

The Future of Suprapubic Single-incision Laparoscopic Appendectomy

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ABSTRACT

Background: Suprapubic single-incision laparoscopic appendectomy (SSILA) has recently been studied by different authors, the targeted benefits were better cosmesis, less infection and possibly less hernia formation.

Aim: To evaluate the feasibility and benefits of SSILA by reviewing the most recent data published to date, and identifying the pros and cons of its use against an umbilical incision.

Materials and methods: A systematic electronic search based on preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement was conducted, articles from 2010 to 2015 were reviewed. Only Adult population was included in the study. Pre-, intra- and postoperative variables were included in our study, such as operative duration, wound infection, cosmetic outcome and pain.

Results: Four studies were included and round up a total of 129 patients. Incision size varied from 1.5 to 2.5 cm, procedure was completed in all studied candidates, mean operative time was 52.9 minutes, no intraoperative complications were recorded, wound infection occurred in 0.015% of cases, mean hospital stay 1 to 4.7 days, pain and cosmetic outcome were difficult to interpret due to the way, their evaluation was conducted. Suprapubic single-incision laparoscopic appendectomy appears to give a better operative view, follow-up duration 1 to 80 weeks. Most studies suffered from bias in all aspects.

Conclusion: Finding a different access site in acute appendicitis may decrease the rate of port-site complications, and hence the morbidity associated with it. The suprapubic incision is an appealing alternative, with lack of strong evidence to support it. The available evidence supports its use, but randomized controlled trials have to be conducted to determine its fait.

Keywords: Appendectomy, Laparoscopic, Single port, Suprapubic.

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INTRODUCTION

From an era where open appendectomy was the gold standard management of acute appendicitis (AA), emerged the three-port laparoscopic appendectomy (TPLA) showing more promising results in regards to postoperative pain, earlier return to work and cosmesis, and eventually proving to be a better predecessor. Surgeons further challenged the three-port ideation with single-incision laparoscopic surgery (SILS), aiming for even better cosmesis, and less postoperative pain. Single-incision laparoscopic surgery was questioned by being more challenging, technically more difficult and can be associated with more complications.¹ A meta-analysis of eight randomized controlled trials (RCTs), which included 1234 patients, one compared TPLA to single-incision laparoscopic appendectomy (SILA) for the management AA. It showed similar outcomes in regards to both surgical and medical complications, similar conversion rate, postoperative ileus, wound infection, re-operation rates, postoperative pain, hospital duration, and time to initiate first meal. Although SILA seems to be superior in regards to return to normal activity, and resumption of normal diet. It still stands behind in regards to operative time by approximately 5 minutes.² Starvros et al concluded that the increased risk of hernia formation was not supported by any clinical evidence in their meta-analysis, but the follow-up duration was reported to be short.³ Many authors concluded that the umbilicus is the most common site for port-site complications, it carries a greater risk of port-site infection (PSI). This conclusions were evident in studies investigating SILS and conventional laparoscopy, done for various abdominal procedures.⁴⁻⁶ Not only the umbilicus flora augments this but also the fact that retrieving the appendix through the incision will further increase such risk, and was linked to an increased incidence of hernia formation at those sites.⁷ The rationale of this review is to evaluate the use of a suprapubic site of entry in SILA. Our objective is to target adults presenting with AA. We will evaluate it using the most recent evidence available.

MATERIALS AND METHODS

Literature Search

Our review followed the PRISMA statement.⁸ We conducted a systematic electronic search using the following

keywords in every possible combination 'wound' 'laparoscopic' 'single' 'port' 'access' 'complications' 'infection' 'SILS' 'LESS' 'incision' 'appendectomy' 'site' 'suprapubic' 'SPL' 'single port appendectomy (SPA)' 'one port umbilical surgery (OPUS)' 'natural orifice transumbilical surgery (NOTUS)' 'SILA'. Search engines used: Medical literature analysis and retrieval system online (MEDLINE), Excerpta medica dataBASE (EMBASE), chochrane library. Relevant articles in the studies collected were also evaluated. Last search was done on 24/8/2015.

Inclusion Criteria

Studies focusing on port-site complication, specially those comparing rate of infection at different incision sites. In addition, we included papers evaluating the applicability of SILA. The search results were limited to systematic reviews, meta-analysis and randomized controlled trials (RCT), once not available the best available evidence was included. Search results were filtered initially by screening the article titles, once approved by the two authors abstracts were further screened, at this stage the full articles were retrieved and decided to be included or not, if at any stage there was a disagreement on the inclusion or exclusion the third author acted as a referee.

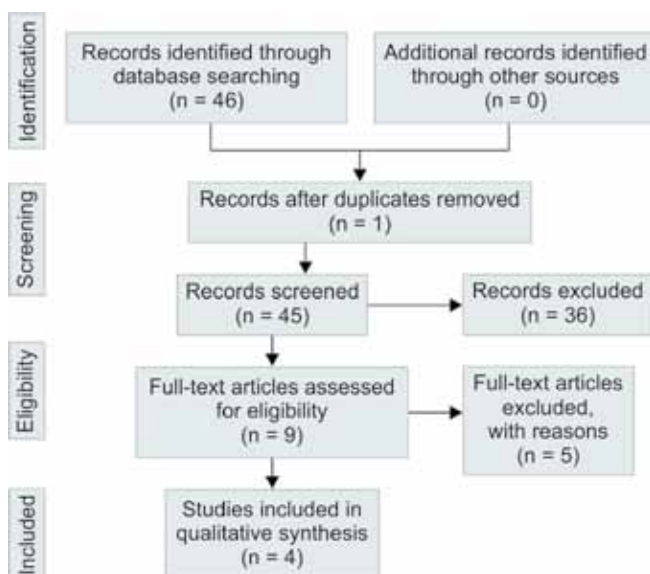
Exclusion Criteria

Studies conducted on pediatrics population, obstetric and gynecology procedure, urological procedures, cases of malignancy and robotic surgery procedures. One study was excluded due to small sample size.

Funding

There was no funding for this review, all articles were obtained through individual university access.

RESULTS



A systematic research revealed 46 articles, the search was restricted to adults (age ≥ 19 years), and studies conducted in the past 5 years only. We have initially restricted the search to RCTs but were not able to obtain any results matching our inclusion criteria, hence the highest level of evidence available was used. From 46 articles, 12 were filtered by title. Eventually, nine articles were reviewed after exclusion by abstracts. Out of nine full texts only four studies were included in our review. One study was excluded due to small sample size.⁹ Exclusion was based nine on our inclusion and exclusion criteria. The articles characteristics are presented in Table 1 and patient characteristics and outcomes in Table 2.

Type of Studies and Bias

All four studies were conducted on adults diagnosed with AA, none of them was an RCT. Only one study included those with complicated AA.⁷ Pooled sample size for all studies was 129 patients. The studies were published between 2011 and 2015. The article type varied, Vidal et al conducted a prospective study,¹⁰ Ze Zhang et al got their results through a propensity matched analysis,⁷ a retrospective study was conducted by Wang Y et al,¹¹ and a case series was presented by Alvarez et al.¹²

The sample size ranged from 15 to 54 patients. All studies suffered from selection bias. There was no random sequence in selecting the candidates, except for Ze Zhang et al⁷ who were trying to eliminate bias by using propensity matched analysis. No evidence of concealment was present when selecting the study candidates in all papers, so, in conclusion selection bias is profound along most of the articles. Both participants and candidates were aware of the type of procedure being performed. Blinding was not evident even in the assessment of variable outcomes, such as postoperative complications and wound cosmesis. Hence, performance and detection bias is also profound along all studies. All papers suffered attrition bias, by excluding the complicated appendixes in three articles,¹⁰⁻¹² or by excluding those who did not have a matching population without mentioning the outcome of them.⁷

Surgical Technical Aspects

All procedures were performed under GA where there was no contraindication to laparoscopic surgery. All surgeries were performed by surgeons experienced in laparoscopic surgery. Wound size was 1.5 cm on two studies,^{11,12} 2 cm⁷ and 2.5 cm.¹⁰ Two authors used a self made port.^{7,11} One conducted the study using SILS port,¹⁰ and one using R-port.¹² The operative time range was [(35–76.36 minutes) (mean = 52.91 minutes)]. None of the studies reported any intraoperative complication, use

Table 1

Study	Year published	Sample size (n = patients)	Incision type and length (port)	Type of study	Surgeon experience	Instrument used to secure/resect appendix and mesoappendix	Follow-up
Alvarez et al ¹²	2012	15	1.5 cm transverse/(R Port)	Series of 15 cases	N/A	Appendix by stable/mesoappendix by clips and cautery	N/A
Vidal et al ¹⁰	2011	20	2.5 cm transverse/SILS port	Prospective study	Same experienced laparoscopic surgeons	Appendix by endo gia/mesoappendix by clips	7 days
Wang et al ¹¹	2015	42	1.5 cm transverse/self made port	Retrospective analysis	Two surgeon team experienced in laparoscopy	Nonabsorbable loop, meso with ultrasonic scalpel	1 month
Ze Zhang et al ⁷	2015	54	2 cm transverse/self made port	Propensity matched analysis	Two surgeon team experienced in laparoscopy	Nonabsorbable loop, meso with ultrasonic scalpel	12 to 20 months

Table 2

Study	Mean operative time in minutes (confidence interval)	Wound complications (n = incidence)	Intraoperative complication/conversion/extra-port	Pain (n = number of patients)	Drain placement	Cosmesis	Hospital stay in days
Ze Zhang	58.91 (± 17.45)	wound infection (n = 1)	0/0/0	Required additional analgesia (n = 13)	5	Psaq satisfaction with appearance 8 (8–16)	4.7 ± 1.6
Wang Y	58 (± 11)	wound infection (n = 1)	0/0/0	Required additional analgesia (n = 8)	4	N/A	3 ± 1
Vidal	40 (± 7)	nell	0/0/0	Vas median 2 (1–4)	4	N/A	2 ± 0.5
Alvarez	35 (15–60)	nell	0/0/0	Required additional analgesia (n = 1)	13	No proper assessment of cosmetic outcome	Mean < 24/ 22 (18–31) hours

of extra-ports, conversion to conventional or open procedure. Drain was used in 4.96% of cases (n = 26). Most of the studies has concluded that a suprapubic approach offered a better visualization of the appendix with a better viewing angle.

Postoperative Course, Pain Assessment

Mean hospital stay averaged from 1 to 4.7 days. Pain assessment was subjective in three out of four studies.^{7,11,12} One study used visual analog scale (VAS) with a pain median value of 2 (1–4).¹⁰

Postoperative Complications

Two out of 129 were complicated with wound infection, no other postoperative complications were mentioned otherwise. It appears that the rate of wound infection is lower in a suprapubic incision in comparison to an umbilical incision in one study (2.3 vs 8.7%)¹¹ and (1.8% vs 3.3–8.2%) in another.⁷

Cosmetic Outcome

Only one study has used patient scar assessment questionnaire (PSAQ) median = 8 (8–16),⁷ the rest based their assessment on clinical basis.

Follow-up

Follow-up ranged from 1 to 80 weeks.

DISCUSSION

Suprapubic incision is an appealing site for performing SILS in AA. We will discuss the feasibility and possibility of such an approach on the bases of comparing it to the conventional umbilical incision. Our study was based on the hypothesis that by choosing a different entry site for AA in SILS, the rate of port-site complications will reduce. The umbilicus is the standard site of entry to date, but, port-site herniation, infection and pain are among the commonly seen complications with such an incision, not only in SILS but also in conventional laparoscopic surgery.^{4,6,7,11} A systemic review conducted by M Owens included 25 review original articles, highlighted port-site hernial complications, based on his data out of 7,802 patients undergoing laparoscopic cholecystectomy (LC), the incidence of hernia was (0.12–1.8% mean 0.69) where at least 68.25% were at the umbilicus. He also mentioned that wound infection is a key player in predisposing late port-site herniation, hence the increased incidence of infection at the umbilicus may explain the increased incidence of hernia at this site.⁴ This approves a previously conducted systematic review included 5984 patients

and showed five reports proposing umbilical herniation as secondary to infection at this site.¹³ In the other hand, varying depth the umbilicus is thought to result in a higher local wound complication rate.¹⁴ A descriptive study published in 2013, it included 570 patients. They analyzed port-site complications, and concluded that the umbilical port is the most common site (47% of port-site complications). The complications ranged from PSI, bleeding, herniation, omental entrapment and port-site metastasis.¹⁵ S Ghata et al in a prospective study on 100 patients assessing wound complication, they have found that most PSI is at the umbilicus, along with subcutaneous emphysema and port-site hernia.⁶ One hundred and fifty patients were studied in an randomized clinical trial conducted by P Bucher et al, it showed similar rates of seroma and hematoma in both umbilical and other ports (3%), in conventional laparoscopic cholecystectomy, he has also shown a 0% hernial rate, yet his study lacks long-term follow-up in regards to hernia, showed no blinding or concealment and suffers selection bias in our opinion. Although no infection was reported one can predict that hematoma/seroma can predispose to wound infection.¹⁶ No level one evidence is present to support a suprapubic SILS. This paper aims not to establish SILS as a gold standard management of AA, but to describe an alternative to the commonly used access site, in order to decrease the complication rate associated with it as described previously, and hence to get more acceptance, to motivate the conduction of RCTs regarding this topic. Suprapubic single-incision laparoscopic appendectomy (SSILA) is relatively new, it was first proposed in 2005. Hence, we would have come to a better conclusion if sufficient sample sizes were available to achieve power. Another issue is the lack of RCTs, but we are looking forward to see the results of Ze Zhang et al upcoming RCT, which will aid in determining the fate of SSILA. With the available evidence we can conclude that, using the commercially available SILS ports, the operative time may be shorter. The mean operative time presented in our paper reflects mostly the work presented by one institute,^{7,11} they used a self made port that might have resulted in longer operative time, not only this but also the use of conventional instruments in their approach would alter the ergonomics and triangulation in the field and hence result in operative delay. The safety of SSILA might be questioned by some, but the 0% rate of intraoperative complications proves no such claim to date. Cosmesis is not compromised by the use of extra-ports or conversion to conventional nor open. All four authors claimed no use of extra-ports, this can be due to many factors. One is that the viewing angle in such an approach can ease the dissection and retrieval of the appendix, another

factor is that the surgeons are familiar with SSILA, a third possibility is that many of these studies has excluded complicated cases, except for Ze Zhange et al,⁷ but he also achieved equal results even after including the complicated cases. Drain placement is subjected to the surgeons preference, and, the intra-abdominal findings. The high percentage of drains used is due to a liberal use of drains by Alvarez in his study. A total of 13 drains were placed in 15 individuals in his study. We could not conclude if pain in SSILA is better than an umbilical approach, this is mainly due to the lack of evidence on this topic. Only one author used VAS and the sample was too small to come up with a conclusion. Authors claim that cosmetic outcome is better. Hypothetically, we can assume that the presence of the incision in the pubic area will be invisible, even if complications, such as infection arises in such an area, the concern regarding it final outcome will not be as if it was at the umbilicus, but as from the evidence available, one author has presented an objective cosmetic assessment.⁷ Hence, we can only base our conclusion hypothetically supported by the subjective opinion of the SSILA authors that we can achieve a better cosmetic outcome with such an approach. The follow-up duration was too short in some studies to evaluate complications, such as herniation, we are hoping that the upcoming RCTs will give a better answer, yet assuming that the infection rate is lower we can hypothesis that we will have a lower rate of hernia formation.

CONCLUSION

Finding a different access site in AA might decrease the rate of port-site complications, and hence the morbidity associated with it, the suprapubic incision is an appealing alternative, with lack of strong evidence to support it. The available evidence supports its use, but more RCTs have to be conducted to give a better decision on such an approach.

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