed, EMBASE, and Cochrane Library from January 1st, 2000, to October 1st, 2024. Terms for "incisional hernia" and "patient-reported outcomes" were combined, including both MeSH and free-text terms (detailed search terms in Appendices).

Additionally, reference lists were manually reviewed to identify any missed studies. Inclusion and exclusion criteria were predefined, and duplicate records were removed. Two authors independently screened, selected, and reviewed studies, with consensus discussions held for final inclusions. For quality assessment, the MINORS criteria were used for non-randomized studies, and the Cochrane Risk of Bias Tool for randomized studies. A third reviewer resolved any disagreements.

Data extraction

Selection criteria for inclusions were patients with complex hernias (e.g., defects > 10 cm, patient risk factors, recurrent hernias, large loss of domain, infection or contamination in the surgical field) undergoing open or laparoscopic IHR [21]. Studies evaluating outcomes solely for laparoscopic procedures or including mixed groups without separate data for open repair were excluded. Additionally, studies reporting only pre- or postoperative data were excluded. Data extracted included study design, sample size, hernia size, surgical technique, follow-up period, PROMs, and outcome measures, following PRISMA guidelines. All efforts were taken to contact authors, when information was missing. Data was extracted for QoL measurement instruments.

Data analysis

The methodical heterogeneity of the studies was examined, regarding the measure of PROM used, and the outcomes of the specific PROM metric used. All continuous data was reported by a mean, together with standard deviation (SD).

A meta-analysis was conducted to synthesize the results. Effects sizes were pooled using a random-effects model to account for heterogeneity, and the summary statistic was a pooled standardized mean difference (SMD). Statistical analyses, including tests for heterogeneity (I^2 statistic) were performed to evaluate consistency across studies, using RevMan (Cochrane, 5.4.1, 2020) due to the expected likelihood in methodological differences. Heterogeneity was assessed using Chi^2. A p-value of < 0.05 was considered statistically significant.

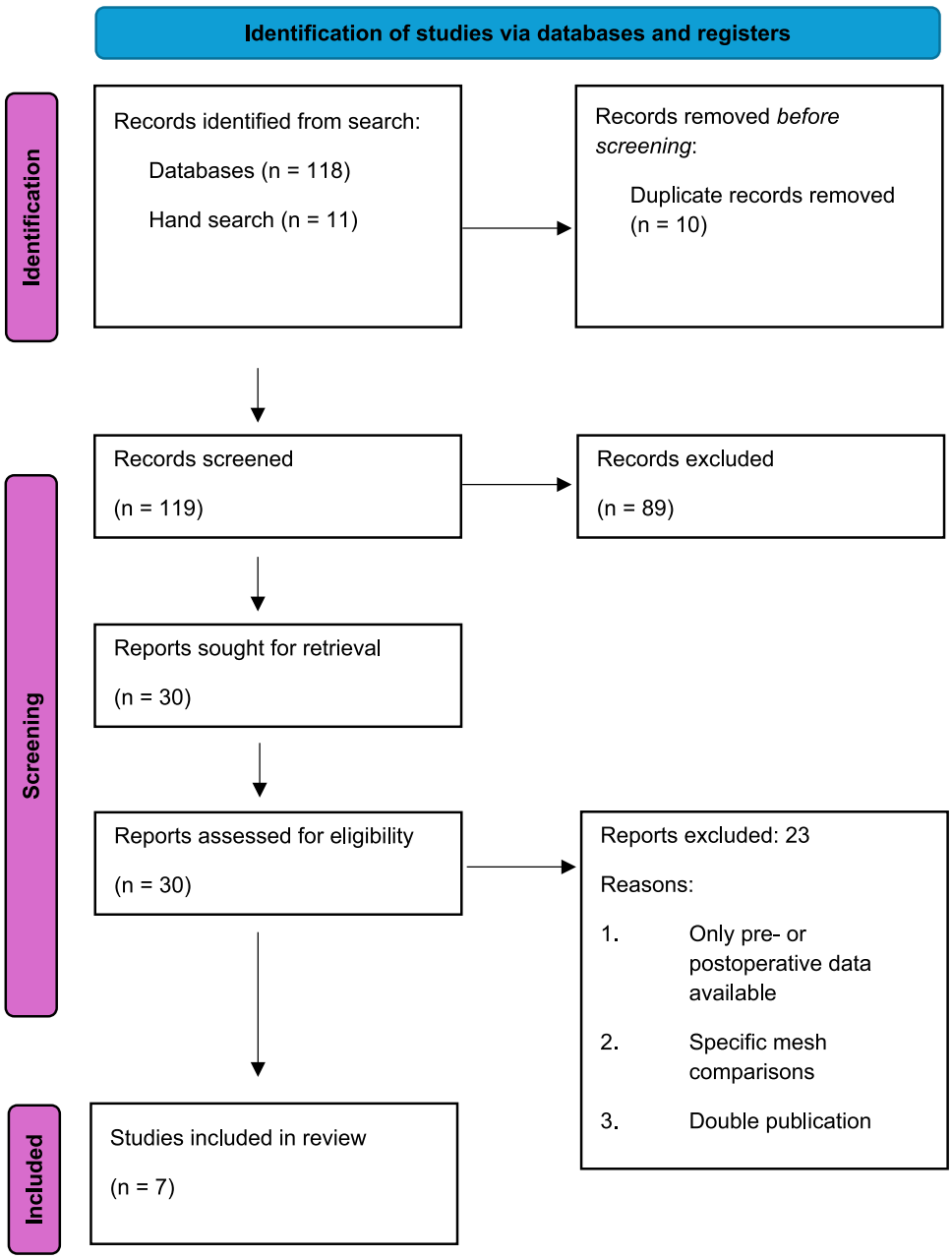
Results

The systematic search yielded 118 articles, with an additional 11 identified through hand searching, as detailed in Fig. 1. After screening, seven articles met the selection criteria and were agreed upon by all reviewers for final analysis [3, 8, 13, 19–21].

Characteristics

Among the included articles, two were prospective, and five were retrospective studies, encompassing a total of 729 patients who underwent open incisional hernia repair (Table 1). All studies included both male and female participants. Five studies described specific hernia size, ranging

Fig. 1 Flowchart of inclusions



from 138.5cm^2 to 300cm^2. One study described the inclusions of large hernias, but not the exact size. Another study did not mention hernia size. Studies that included laparoscopic procedures or mixed groups without separate data for open repair were excluded from analysis.

Study quality and risk of bias assessment

The Minors score for the non-comparative study was median 11 out of maximum 16 points and median 17 (range 15–24) for the four comparative studies out of maximum 24, both indicating good study quality (Table 2).

The Cochrane Risk of Bias Tool showed low concerns for bias in both prospective studies (Table 3).

Quality of life assessment tools

There was clinical heterogeneity in the tools for assessment of QoL throughout the included articles. QoL was measured using SF-36 in 337 patients, the Carolinas Comfort Scale in 381 patients, and the EQ-5D-3L in 233 patients. Additional tools included the Hernia-Related Quality of Life Survey in 91 patients, and EuraHS QoL, also used in 91 patients. One study utilized an NRS for pain classification in 142 patients. QoL data were described after

six months in three studies and after twelve months in four studies.

Outcome measures

The SF-36, used in most studies, showed statistically significant improvements across all domains post-surgery ($p < 0.0001$). Improvements were particularly notable in role physical, general health, and role emotional domains (Table 4).

Other QoL instruments, including EQ-5D-3L, HerQLes, EuraHS QoL, and CCS, reported significant improvements in pain reduction, activity limitation, and mesh sensation, with p-values < 0.0001. The CCS specifically showed significant improvements in pain ($p = 0.0004$) and activity limitation ($p = 0.0001$) (Table 5).

Overall effect size

The meta-analysis included 7 studies, all focused on open procedures, yielding a pooled standardized mean difference (SMD) of 0.70 (95% CI: 0.13 to 1.30, $p < 0.04$), indicating a moderate to large effect of the intervention compared to the preoperative values group (Fig. 2).

The I^2 test showed a heterogeneity of 96%, indicating a high level of heterogeneity in the meta-analysis.

Discussion

QoL after IHR is an important indicator of surgical success [5]. This study demonstrates that IHR positively affects multiple QoL aspects for patients. By excluding laparoscopic procedures, the analysis focuses solely on open procedures, providing a clearer understanding of their impact. The observed improvements in physical, emotional, and general health domains underscore the effectiveness of open surgery in restoring patients' QoL.

A variety of validated QoL instruments were employed across the studies, such as the SF-36 and CCS. While the heterogeneity of tools introduces some variability, consistent improvements were observed regardless of the instrument used. The pooled standardized mean difference (SMD) of 0.70 highlights the moderate to large effect of open IHR on QoL outcomes.

Questionnaires

While this study identified several validated QoL tools, including SF-36, EQ-5D, CCS, and HerQLes, the heterogeneity in their application across studies complicates direct comparisons. Generic QoL questionnaires, like SF-36 and EQ-5D, provide a broad overview of patient well-being but may fail to capture specific hernia-related complaints, such as mesh sensation or abdominal function. Hernia-specific PROMs like CCS and HerQLes focus more on symptoms directly impacted by IHR, such as pain and mobility limitations, allowing for a tailored approach to hernia care. The inconsistency in assessment methods suggests the need for standardized PROMs in future research. [16].

The difficulty of comparing QoL outcomes across studies is compounded by the use of different surveys that measure distinct aspects of patient well-being. While a universal QoL survey for hernia repair would streamline comparisons and enhance consistency, it must strike a balance between capturing generic health outcomes and addressing hernia-specific concerns. Developing such a tool, endorsed by international hernia societies, would greatly benefit future research and clinical practice.

Time of measurement

There is no ideal time to measure QoL after surgery, as each period provides different insights [14]. The early postoperative period (1–3 months) captures immediate recovery factors, including pain, mobility and satisfaction, but also complications. This is important for acute recovery. The intermediate period (6–12 months) shows the ongoing effect of surgery: pain, functional outcome and psychological effects tend to stabilize in this period. Moreover, effectiveness of the hernia repair and sustained relief from preoperative symptoms can be measured. Recurrence is best measured in a later stadium, 1–5 years postoperatively. The studies included in this meta-analysis all provided data from the intermediate period (6–12 months), deliberately excluding patients in the acute recovery phase to focus on sustained QoL outcomes. Recurrence data, critical for long-term outcomes, was not uniformly addressed in the included studies, which represents a notable gap in the current evidence base.

Limitations

This study has several limitations that impact the strength of its conclusions. First, the high heterogeneity ($I^2 = 96\%$) in the meta-analysis indicates significant variability among the included studies, complicating direct comparisons. Furthermore, the small number of high-quality prospective studies included limits the strength of the findings, underscoring the need for more robust research on QoL following IHR. A significant number of the studies do not focus specifically on complex hernias, resulting in the exclusion of many articles from the initial search. The decision was made to focus exclusively on complex hernias, as the quality of life in these patients may be notably impacted by factors such as multiple surgeries, reduced trust in healthcare, and a sense of losing control over their own condition [22].

Additionally, the variation in QoL assessment tools across studies complicates direct comparisons. While generic tools like the SF-36 offer a broad overview of patient well-being, they may not capture specific hernia-related concerns, such as mesh sensation or abdominal function. In contrast, hernia-specific tools focus more on symptoms directly impacted by IHR, including pain and mobility limitations [13]. This inconsistency in assessment methods suggests that using hernia-specific PROMs is critical, as using solely generic questionnaires, may fail to reveal differences in QoL outcomes between surgical techniques [3]. Despite these limitations, this study maintains a high level of quality by focusing on a more homogenous patient group, allowing for a clearer understanding of QoL outcomes specific to IHR. By addressing this gap, a solid foundation was provided for future research to build upon, encouraging more standardized and patient-centered approaches in assessing QoL following hernia repair.

Future perspectives

This work establishes a starting point for further studies to explore the nuances of surgical technique and patient experience, ultimately enhancing the evidence base for improving PROMs in abdominal wall hernia repair. Additionally, exploring the psychological impact of hernia surgery—such as anxiety, depression, and body image concerns—could provide valuable insights into how these factors influence overall QoL [13, 16]. In conclusion, this review highlights that IHR significantly improves QoL for patients. Future studies focusing on patient-centered outcomes will be essential for optimizing surgical decision-making and tailoring approaches to enhance patient well-being.

Appendix 1.1- Searches

PubMed search

Date: October 1st, 2024

(((((((((("Incisional Hernia"[Mesh]) OR ("Hernia, Abdominal"[Mesh:NoExp])) OR ("Hernia, Ventral"[Mesh])) OR (Incisional hernia*[Title/Abstract])) OR (Postoperative hernia*[Title/Abstract])) OR (Abdominal hernia*[Title/Abstract])) OR (Ventral hernia*[Title/Abstract])) AND (("Postoperative Period"[Mesh:NoExp]) OR (Postoperative period[Title/Abstract]))) AND (("Quality of Life"[Mesh]) OR ((((Life quality[Title/Abstract]) OR (Health-Related Quality Of Life[Title/Abstract])) OR (Health Related Quality Of Life[Title/Abstract])) OR (HRQOL[Title/Abstract])))) AND ((("Quality of Life"[Mesh]) OR ((((Life quality[Title/Abstract]) OR (Health-Related Quality Of Life[Title/Abstract])) OR (Health Related Quality Of Life[Title/Abstract])) OR (HRQOL[Title/Abstract])))) OR (("Surveys and Questionnaires"[Mesh]) OR ((((Questionnaires[Title/Abstract] AND Surveys[Title/Abstract]) OR (Survey Method*[Title/Abstract])) OR (survey*[Title/Abstract])) OR (Questionnaire*[Title/Abstract]))))

Cochrane search

Date: October 1st, 2024

#1MeSH descriptor: [Incisional Hernia] 1 tree(s) exploded 285

#2MeSH descriptor: [Hernia, Ventral] this term only 419

#3MeSH descriptor: [Hernia, Abdominal] this term only 89

#4(Ventral hernia): ti, ab, kw 714

#5(Abdominal hernia): ti, ab,kw 1797

#6(Incisional hernia): ti, ab,kw 1069

#7 #1 OR #2 OR #3 OR #4 OR #5 OR #6 2374

#8MeSH descriptor: [Postoperative Period] explode all trees 7520

#9(Postoperative period): ti,ab,kw 40964

#10 #8 OR #9 42092

#11MeSH descriptor: [Quality of Life] explode all trees 43422

#12(Quality of life): ti,ab,kw 166771

#13(Health-related quality of life): ti,ab,kw 24963

#14MeSH descriptor: [Patient Reported Outcome Measures] explode all trees 1767

#15(Patient reported outcome measures): ti,ab,kw 14441

#16(PROM): ti,ab,kw 1075

#17(Health related quality of life): ti,ab,kw 35889

#18 #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 176277

#19MeSH descriptor: [Surveys and Questionnaires] explode all trees 77482

#20(Questionnaire): ti,ab,kw 147287

#21(Survey): ti,ab,kw 40935

#22 #19 OR #20 OR #21 227831

#23 #7 AND #10 AND #18 AND #22 26

EMBASE search

Date: October 1st, 2024

Search for: (exp Hernia, Ventral/ or Hernia, Ventral.mp. or (exp Incisional Hernia/ or Incisional Hernia.mp.) or (exp Hernia, Abdominal/ or Hernia, Abdominal.mp.)) and (exp Postoperative Period/ or Postoperative Period.mp.) and (exp "Quality of Life"/ or "Quality of Life".mp.) and (exp "Surveys and Questionnaires"/ or "Surveys and Questionnaires".mp. or (exp Patient Reported Outcome Measures/ or Patient Reported Outcome Measures.mp.))

Appendix 2 Figures and Tables

See Fig. 2 and Tables 1, 2, 3, 4, 5.

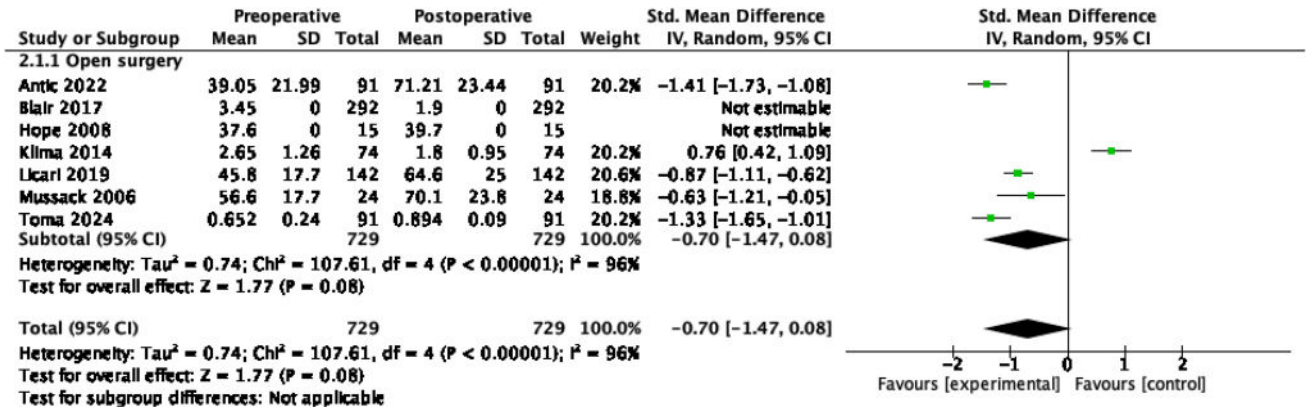


Fig. 2 Forest plot of total effect size

Table 1 Characteristics of the included studies

Study	Year	Study design	Number of patients	Open surgery (%)	Laparoscopic surgery (%)	Follow up time (months)	Hernia size, cm2, mean (range or SD)	BMI, kg/m2, median (range or SD)	Outcome measures	Questionnaire used
Licari et al. [29]	2019	RC	142	142 (100)	0 (0)	6	138.5 + 2.63	29 + 3.74	QoL, pain	SF-36, NRS
Mussack et al. [30]	2006	Matched con	48	24 (50)	24 (50)	12	135 (45-105(	32 (21-44)	QoL	SF-36
Antic et al. [13]	2022	PR	91	91 (100)	0 (0)	6	11.7+8.4	26.4 + 5.9	QoL	SF-36, EQ5D3L, HerQLES, EuraHS QoL
Blair et al. [31]	2017	RC	292	292 (100)	0 (0)	12	291.2 + 236.2	34 + 7.9	QoL	CCS
Klima et al. [6]	2014	RC	74	74 (100)	0 (0)	12	300 + 183.5	33.5 + 8	QoL	CCS
Hope et al. [32]	2008	RC	56	15 (27)	41 (73)	6	-	-	QoL	SF-36, CCS
Toma et al [5]	2024	PC	91	91 (100)	0 (0)	12	-	12.6 + 6.88 (3	QoL	EQ5D

BMI: Body Mass Index, QoL: Quality of Life, SF-36: Short-From-36, NRS: numeric rating scale, HerQLes: Hernia related Quality of Life, CCS: Carolinas Comfort Scale
RD: retrospective cohort, PD: prospective cohort, PR: prospective randomized

Table 2 Study quality grading according to the MINORS criteria

Study	Year	1	2	3	4	5	6	7	8	9	10	11	12	MINORS score
Licari et al. [29]	2019	2	2	2	2	0	2	1	0	N/A	N/A	N/A	N/A	11
Mussack et al. [30]	2006	2	0	1	2	0	2	0	0	2	2	2	2	15
Blair et al. [31]	2017	2	1	2	2	1	2	0	0	2	2	1	2	17
Klima et al. [6]	2014	2	2	2	2	2	2	0	0	2	2	2	2	20
Hope et al. [32]	2008	2	1	2	2	0	2	0	0	2	2	2	2	17
Toma et al. [5]	2024	2	2	2	2	2	2	2	2	2	2	2	2	24

MINORS: methodological index for non-randomized studies

Table 3 Study quality grading according to the Cochrane Risk of Bias Tool for randomized studies

Study	Year	Risk of bias from randomization process	Risk of bias due to effect of assignment	Risk of bias due to effect of adherence	Missing outcome data	Risk of bias in measurement of the outcome	Risk of bias in selection of the reported result	Overall risk of bias
Antic et al. [13]	2022	Low	Some concer	Some concer	Low	Some concer	Low	Some concer

Table 4 SF-36 comparison pre- and postoperatively

Outcome	Studies (n)	Participants (n)	Effect estimate (MD, 95%-CI)	p
Physical functioning	4	337	-29.06 [-43.19, -14.93]	**<0.0001**
Role physical	4	337	-35.21 [-59.90, -10.51]	**0.005**
Bodily pain	4	337	-25.30 [-61.23, 10.62]	0.17
General health	4	337	-17.92 [-29.18, -6.65]	**0.002**
Vitality	4	337	-11.47 [-22.05, -0.89]	**0.03**
Social functioning	4	337	-29.73 [-33.24, -26.21]	**<0.0001**
Role emotional	4	337	-35.66 [-59.86, -11.46]	**<0.0001**
Mental health	4	337	2.40 [-4.12, 8.92]	0.47

Table 5 Other quality of life questionnaires

Outcome	Studies (n)	Participants (n)	Total effect estimate (MD, 95%-CI)	p
NRS	1	91	-0.29 [-0.98, 0.40]	0.41
EQ5D	1	233	-0.29 [-0.33, -0.25]	**<0.00001**
HerQles	1	142	-23.10 [-25.72, -20.48]	**<0.00001**
EuraHS	1	142	33.70 [29.42, 37.98]	**<0.00001**
CCS-P	2	443	0.59 [0.27, 0.91]	**0.0004**
CCS-AL	2	443	0.64 [0.32, 0.96]	**0.0001**
CCS-MS	2	406	Not estimable	**NA**

NRS: numeric rating scale, EQ5D: Euro Quality of Life Five Dimensions, HerQles: Hernia related quality of life, EuraHS: European Hernia Society Quality of Life, CCS-P: Carolinas Comfort Scale Pain, CCS-AL: Carolinas Comfort Scale Activity Limitation, CCS-MS: Carolinas Comfort Scale Mesh Sensation

Data availability The data that support the findings of this study are available from the corresponding author.

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