

Can Single Incision Laparoscopic Appendectomy Replace the Traditional Three Port Laparoscopic Approach in Coming Future: A Review

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Abstract

In this modern era, the major aims of most of the GI surgeons have been a minimal invasive approach towards surgery, thereby reducing the various complications associated with the surgery. Till now open appendectomy has been practiced a lot for the treatment of acute appendicitis. The 3port laparoscopic approach is widely used and now considered as a gold standard treatment for acute appendicitis currently the 3-port laparoscopic appendectomy. In recent years, laparoendoscopic single site surgery (LESS) has become a major focus of study, with even difficult procedures achieved using this technique, which uses a single port, rather than the traditional 3-ports for the removal of the diseased appendix laparoscopically known as Single Incision Laparoscopic Appendectomy (SILA). This is a comparatively minimal approach towards surgery as minimal invasive surgery. Therefore the purpose of this review is to compare the outcomes of SILA versus traditional 3-port laparoscopic appendectomy and hence giving an idea of whether SILA is an alternative to replace the traditional approach as the new treatment of choice in coming future.

Keywords: Laparoendoscopic single site surgery; Single incision laparoscopic appendectomy; Single incision laparoscopic surgery; 3 Port laparoscopic appendectomy; Natural orifice transluminal endoscopic surgery; Minimal invasive surgery

Abbreviations: LESS: laparoendoscopic single site surgery; SILA: Single Incision Laparoscopic Appendectomy; SILS: Single Incision Laparoscopic Surgery; 3PLA: 3 Port Laparoscopic Appendectomy; NOTES: Natural Orifice Transluminal Endoscopic Surgery; MIS: Minimal Invasive Surgery

Introduction

Medicine is an ever-changing and ever-growing field where day after day and year after year new things are invented, applied for the treatment of various diseases. In the line of treatment, surgery has been one of the feared treatment options for most of the patients; therefore surgeons try to provide the patients with the best possible surgical treatment options. The best possible surgical option has always been the one with the lesser complications intra and postoperatively, well-controlled pain, less stay at hospital etc. Both doctors and patient don't want to maximize hospital stay as one study stated that extended hospital stay has been associated with increased incidence of hospital acquired infections, which causes further increase in morbidity and mortality [1]. One of the greatest achievements in the history of surgery has been evolved from open surgical techniques to the operative video-laparoscopy

Acute appendicitis is one of the most common cause of acute abdomen and one of the most common surgical emergencies. Appendectomy for acute appendicitis is one of the most commonly performed surgical procedures [2]. The surgical technique of first open appendectomy (OA) was performed by Dr. Charles Mcburney in and this approach has not significantly changed in the last 1 century [3]. In 1983, Dr. Kurt Semm, performed first minimally invasive laparoscopic appendectomy, thereafter LA has become the standard of practice in uncomplicated appendectomies in most minimally invasive institution [4]. In the past few years of minimally invasive surgery, LESS, NOTES has gained popularity. SILA was first described in 1998 by Esposito and has gained popularity as a method with a concept of "scarless" abdomen [5]. While Pelosi in 1992 performed the first SILA for acute appendicitis [6]. Innovative methods such as NOTES (Natural Orifice

Tran luminal Endoscopic Surgery) and single incision laparoscopy (SIL) have demonstrated promissory results in various surgical procedures, appendectomy among them [7]. According to a recent study, SILA resulted in faster recovery than conventional 3-port LA [8]. However in some other studies it has also been reported that SILS is associated with a longer operative time and higher postoperative pain scores, and that patients need more analgesics to feel comfortable [9]. NOTES, SILS, and robotic surgery do not constitute techniques, rather they are concepts, hence regarded as transitions from laparoscopic surgery to unknown fields of minimally invasive therapeutic modalities [10]. SILS was recommended as a possible alternative of the traditional laparoscopic surgery via four ports for the biliary tract by Navarra et al. [11]. With NOTES having a diminished success, because of the inability to find a clean site for access, thereby increasing the chances of intra-abdominal spillage or infection from the incision [12] increased interest has been seen in SILS. SILS occupies a space between NOTES and standard laparoscopy [13]. There have been several studies regarding comparison between the SILA and 3PLA and to evaluate the possible advantage and disadvantages between them. Therefore the purpose of this article is to review and assess the outcomes and results related to SILA and 3PLA thus have an idea that whether SILA can be replacement for 3PLA in coming years.

Discussion

Minimal invasive surgery has continued to evolve, with a focus on improving cosmetic results and others potential benefits regarding

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postoperative outcomes and to reduce surgical trauma. Both techniques have their own advantages and disadvantage. A comparison of outcomes between both techniques is required to be looked into.

Cosmetic

One of the commonly seen advantages of SILA over 3PLA is the reduction in incisions needed. Where in SILA there is a single about 2 cm intraumbilical skin incision from which SILS port is inserted while other two 10-mm and two 5 mm trocars were inserted from the same port. While in 3PLA there is need for three incisions; two 5 mm ports and one 10 mm port [14]. In a study of scar comparison by both SILA and traditional 3-port by Ceci et al. [15] it was concluded that the former was found to reduce scars, thus it is advantageous from cosmetic improvement. Another study by Teoh et al. [16] concluded that the LESS approach resulted in better cosmetic scores and satisfaction scores than 3-PLA. Most researchers found that the cosmetic scores given by patients undergoing SILA was higher than that given by patients undergoing the 3PLA [17,18]. Conversely, according to study conducted by Lee et al. [19], reported that the cosmetic satisfaction score and postoperative pain scores were not significantly different between SILA and 3-port LA. According to these studies, patients were more satisfied with the cosmetic appearance of SILA over 3PLA.

Operative time

As SILA is considered to be a relatively less used technique, it is essential to understand the learning experience of the surgeons and how the operative time changes with experience. According to the studies conducted by Teoh et al., Pan et al., Carter et al., Vilallonga et al., Kye et al. and Frutos et al. [16,18,20-23] the results showed that SILA was associated with significant longer operative times than 3-port LA. More time is needed for performing SILA than 3PLA may be due to the characteristic single incision of SILA technique would increase its technical difficulty because all surgical procedures have to be performed in one working channel [18,24]. However in the study conducted by Ahmed et al. [25] showed that SILA which took 74 minutes to complete the operation was quicker than traditional 3-port which took 89minutes with the total operation time being 15 min shorter. The shorter operating time observed in SILA may be due to more experienced surgeons in the SILA group. Interestingly though, in another study conducted by Mutter et al. [26] stated that even though the surgeons with experience performed more rapidly, there was no significant difference. But the study by Tay et al. [27] reported that a second surgeon showed faster improvement on mentoring from the first surgeon. Overall, the learning curve is said to be quite short [28]. The technical change from conventional to single-port LA requires a learning curve of at least 10 surgeries for a basic handling of SILA [29]. Therefore with more experience, the time required for the operation significantly decreases.

Length of hospital stay

Shortening the stay in the hospital is one main concern of the patient and patient party and is beneficial to both hospital and patient, as it reduces costs also. As one study by Adolfo et al. [30] showed the mean postoperative hospital stay was shorter in the SILA group than in the 3PLA group but the difference was not significant. Other studies though, didn't find a much significant difference in hospital stay [20,23,31,32]. However some studies regarding SILC was said to have a significantly shorter stay in the hospital [33]. This was supported by a few other studies [34,35]. So among different studies done the LOS between SILA and 3PLA has not much difference.

Post-operative pain

Pain is one of the main concerns for patients after surgery. In order for patients to return back to their daily activities, postoperative

pain needs to be less. Less post-operative pain also allows less use of analgesics. In the study conducted by Carter et al. [20] showed the SILA patients reported a mean pain score of 4.4 of 10 in the first 12 hours after surgery, compared with 3.5 for 3-port patients. A visual analogue scale was used from 0-10 in which 0 refers no pain whereas as 10 refers to severe pain in ascending order. In another study Post-surgery pain was measured using the VAS scale (0-10), with higher readings for SILS with a statistically significant difference, SILA=4, 3PLA=3.3 [23]. In contrary other study by Ahmed et al. [25] showed patient have slightly less pain following SILA; comparison to 3-PLA. However, this was not statistically significant in which SILA group required less morphine in recovery. Another two study reported significant difference on pain score in favor of the SILA group during the first 24 h [21,22]. Teoh et al. [16] described no significant differences in pain score when evaluated at rest but a decrease in this score in the CLA group during coughing and standing. As many patients felt pain after surgery, it is difficult to conclude precisely on whether or not there is less post-operative pain. More study is required in this area.

Complications

During or after surgery both doctors and patient don't want any complication, which could lengthen the hospital stay and could affect the normal life after operation The most frequently reported surgery-related complications were wound infection, prolonged postoperative ileus, incisional hernia, intra-abdominal infection, stump leakage etc. According to study done by villabos et al. [36] there were 2 intra-abdominal abscess cases requiring hospitalization for IV antibiotics for SILA group, and only 1 case for 3PLA. Other complications such as postoperative ileus or surgical wound infection, among others, showed no significant differences. Peters et al. [37] stated that there was no significant difference in wound infection between the SPILA group (6/180) and the three-port group (3/180). A single patient suffered an intra-abdominal abscess, occurring in the three-port group. According to the several studies conducted by Teoh et al., Frutos et al., Sozutek et al. and Lee et al. [14,16,19,21] showed patient complications were similar between groups the results for SILA and 3PLA groups revealed no significant difference despite some fewer complications in each groups.

Conversion (to additional port or Open)

During the course of surgery every surgeon wants to finish the surgery without any complication or difficulty but due to some unavoidable circumstances surgeon need to convert the operation for example difficult and unclear anatomy, intra operative bleeding that can't be tackled by existing procedure etc. In one study by Ahmed et al. out of 33 patients in SILA group 3 patients in the required an additional port, 2 patients underwent standard three port laparoscopic surgery, and 1 patient was converted to an open operation. While out of 34 patients the 3PLA group, 2 patients required an additional port and 2 patients were converted to an open operation. Another study Carter et al. showed 1 case of SILA need to be converted which required 2 additional port due to intra operative complication. While in 3PLA group this is no any conversion. Others studies Sozutek et al., Teoh et al. and Frutos et al. [14,16,21] regarding conversions reported that there was not significant difference in the conversion rates among two groups. Sozutek et al. [14] in their studies stated that considering results of patients with complicated appendicitis treated with SILA and 3PLA, both methods may be applicable in experienced hands. As in all laparoscopic operations, insufficient exposure due to severe inflammation or dense adhesions is always the main indications for open conversion or additional port. Conversion should be considered as a surgical decision and not a complication.

Cost

Although not many studies have clearly stated about the cost difference between SILA and 3PLA, one meta-analysis conducted by

Jun Gao et al. [17] reported that the use of additional device makes SILA more expensive than 3PLA.

In a comparison of costs, it is said that SILC is more expensive than traditional 4 port laparoscopic cholecystectomy [38,39]. In another study Bucher et al. [40] surgeons tried to reduce the cost by reusing material. According to the study conducted by Lee et al. cost was significantly lower in the SILA group compared with the CLA group because of using a unique "single-port", that could reduce the number of trocars, generally 3 trocars were needed for CLA and 1 trocar for SILA [41]. However, it must be noted that the surgical techniques differed among the included studies in terms of the type of umbilical port (triport vs. "homemade") and straight versus curved instruments. These differences impact the cost of SILA significantly [42]. The study conducted by Seung Min Baik et al. [43] showed no any significant difference in the cost comparisons between the two groups. (SILA \$1,527 ± 218.3 and 3PLA \$1,549 ± 119.8)

Conclusion

In the current era of modern surgery SILS represents a new technique in minimally invasive surgery and has been applied to various abdominal operations aiming to reduce the trauma of surgical access and improving cosmesis. Paul Buckley 3rd et al. [44] in their study concluded that Single-incision laparoscopic (SILS) surgery has emerged as an alternative to 3-PLA, with some advantages in terms of patient satisfaction and cosmesis and SILA performed by experienced surgeons have shown similar postoperative outcomes as 3PLA. SILA is a safe technical alternative to 3PLA for patients with appendicitis. Some studies have shown that SILA has the advantage of shorter hospital stay and it can achieve comparable operative time, blood loss, postoperative recovery, postoperative pain and complications with 3 port laparoscopic [45]. SILA is feasible technique and represents a possible alternative to conventional laparoscopic appendectomy as it does not increase the rate of complications. However Jun gao et al. [17] in their study reported that SILA should not yet be considered the gold standard for appendectomy as long term data on outcome are lacking.

Hence, SILA is a procedure still in the progress of being superior to traditional 3 port in the field of minimally invasive surgery for the treatment of acute appendicitis and many more studies should be conducted in large scale to see if SILA can replace 3PLA in future.

Conflict of interests

Authors have no conflict of interests to declare

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