

ORIGINAL ARTICLE

Single-Incision Laparoscopic Appendectomy in Children – An Insight to the Postoperative Quality of Life in Yogyakarta Academic Hospital

Euginia Junitha¹, Khazaini Azmi Nabila¹, Dean Batrisha¹, Eko Purnomo²

¹ University of Gadjah Mada, Faculty of Medicine, Public Health and Nursing, 55281, Yogyakarta, Indonesia

² Pediatric Surgery Study Program, Surgery Department, Faculty of Medicine, Public Health and Nursing - Academic Hospital University of Gadjah Mada, 55281, Yogyakarta, Indonesia

ABSTRACT

Introduction: Single-incision laparoscopic Surgery (SILS) marks an advancement in minimally invasive surgical techniques by utilizing a single access point through the umbilicus. However, few studies in Indonesia focus specifically on the pediatric population, thus the use of a quality-of-life questionnaire such as SF-36 is necessary to assess the surgical outcomes. The aim of this study was to assess the postoperative quality of life in pediatric patients following SILA. **Methods:** In October 2024, an online cross-sectional survey was conducted involving parents at an academic hospital in Yogyakarta between September 2022 and May 2024 using the SF-36 questionnaire. Demographic variables such as age, sex, follow-up interval, and the QoL scores per SF-36 domain were assessed. Univariate analysis was conducted for these demographic variables to the SF-36 Overall score using T-test. **Results:** Out of 46 patients, 29 were enrolled, predominantly male (57.9%), with a mean age of 10.26 years (95% CI: 7.76–12.76). Most cases were uncomplicated appendicitis (66.7%). The results showed high median scores in physical functioning and emotional well-being, while social functioning and pain had lower median scores. Boys exhibited higher overall SF-36 scores than girls, and longer follow-up durations correlated with better QoL scores. No statistically significant differences in SF-36 scores were found based on age or appendicitis classification. **Conclusion:** Patients' QOL post-SILA resulted in high scores across all SF-36 domains and high satisfaction. Males and follow-up duration of ≥ 13 months showed a trend of higher SF-36 score.

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Corresponding Author:

Euginia Junitha, MD

Email: euginiajunitha@mail.ugm.ac.id

Tel : +62 822 6615 9858

INTRODUCTION

SILS appendectomy is gaining a prominent spotlight as a minimally invasive surgery technique due to its potential benefits over traditional multi-port procedures and open surgeries. The primary advantage of SILS compared to standard laparoscopic surgery lies in its cosmetic outcomes, as the procedure can result in nearly scarless incisions when the incision is concealed within the umbilicus. With only a single incision, the risk of complications, such as port-site hernias, hematomas, and wound infections, is reduced (1). SILS requires a more technically demanding approach, which surgeons must consider before choosing this method.

A key factor in determining surgery success is the patient's quality of life. Evaluating QOL following SILS

appendectomy in pediatric patients can provide insights into recovery in terms of general health, physical functioning, and emotional well-being. Improved QOL may validate SILS as a preferred approach, guiding surgical practices and informing pre- and post-operative care strategies for this demographic.

The present study aims to evaluate the quality-of-life outcomes in pediatric patients following SILS appendectomy by examining key dimensions such as physical functioning, emotional well-being, and overall satisfaction post-surgery.

MATERIALS AND METHODS

This cross-sectional study aimed to assess quality of life and postoperative satisfaction for pediatric patients with a history of SILS procedure between September 2022 and May 2024 in the Universitas Gadjah Mada Academic Hospital in Yogyakarta, Indonesia. This study has been approved by the Medical and Health Research Ethics Committee (MHREC) Faculty of Medicine Public

Health and Nursing Universitas Gadjah Mada under the ref no. KE/FK/0047/EC/2025. Parents were contacted prior to the study and received a clear explanation of the research's purpose before the survey session. The study population included those who provided consent and patients aged <18 years old with a history of SILS procedure, while those outside this age range and did not consent were excluded. Patients whose surgical approach was modified from single-incision laparoscopic surgery (SILA) to open laparotomy were excluded from this study.

All 46 parents of qualifying patients were reached out to through phone calls and emails with invitations to participate in the study. A total of twenty-nine parents (63% response rate) finished the online SF-36 survey. The online format enhanced access for families with follow-up durations longer than 12 months after surgery. To evaluate possible non-response bias, we performed a sensitivity analysis contrasting the entire cohort (n=29, mean SF-36 score 81.3) with respondents who had extended follow-up (>12 months, n=15, mean 82.1). The quality-of-life ratings stayed consistently elevated in both groups, indicating a negligible effect from those who did not respond

Data regarding the diagnosis and appendicitis grading for each participant were retrieved from the medical record and classified into uncomplicated or complicated appendicitis according to the WSES grading system (2). Grade 0 and 1 account for non-complicated cases, while Grades 2 to 4 are considered complicated. If the medical record does not specify the grading, it is determined based on the surgical report and histopathological results. Age, sex, duration of surgery, and length of hospital stay were also retrieved from the medical records and assessed as demographic characteristics.

Follow-up period varied from 7 to 23 months, with a median of 13 months (interquartile range: 7-23 months). Patients were categorized into two groups based on this median value: shorter follow-up (<13 months) and longer follow-up (\geq 13 months). This categorization enabled us to investigate if the duration since surgery affected the quality-of-life scores reported by parents on the SF-36 questionnaire. The median split technique is a commonly used exploratory method in medical research when there is no recognized clinical threshold for the outcome of interest. For a sensitivity analysis, we examined different groupings with tertiles (thirds of follow-up duration) and observed consistent trends showing higher scores in the longer follow-up group at all evaluated cutoffs. This approach increases confidence in the robustness of our findings despite the lack of a pre-specified clinical threshold.

This study used the SF 36 questionnaire, a health-related quality of life survey tool with 36 questions assessing 9 domains: physical functioning (PF), Role limitations due

to physical health (RP), Role limitations due to emotional problems (RE), Energy/fatigue (Vitality - VT), Emotional well-being (Mental Health - MH), Social functioning (SF), Pain (Bodily Pain - BP), general health (GH), and Health change (HC). This tool uses a Likert scale with each domain's total score ranging from 0-100. The developers provided cut-off points derived from studies utilizing this tool, which we use in the study. SF-36. Overall SF-36 scores were calculated by averaging the nine domain scores of SF-36, which included the health change category. This total score serves as a composite measure created for study-specific descriptive and exploratory needs and is not aligned with a validated standard SF-36 summary score.

Parents filled out the SF-36 questionnaire for their kids. This parent-report methodology is substantiated for pediatric application, as demonstrated by Landgraf et al., 1998 and additional studies (14). There are Indonesian population norms for the SF-36 that can be used for comparison. Pediatric-specific quality-of-life tools like PedsQL were considered but deemed unsuitable due to the lack of a validated Bahasa Indonesia version at the time of this study.

Descriptive statistics were displayed as mean, median, and proportions. Subsequent grouping for high or low category in the domains of SF-36 was done following the cut-off point as provided by the test developers (3). Demographic variables are then assessed with each domain category with either T-test or Mann-Whitney test followed by binary logistic regression for statistically significant findings ($P < 0.05$). All analyses were performed with IBM SPSS Statistics version 26 (IBM Corp.).

We used t-tests and Mann-Whitney U tests to compare demographic factors with SF-36 scores. Since we tested multiple variables, we applied a Bonferroni correction (dividing 0.05 by 4 comparisons = 0.0125). The sex difference changed from $p = 0.038$ to non-significant, and the follow-up difference changed from $p = 0.049$ to non-significant. These are now reported as trends rather than significant findings. Effect sizes were also calculated to show the practical importance of these trends.

RESULTS

A total of 46 patients were screened for eligibility. A flowchart of the patient selection process is provided in Figure 1. Among the 29 patients enrolled, a slight male predominance was observed (57.9%). The mean age of respondents at the time of the procedure was 10.26 years (95% CI: 7.76–12.76), with a median follow-up period of 13 months. Most of the respondents did not report complicated appendicitis cases (66.7%) (Table I).

Survey domain scores revealed that the highest median scores were in physical functioning (median: 100, range

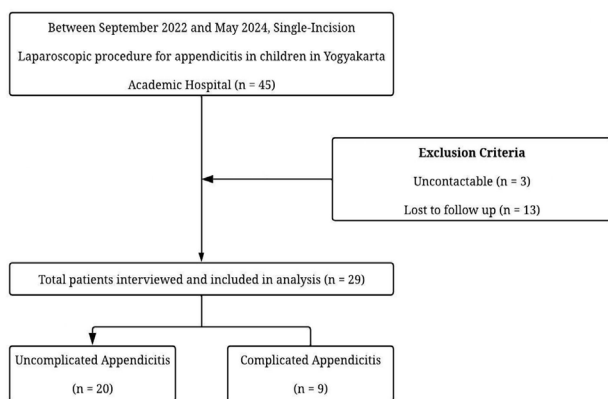


Figure 1: Flowchart of the participant selection process

Table I: Demographic characteristics of included patients

Demographic characteristics	Numbers
Age on Operation	10 (1-17) years
Sex	
Male	12 (58.5%)
Female	17 (41.4%)
Follow up duration	13 (7-23)
Type of appendicitis	
Complicated	9 (30%)
Uncomplicated	20 (66.7%)
SF-36	
Physical functioning	100 (6-100)
Role limitations due to physical health	100 (50-100)
Role limitations due to emotional problems	100 (0-100)
Energy/fatigue	73.97 (CI 95%: 67.39 - 80.19)
Emotional well-being	73.79 (CI 95%: 67.3 - 80.19)
Social functioning	75 (38-100)
Pain	75 (0-100)
General health	79.48 (CI 95%: 73.40-85.57)
Health change	100 (25-100)
SF-36 Overall Score	81.61 (CI 95%: 77.75-85.47)
Unsatisfied	0
Somewhat unsatisfied	0
Neutral	1 (3.4%)
Somewhat satisfied	8 (27.6%)
Satisfied	20 (69.0%)

6–100), role limitations due to physical health (median: 100, range 50–100), health change (median: 100, range 25–100), and role limitations due to emotional problems (median: 100, range 0–100). Lower median scores were observed in social functioning (median: 75, range: 38–100) and pain (median: 75, range: 0–100). The mean scores for energy/fatigue, emotional well-being, and general health were 73.97 (95% CI: 67.39–80.19), 73.97 (95% CI: 67.39–80.19), and 79.48 (95% CI: 73.40–85.57), respectively.

Boys (Mean: 81.9; SD 12.4) have higher total SF-36 scores compared to girls (Mean difference: 0.5; p Value: 0.038). Patients with longer follow-up (≥ 13 months) had slightly higher average quality-of-life scores (82.9 ± 10.05) compared to shorter follow-up (< 13 months, 80.3 ± 10.4). The difference was 2.6 points ($p=0.049$). Differences in SF-36 according to age and appendicitis classification were not statistically significant (Table II).

Table II: Average SF-36 score analysis with demographic characteristics

Characteristics	N	Mean	SD	T Value	p value
Sex					
Male	12	81.9090	12.4154	.129	0.038*
Female	17	81.4085	6.1099		
Age					
≥ 10	16	81.2674	11.4988	-.202	0.842
< 10	13	82.0442	8.6168		
Follow-up duration					
≥ 13	15	82.8741	10.057	0.685	0.049*
< 13	14	80.2672	10.4275		
Appendicitis Classification					
Complicated	9	83.2654	8.7744	.581	0.973
Uncomplicated	20	80.8731	10.8269		

Note : Abbreviations: SD, standard deviation.
P values were calculated using independent t-test.
* Statistically significant at $p < 0.05$.
P values were calculated using independent t-test.
* Statistically significant at $p < 0.05$.

DISCUSSION

This study introduces a new perspective by concentrating on pediatric QOL outcomes following SIL appendectomy in one of Yogyakarta’s academic hospitals. While previous research has largely addressed the clinical and technical aspects of SILS, this study seeks to investigate the procedure’s wider effects on children’s physical, emotional, and social well-being. By assessing these quality-of-life factors, the research provides insights into how SILS influences recovery and daily functioning, highlighting the significance of patient-centered outcomes in assessing surgical success for pediatric patients.

Participants in this study presented with high scores across

all SF-36 domains when compared to the mean values from the medical outcome studies by the developers (3). The highest scoring domains are in the physical or general health categories. It can be interpreted that patients were able to recover in all aspects of quality of life and return to daily functioning post-SILA, with the shortest duration of follow-up being 7 months. Lower scores were found in the energy/fatigue and pain domains, though the values are above the mean cut-offs. The social functioning and emotional well-being domains also presented with lower scores. This could be attributed to the absence from formal schooling during the surgery and recovery time, resulting in a disruption of peer interactions and a lack of structured activities. A study by K and Pandian, 2024 (4), evaluated the daily and social functioning of children post-appendectomy, and found that the average duration of patients to return to school after laparoscopic appendectomy was 7-14 days.

Follow-up duration was found to be a statistically significant factor in the subgroup analysis. Longer follow-up durations (≥ 13 months) was associated with higher average SF-36 scores; thus, participants' overall quality of life improved after more than a year post surgery. Though another reason might be due to a longer recovery period in the population with a longer follow-up duration. Previous research has noted several long-term outcomes post appendectomy, notably increased risk of SBO in complicated appendicitis, adverse functional outcome, and increased hospital cost (5,6). This highlights the importance of long-term assessments of surgical outcomes post-appendectomy. However, it should be noted that recall bias can affect the validity of these results because more time has passed post-surgery. Girls were found to have a lower total SF-36 score compared to boys. Past research found girls to have higher chronic pain scores and prevalence, though its mechanisms aren't clear yet (7). Operative complications are also noted to be higher in girls (8). A possible explanation for this is the higher pain sensitivity, pain facilitation, and diminished pain inhibition compared to boys, though this should be reviewed further in the pediatric population (7).

Most (96.6%) participants reported partial or full satisfaction in the appearance and size of the surgical scar. A study by Kim et al., 2023 compared SILA to traditional 3-port laparoscopic appendectomy found that SILA had a slightly better postoperative scar assessment (9). The Patient Scar Assessment Questionnaire (PSAQ) was used. They reported significant differences in total score and appearance, but no significant difference in satisfaction with appearance and symptoms. Liu et al., 2023 also utilized a questionnaire to evaluate the cosmetic appearance of the postoperative abdomen, and found significantly higher scores in the SILA group (10). Single-incision laparoscopic appendectomy (SILA)

has emerged as a feasible and safe alternative to traditional multiport laparoscopic appendectomy (MPLA) in pediatric patients. Studies have shown that SILA can be performed on children as young as 19 months (11) with comparable outcomes to MPLA in terms of length of stay and readmission rates (12,13). While SILA may have slightly longer operative times initially, it can lead to reduced postoperative narcotic use (12) and faster operative times with experience (13). However, factors such as male gender, obesity, and perforated appendicitis may increase the likelihood of conversion to multiport surgery. Despite these challenges, SILA has been successfully implemented in up to 92.2% of cases in some centers (13). Overall, SILA appears to be a promising technique for pediatric appendectomies, offering potential cosmetic benefits without compromising patient safety or outcomes.

The findings of this descriptive study offer important perspectives on the quality of life post-SILA. One notable strength is the diverse age range and appendicitis grading of the participants, which provides a multifaceted perspective on recovery. To our knowledge, this study is the first to evaluate the quality of life of patients post-SILA in Indonesia. However, our study is limited by a small sample size and its reliance on self-reported data from a single institution. SF-36 relies on self-reported data, which can introduce biases, such as social desirability bias or recall bias.

The median follow-up time was 13 months, with some parents answering up to 23 months after surgery. Parents trying to remember details from many months ago might not remember perfectly (recall bias). To check if this affected our results, we looked only at patients with shorter follow-up (< 18 months, $n=21$). These patients still had high quality-of-life scores (Physical Functioning median=100, similar to the full group). This suggests recall bias did not strongly affect our findings. Future studies should collect data closer to the time of surgery. To build on this work, future studies should employ a mixed-method approach and include objective measures for complications and cosmetic outcomes. Interviews should include open-ended questions to allow for more comprehensive narratives. This study compared SILA patients only, with no comparison group, like multi-port laparoscopic surgery. Without a comparator group (e.g., multiport laparoscopic appendectomy), causality cannot be established; observed QoL reflects association only. Future studies should compare SILA to multi-port surgery across multiple hospitals to see which works better. For the sex difference (Cohen's $d=0.52$, $\alpha=0.05$, $n=29$), power was 0.71; larger samples are needed for confirmatory studies. Screening of all 46 eligible patients (63% response) reflects single-center feasibility constraints.

In addition, future research should implement multicenter studies and comparative methodologies to

enhance the robustness of findings. The larger sample sizes associated with multicenter collaborations improve statistical power, leading to more reliable conclusions. Studies should include a control population of patients undergoing multiport laparoscopic appendectomy for analytical comparison.

CONCLUSION

Participants reported high satisfaction and high scores across all SF-36 domains, with the highest scoring domains being in the physical or general health categories. Patients were able to recover in all aspects of quality of life and return to daily functioning post-SILA. Males and follow-up duration ≥ 13 months showed a trend of higher average SF-36 scores. Multicenter studies, control groups, or a mixed-method approach could be used in future studies to improve the robustness of findings.

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