World Journal of Internal Medicine and Surgery
ISSN (O): 3048-510X ISSN (P): 3051-2565
Review Article
Impact Factor 5.014
2026, Volume 3, Issue 4, Page: 21-27. www.wjims.com

SINGLE INCISION LAPAROSCOPIC APPENDECTOMY FOR ACUTE UNCOMPLICATED APPENDICITIS: REVIEW ARTICLE

Kumar H.R. (MBBS, MS)*

Associate Professor of Surgery, Taylor University School of Medicine and Health Science, 47500 Subang Jaya, Malaysia.

Article Info

Article Received: 04 May 2026,
Article Revised: 25 May 2026,
Published on: 11 June 2026.

***Corresponding author:**

Dr. Kumar H.R. (MBBS, MS)*

Associate Professor of Surgery, Taylor University School of Medicine and Health Science, 47500 Subang Jaya, Malaysia.
kharirajah@yahoo.com.my

https://doi.org/10.5281/zenodo.20717218

How to cite this Article: Kumar H.R. (MBBS, MS) (2026). Single Incision Laparoscopic Appendectomy For Acute Uncomplicated Appendicitis: Review Article. World Journal of Internal Medicine and Surgery, 3(4), 21–27.

ABSTRACT

Acute appendicitis remains one of the most common surgical emergencies worldwide, with laparoscopic appendectomy serving as the standard of care in most centers. Over the past two decades, advancements in minimally invasive surgery have led to the introduction of single-incision laparoscopic surgery (SILS), including single-incision laparoscopic appendectomy (SILA). This technique aims to reduce postoperative pain further, minimize scarring, and enhance recovery compared to conventional multi-port laparoscopic appendectomy (CLA). However, the clinical benefits and limitations of SILA in managing acute uncomplicated appendicitis remain debated due to concerns regarding technical complexity, operative time, and potential complications. This review systematically examines the current evidence regarding SILA, focusing on operative outcomes, safety, feasibility, cosmetic benefits, and cost-effectiveness in adults and children. Despite its advantages, the widespread adoption of SILA is limited by its steep learning curve and lack of clear clinical superiority. SILA remains an evolving technique that holds promise but requires careful patient selection and surgeon expertise to optimize outcomes

KEYWORDS: “Acute appendicitis”,” Uncomplicated appendicitis”,” SILA”,” SILS”, **“**Children”,” Adults**”,”** Laparoscopy”, and “Complications**”.**

INTRODUCTION

Acute appendicitis is an acute abdominal condition that presents due to obstruction and inflammation of the appendix. It is one of the most common general surgical intra-abdominal emergencies, with an incidence of 90 to 150 patients per 100,000 population in the world. There is a slightly higher rate in males than in females, and the clinical presentation is of right lower abdominal pain with symptoms of nausea and vomiting, and clinical examination of the abdomen will reveal tenderness and guarding over the right iliac fossa (Moris, 2021). The diagnosis of acute appendicitis is confirmed by inflammatory markers, such as an elevated white blood cell count and C-reactive protein (CRP), as well as clinical examination. Imaging, including ultrasound and computerized tomography, is reserved for atypical cases (Bhangu, 2015). The management of acute appendicitis can be divided into non-operative treatment with intravenous antibiotics and appendectomy, which can be performed as an open or laparoscopic procedure (Weledji, 2012; Becker, 2018).

Single-incision laparoscopic appendectomy was introduced in the 1990s as a follow-up to conventional three-port laparoscopic appendectomy. Its introduction was associated with a better cosmetic appearance. It reduced postoperative pain but was also associated with difficulty in maneuvering the instruments, an increased risk of instrument collision, and reduced visualization. Single-incision laparoscopic appendectomy is also associated with increased cost due to the need for specialized equipment (Switzer, 2012).The World Society of Emergency Surgeons (WSES), in their guidelines for the management of acute appendicitis, have stated

that single -incision laparoscopic appendectomy is safe and effective for the surgical management of acute appendicitis, but it is associated with higher analgesia usage and higher wound infection rate (Di Saverio, 2020).

In this review, we examine the roles of Single-incision laparoscopic appendectomy in the management of acute appendicitis in adults and children. We will also look at the complications of single -incision laparoscopic appendectomy. A comprehensive literature review was conducted utilizing PUBMED, the Cochrane Database of Systematic Reviews, Google Scholar, and Semantic Scholar. The search focused on randomized controlled trials, non-randomized trials, observational and cohort studies, clinical reviews, systematic reviews, and meta-analyses published from 1990 to 2026. The keywords employed in the search included: "Acute appendicitis," "Uncomplicated appendicitis," "SILA," "children," "adults," "laparoscopy," SILS," and "complications." All articles were in English and were assessed through manual cross-referencing of the literature. Commentaries, case reports, and editorials were excluded from this review. The study included only adult and pediatric patients with acute appendicitis.

DISCUSSION

Single-incision laparoscopic appendectomy in adults

Single-incision laparoscopic appendectomy is performed by placing a 15mm skin incision over the sub-umbilical region, and then an incision is made on the rectus with the insertion of a 5mm port, and another incision is made on the opposite side of the rectus to insert a 10mm or 5mm port. A flexible SILS port can also be used as an alternative, which allows the passage of 2 instruments and interchange between 5mm and 12mm cannulas. The mobilization of the appendix, dissection of the meso-appendix, and performance of the appendectomy are the same as in a conventional laparoscopic appendectomy. The appendicular stump can be closed with sutures or staplers. Closure of the umbilical incision in the rectus is important to prevent incisional hernia formation (Feinberg, 2011; Chouillard, 2010; Bhatia, 2011).

A retrospective study comparing single -incision laparoscopic appendectomy and conventional laparoscopic appendectomy was conducted by Liang et al. A total of 688 patients were included in this study, with 618 patients undergoing conventional laparoscopic appendectomy and 70 undergoing single-incision laparoscopic appendectomy. Post-operative complications were higher in the conventional laparoscopic appendectomy group (18.1% vs7.1%), and single-incision laparoscopic appendectomy was associated with faster oral intake (Liang, 2014).Single-incision laparoscopic appendectomy was compared with conventional laparoscopic appendectomy for acute appendicitis by Kohama et al. A total of 568 patients were included in this retrospective observational study, with 241patients undergoing single -incision laparoscopic appendectomy and 327 patients undergoing conventional laparoscopic appendectomy. Single-incision laparoscopic appendectomy was associated with increased analgesia usage, but reduced length of hospital stays when compared with conventional laparoscopic appendectomy (Kohama, 2024).

A systematic review and meta-analysis comparing single-incision laparoscopic appendectomy and conventional laparoscopic appendectomy was conducted by Aly et al. A total of 8 studies with 995 patients were included in this study, and there were no significant differences regarding post-operative complications, post-operative analgesic usage, and length of hospital stay. Single -incision laparoscopic appendectomy was associated with better wound cosmesis (Aly, 2016). A meta-analysis comparing single-incision laparoscopic appendectomy and conventional multiport laparoscopic appendectomy for acute appendicitis was conducted by Pisanu et al. A total of 13 studies with 893 patients were included in this study, with 402 patients undergoing single-incision laparoscopic appendectomy and 491 patients undergoing conventional laparoscopic appendectomy. There were no differences in the postoperative complications, length of hospital stays, and time to return to work between the procedures (Pisanu, 2013). A systematic review and meta-analysis comparing single-incision and conventional three-port laparoscopic appendectomy for acute appendicitis was conducted by Markar et al. A total of 7 studies with 1108 patients were included in this study, with 555 patients undergoing single-incision laparoscopic appendectomy and 553 undergoing conventional laparoscopic appendectomy. There were no differences regarding postoperative complications, wound infection, and length of hospital stay, but single-incision laparoscopic appendectomy was associated with a longer operative time (WMD6.96,95%CI,3.79-10.12). This study showed that single-incision laparoscopic appendectomy was safe for the management of acute appendicitis (Markar, 2013). Another systematic review and meta-analysis comparing single -incision and conventional laparoscopic appendectomy was conducted by Cai et al. A total of 6 studies with 1068 patients were included in this study (535-single -incision laparoscopic appendectomy and 533-conventional laparoscopic appendectomy). Single-incision laparoscopic appendectomy was associated with a longer operative time and a higher conversion rate,

but there were no differences in post-operative complications and length of hospital stay (Cai, 2013).

A meta-analysis of randomized controlled trials comparing single-incision and conventional three-port laparoscopic appendectomy was conducted by Yin Han et al. A total of 26 studies with 3103 patients were included in this study, and single-incision laparoscopic appendectomy was associated with a shorter time to return to work (MD=0.76,95%CI,1.15-3.37), longer operative time(MD=7.57,95%CI,5.85-10,10), and higher rate of conversion to open appendectomy(RR2.60,95%CI,1.27-5.31). There were no differences regarding postoperative pain and wound infection rates between the procedures (Han, 2024). Another meta-analysis of randomized controlled trials comparing single incision and conventional laparoscopic appendectomy was conducted by Antoniou et al. Five studies with 746 patients were included in this study, and there were no differences in the wound infection rates (4% vs 4.8%), or the morbidity rates (9.6% vs 8.6%). The duration of surgery was longer with the single incision laparoscopic appendectomy (Antoniou, 2014).

A systematic review and meta-analysis of randomized controlled trials comparing single incision and conventional three-port laparoscopic appendectomy was conducted by Xu et al. Eight studies with 616 patients undergoing single incision laparoscopic appendectomy and 618 patients undergoing conventional three-port laparoscopic appendectomy. Single-incision laparoscopic appendectomy was associated with a longer operative time and the need for additional trocars. But it was associated with a faster return to normal activity, with no differences in the postoperative complications (Xu, 2015). Another systematic review and meta-analysis of randomized controlled trials comparing single incision and conventional multiport laparoscopic appendectomy was conducted by Zhou et al. Eleven studies with 1216 patients were included in this study, with 611 patients undergoing single incision laparoscopic appendectomy and 605 patients undergoing conventional three-port laparoscopic appendectomy. Single-incision laparoscopic appendectomy was associated with a shorter stay in the hospital, but it was associated with a longer operative procedure. There were no differences with post operative complications between the procedures (Zhou, 2014). A meta-analysis of randomized controlled trials comparing single-incision laparoscopic appendectomy and conventional three-port laparoscopic appendectomy was conducted by Deng et al. A total of 11 studies with 1489 patients were included in this study. Single-incision laparoscopic appendectomy was associated with a shorter hospital stay (WMD=0.63, 95% CI,1.04,0.21), but longer operative time (WMD=6.56,95%CI,3.55,9.85), and higher conversion rate (OR:6.82,95%CI,3.14,14.79). There were also no differences in the complication rates between the procedures (Deng, 2017). Another meta-analysis of randomized controlled trials that was conducted by Ji Hua et al, comparing single-incision laparoscopic appendectomy and conventional three-port laparoscopic appendectomy, also concluded that single-incision laparoscopic appendectomy was associated with a longer operative time and a shorter return to normal activity (Hua, 2014).

A meta-analysis was conducted by Lee et al, comparing operative time and postoperative pain between single-incision laparoscopic appendectomy and conventional three-port laparoscopic appendectomy. A total of 21 studies with 2454 patients were included in this study, and single incision laparoscopic appendectomy was associated with a longer operative time (MD-3.80 mins,95%CI,0.25-7.85), but reduced postoperative analgesic usage (SMD=0.24,95%CI,0.10-0.38). There were no differences regarding the postoperative complications and conversion to open appendectomy between the procedures (Lee, 2026).A systematic review and meta-analysis of randomized controlled trials comparing single -incision laparoscopic appendectomy and conventional three-port laparoscopic appendectomy was conducted by Clerveus et al. Six studies with 800 patients were included in this study, with 401 undergoing single-incision laparoscopic appendectomy and 399 undergoing conventional laparoscopic appendectomy. Single-incision laparoscopic appendectomy had a higher technical failure rate (OR-3.30,95%CI,1.26-8.65) and longer operative time (MD=4.67,95%CI,1.76-7.57). Single-incision laparoscopic appendectomy was, however, associated with better cosmetic results and earlier return to work (Clerveus M. M.-R.-S.-B.-Y.-R., 2014).

A meta-analysis comparing the safety and efficacy of single -incision laparoscopic appendectomy was conducted by Li et al. Sixteen studies with 1624 patients were included in this study, and single incision laparoscopic appendectomy was associated with similar post-operative complications and post-operative analgesia usage as conventional three-port laparoscopic appendectomy (Li, 2013).A systematic review of randomized controlled trials on the role of single incision laparoscopic appendectomy in the treatment of acute appendicitis was conducted by Vettoretto et al. A total of 5 studies with 761 patients (397 -single incision laparoscopic appendectomy and 382-conventional laparoscopic appendectomy) were included in this study. There were no significant differences regarding the morbidity, wound infection

rate, and length of hospital stay between the two procedures (Vettoretto, 2015).

Single Incision laparoscopic appendectomy in children

Single-incision laparoscopic appendectomy has been introduced for the surgical management of acute, uncomplicated appendicitis in children. A retrospective study was conducted by Gates et al, which looked at the role of single-incision laparoscopic appendectomy in children. A total of 1001 patients were included in this study, with 959 patients undergoing single -incision laparoscopic appendectomy and 35 undergoing conventional laparoscopic appendectomy. Single-incision laparoscopic appendectomy was successful in 92.2% of cases, and the conversion rate was 8%. Some of the factors for conversion were obesity and perforated appendicitis (Gates, 2019). Chandler et al also performed a retrospective study on the comparison of single-incision laparoscopic appendectomy and conventional laparoscopic appendectomy in children. One hundred and ten patients were included in this study, with 50 patients undergoing single incision laparoscopic appendectomy and 46 undergoing conventional laparoscopic appendectomy. The operating time was slightly longer in the single incision laparoscopic appendectomy group, but there were no differences regarding morbidity and length of hospital stay (Chandler, 2010).

A randomized controlled trial was conducted by Perez et al on single incision laparoscopic appendectomy for acute appendicitis in children. A total of 50 patients were randomized into 25 patients who underwent single-incision laparoscopic appendectomy and 25 patients who underwent conventional three-port laparoscopic appendectomy. There were no differences with post-operative complications, length of hospital stays, post-operative analgesia usage, and duration of surgery. This study concluded that single-incision laparoscopic appendectomy was safe and feasible in children (Perez, 2013).A systematic review and meta-analysis comparing single-incision laparoscopic appendectomy and conventional three-port laparoscopic appendectomy for acute appendicitis in children was conducted by Zhang et al. A total of 12 studies with 2249 patients were included, with 744 patients undergoing single-incision laparoscopic appendectomy and 1505 undergoing conventional laparoscopic appendectomy. Single-incision laparoscopic appendectomy was associated with a higher wound infection rate (OR-2.25,95%CI,1.21-4.17), and longer operative time (WMD=5.73 minutes,95%CI,4.17-7.28). There were no differences regarding the intra-abdominal abscess rate and the length of hospital stay between the procedures (Zhang, 2015).

A systematic review and meta-analysis comparing single incision laparoscopic appendectomy and conventional laparoscopic appendectomy in acute appendicitis in children was conducted by Zhao et al. A total of 12 studies with 2109 patients were included, with 933 patients undergoing single -incision laparoscopic appendectomy and 1176 patients undergoing conventional laparoscopic appendectomy. There were no differences regarding post-operative morbidity, wound infection rate, and length of hospital stay between the procedures (Zhao, 2015).Another systematic review and meta-analysis comparing single incision laparoscopic appendectomy and conventional three-port laparoscopic appendectomy was conducted by Zaman et al. A total of 4 studies with 520 patients, of which 260 underwent single -incision laparoscopic appendectomy and 260 underwent conventional three-port laparoscopic appendectomy. There were no differences in surgical site infection, intra-abdominal abscess formation, and incisional hernia formation between the procedures. Single-incision laparoscopic appendectomy was associated with a longer operative time (Zaman, 2021).

Table I.

Study	Study Type	Year	N=numbers	Single Incision Laparoscopic Appendectomy (SILA)	Conventional three-port Laparoscopic Appendectomy
Aly et al	Systematic review & Meta-analysis	2016	995	Better wound cosmesis-MD-0.55(0.33-0.77)	Reduced operative time-MD-5.81(2.01-9.62) Reduced Conversion rates-OR-4.14(1.93-8.91)
Antoniou et al	Systematic Review & Meta-analysis	2014	746	Morbidity Rate-9.6% Wound Infection Rate-4.0%	Morbidity Rate-8.6% Wound Infection Rate-4.8%
Deng et al	Meta-analysis of Randomized Controlled Trials	2017	1489	Higher Conversion Rate-OR-6.82,95%CI,3.14-14.79 Shorter Hospital Stay-WMD-0.63,95%CI,1.04-0.21	Shorter operative time when compared to a single incision laparoscopic appendectomy WMD-6.56,95%CI,3.55-9.58

Han et al	Meta-analysis of Randomized Controlled Trials	2024	3103	Higher Conversion Rate-RR 2.62,95%CI,1.27-5.31 Shorter time to return to normal activity-MD-0.76,95%CI,1.11-0.76	Shorter operative time when compared to a single incision laparoscopic appendectomy MD-7.97,95%CI,5.85-10.10

Table showing the comparison of single incision laparoscopic appendectomy and conventional three-port laparoscopic appendectomy

CONCLUSION

Single-incision laparoscopic appendectomy is a safe and feasible approach for the management of acute uncomplicated appendicitis. It offers clear advantages in cosmetic outcomes and may provide modest reductions in postoperative pain. However, these benefits must be balanced against longer operative times, technical difficulty, and potential cost implications. Current evidence suggests that SILA is not demonstrably superior to conventional laparoscopic appendectomy in terms of clinical outcomes such as complication rates and recovery. Instead, it should be considered an alternative technique best utilized by experienced surgeons in appropriately selected patients.

Conflict of interest-There is no conflict of interest.

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