British Journal of Medicine & Medical Research
15(11): 1-7, 2016, Article no.BJMMR.25988
ISSN: 2231-0614, NLM ID: 101570965

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Cost Benefit Alternative to Single Access Laparoscopic Cholecystectomy

A. M. Abdelaziz Hassan[1*], M. Mahmoud[1], S. B. Elsebaie[1], A. I. Nafeh[1] and M. M. Elsebae[1]

[1]Department of General Surgery, Theodor Bilharz Research Institute, Giza, Egypt.

Authors' contributions

This work was carried out in collaboration between all authors. Authors AMAH and MME designed the study, collected the data and wrote the manuscript. Authors MM, SBE and AIN designed the study and collected the data. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2016/25988
Editor(s):
(1) Devendra K. Gupta, Department of Pediatric Surgery, All India Institute of Medical Sciences, New Delhi, India.
Reviewers:
(1) Apurva Pande, Hepatology,Institute of Liver and Biliary Sciences, New Delhi, India.
(2) Einar Arnbjörnsson, Skane University Hospital and Lund University, Lund, Sweden.
Complete Peer review History: http://sciencedomain.org/review-history/14693

Original Research Article

Received 29th March 2016
Accepted 6th May 2016
Published 18th May 2016

ABSTRACT

Introduction: Single-incision laparoscopic surgery is an attractive approach for cholecystectomy. However, its widespread application has many limitations. A significant obstacle of application in developing countries is the expensive and non affordable specialized single port systems and roticulating instruments.
Objective: To assess the feasibility and effectiveness of the glove port technique of trans-umbilical single incision laparoscopic cholecystectomy (SILC) performed by a single surgeon using the conventional laparoscopic instruments.
Methodology: 70 patients with symptomatic gall bladder stone disease were selected and underwent glove port laparoscopic cholecystectomy (GPLC). Patient's demographic data, operative data, early postoperative complications, patient satisfaction score and wound measurement 3 months later, were documented and statistically analyzed.
Results: The mean operative time was 47.75 min. The mean estimated blood loss was 14.5 ml. No conversion of the technique occurred. Overall intra operative complication rate was 5.7%, while post operative complication rate was 4.2%.
Conclusion: On technical basis; we consider GPLC in selected cases; a safe, feasible and convenient, and cost effective method of SILC.

**Corresponding author: E-mail: ahmedelmaghney@yahoo.com;*

Keywords: Gall bladder; single incision laparoscopic surgery; glove port laparoscopic cholecystectomy.

1. INTRODUCTION

Single Incision Laparoscopic Surgery (SILS), which is based on the idea that all the laparoscopic trocars are inserted through the same incision, has gained popularity in the last few years because of reduced surgical trauma, expectation of reduced risk for wound complications, reduced post operative pain and analgesia requirement and better cosmosis [1,2]. Despite those advantages, technical challenges and limited financial resources may harbor the practice of SILS due to the high costs of its special requirements (roticulating instruments and the more expensive semi flexible laparoscope & special ports). Moreover, it requires a longer learning curve. These limitations precluded this procedure in many centers, especially in developing countries. Although technical challenges and the learning curve can be dealt with, when performed by surgeons who are experienced in laparoscopic surgery, it is still of great importance to increase cost- effectiveness [3-6].

In this context, we conducted this study to assess the feasibility, effectiveness and cost benefits of the glove port technique of trans-umbilical single incision laparoscopic cholecystectomy (SILC) performed by a single surgeon using the conventional laparoscopic instruments.

2. PATIENTS AND METHODS

A prospective study was done for patients with symptomatic gall bladder stone disease conducted to between November 2013 and October 2015. All patients in the study gave written informed consents for single port laparoscopic surgery with the understanding that conversion to either multiport laparoscopic or open cholecystectomy may be possible. Patients included in the study were those with chronic calcular gall bladder disease with an overall good health (ASA I/II) and body mass index (BMI) < 35 kg/m^2. Patients with complex biliary disease (acute cholecystitis, choledocholithiasis, history of jaundice, pancreatitis), prior history of upper abdominal surgical procedures and umbilical hernia or diseased umbilicus were excluded. For all patients, the main author was the main surgeon of the surgical crew.

2.1 Surgical Technique

2.1.1 Position of the patient and surgical team

The patient was positioned supine with the legs split apart and strapped firmly to the leg boards with both upper and lower limbs abducted. A restraining belt placed at the level of the pelvis to secure the patient to the table. The staff must be positioned such that the surgeon is between the patient's legs, the first auxiliary on the left, and the scrubbing nurse on the right. The monitor should be left by the patient's right shoulder level.

2.1.2 Placement of the glove port

After pulling out the umbilicus, it was held with two-toothed forceps and a curved 15-25 mm incision was made through it using 11 mm blade taking care not to extend beyond the umbilical outer extremity. This was deepened through the fat then; the flaps are undermined to expose the fascia. Fascial incision of 2.5-3 cm was done. Afterwards, insertion of the glove port was performed. It was prepared with a single treated latex glove of size 7, 1 flexible and smaller inner ring such as a sterilized rubber bangle (inner diameter = 5-6 cm) and a rigid outer ring with larger diameter (Inner diameter = 11-12 cm). Inner ring was placed within the wrist portion of glove fold and outer ring was placed within the palm portion of glove fold. Two 10-mm and two 5-mm trocars were fixed to four fingers of glove apart from the thumb finger. The inner ring portion was introduced into peritoneal cavity through the incision and pneumoperitoneum was created. The outer ring portion remained outside the abdominal wall. This position makes glove port self retaining after pneumoperitoneum (Figs. 1A and B) and 2A and B)).

2.1.3 Placement of traction suture

The patient position was changed to a reverse Trendelemburg position (cranial elevation) and discrete left lateral docubitus. A grasper was used to move the omentum away from the right upper quadrant so as to obtain a view of the fundus of the gall bladder. Then retraction of the gall bladder fundus in a cephalic lateral position was done. Maintenance of the fundus in such a position was kept by placing a suture on a straight needle through the abdominal wall just

below the costal margin, passing through the gall bladder fundus, then through the abdominal wall and fixed on the skin (Fig. 3). After 4 cases we found that introduction of a traction grasper through the glove port was feasible and convenient and we did not use the traction sutures afterthought.

(A)

(B)

Fig. 1. Materials used for glove port technique

2.1.4 Surgical procedure

Dissection of the Calot's triangle with control of the cystic artery and clipping of the duct was done, using two clips proximally and one clip distally. After clipping is completed, dissection of the gall bladder from its liver bed was performed by using electric cautery dissecting hook. The fundal traction suture was loosened and the gall bladder was freed from the liver. After the achievement of meticulous hemostasis in the liver bed, removal of the gall bladder was done through the glove port.

(A)

(B)

Fig. 2. Installment of glove port

2.1.5 Closure of the incision

Closure of the anterior layer of the rectus muscle was performed by using 0 PDS on J shaped needle followed by subcuticular closure of the curved umbilical incision using 4/0 Monocryl restoring the umbilicus to its normal physiological position (Fig. 4).

Patient demographic data, operative data, length of postoperative hospital stay, and perioperative complications (if present) were collected prospectively. Each patient was followed on the 8th postoperative day for wound examination and stitch removal. Three months after the procedure patient satisfaction score by an analog scale of 10 grades and wound measurement of its linear dimensions using a tape measure was done.

Fig. 3. Placement of traction suture

Fig. 4. Wound closure

3. RESULTS

Seventy patients with symptomatic gall bladder stone disease underwent GPLC during the study time period. The patients mean age was 38.06, with a ratio of 6:64 (male: female ratio). The average BMI was 29.44. All patients were ASA I except of three patient, whom were ASA II. The time consumed for glove port placement after skin incision, mean operative time, mean estimated blood loss and intra-operative complications are shown in Table 1. No conversion of the technique occurred. It worth notice that; the mean operative time has declined with rising of the learning curve. A drain was inserted in three cases with intra-operative incidents of gall bladder perforation or cystic artery bleeding.

Hospital stay, post-operative wound complications, wound length three months after the procedure and patient satisfaction score of the procedure are shown in Table 2. Overall rate wound complications (including seroma, hematoma and infection) was 2.5%. Mean Patient satisfaction at 3rd month was an average of 9.41.

Table 1. Intra-operative data

Port placement time (mean in min)	5.2
Operative time (mean in min)	47.75
First 25 cases	67.2
Last 45 cases	41.3
Estimated blood loss (mean in ml)	14.5
Complications – n (%)	
GB perforation*	3 (4.3)
Cystic artery bleeding*	1 (2.5)
Technique conversion – n (%)*	0 (0%)
Drain insertion – n (%)*	3 (4.3)

Table 2. Post-operative data

Hospital stay – n (%)	
Same operative day	49 (70)
1 day	19 (27.2)
2 days	2 (2.8)
Wound seroma – n (%)	2 (2.8)
Wound hematoma – n (%)	1 (1.4)
Wound infection – n (%)	0 (0)
Wound length (3rd month) – cm	
Mean	1.59
Range	1.37-2.2
Patient satisfaction (3rd month) – mean	9.41

4. DISCUSSION

Laparoscopic cholecystectomy, which was traditionally performed through four ports, is now being done successfully with fewer ports [7]. Single incision laparoscopic surgery (SILS) has emerged as a novel technique to minimize postoperative morbidity and improve cosmesis. The technique involved the use of a singular access device that allowed introduction of three to four instruments through the device using a single opening in the umbilicus. The initial favorable reports with use of these devices paved way for a wide range of access devices entering the market [8]. These latest devices allow the surgeon to insert more than two instruments and an optic with or without trocars; through the same port [9]. The articulating instruments used through these access devices give a sense of triangulation [10,11]. Despite

those advantages, the high costs of its special requirements preclude its use in many centers. In the quest for assessment of the feasibility, effectiveness, safety and perceived benefits of the glove port laparoscopic cholecystectomy (GPLC); we performed this study of selected seventy patients.

The use of the "glove-port" has been reported previously in general surgery studies as in other specialties [12-14]. It is moving from single-case descriptions to case series [15,16]. In our study the glove-port technique showed multiple advantages. It is easy to use and can be simply accommodated to the abdominal wall even in over weight patients. It is also attractive with regard to technique, as it allows using simultaneously up to four instruments without any size limit which accordingly provides a wider axis of movement. This advantage limited the need for fundus slinging, which we stopped to do after 4 cases of the study. In addition, the instruments can be interchanged, crossed and rotated as the situation requires. Furthermore, there is freedom of movement in the horizontal and vertical planes and friction is avoided between the trocars and abdominal wall. This could be an advantage with regard to parietal trauma and could result in less postoperative pain [17,18] and this fact can have several merits: the effect of the two rings of the wound retractor can prevent subcutaneous emphysema, port-site infection and bleeding. This means that the glove acts as a wound protector and avoids port site contamination (0% in our study) or metastasis while retrieving infected or malignant specimens. Some randomized controlled trials have shown negative results of GPLC regarding operative time, wound-related complications, and postoperative pain. However, our data shows equivalent clinical outcomes among the two approaches in terms of postoperative pain and complications; in agreement with other studies. The umbilical incision is minimized; this advantage can decrease the postoperative pain and the rate of surgical site hernia development. No extra-umbilical incisions were used and virtually no scar remained [19,20,21,22].

The GPLC procedure has a lower cost than both the SILC procedure with commercially available dedicated devices. The use of surgical glove obviates issues of devices cost but of course not operative skills. Additional cost benefit advantage is the use of conventional laparoscopic materials, allowing the realization of single access surgery at any center that has access to laparoscopy and has trained staff. Therefore, the cost of the SILC procedure should not be the reason to reject the technique. This study has demonstrated that considerable savings occur with the policy of using the conventional re-usable laparoscopic instruments. Using a disposable set, the instruments cost per procedure are 6.4 times greater than the cost of using re-usable laparoscopic cholecystectomy sets in some studies. It behooves surgeons to be cost-effective and to reduce unnecessary expenditure and wastage. There is no evidence to support use of once-only laparoscopic instruments on grounds of patient safety, ease of use or transmission of infection. Even greater savings would accrue if the results were extrapolated to cover all laparoscopic surgery of whatever discipline [23,24].

On the cons side of the technique; although no gas leakage was noted during the procedure but intra-abdominal smoke that may slow the procedure somewhat is another problem because there is no separate venting channel. Significant coordination between the surgeon and the camera holder is needed which also affects the operative time. The surgeon also has to be adapted to counterintuitive movements due to frequent crossing of the instruments hafts at the point of entry into the abdominal cavity. Finally, if the lack of a fixed axis for instruments can be an advantage for movements as above discussed, it can cause in some conditions a further difficulty for the surgeon: the glove cannot always give just the same stability of a traditional trocar or single-incision device.

5. CONCLUSION

On technical basis; we consider GPLC in selected cases is a feasible and effective method of SILC because of easy and safe port placement and prevention of port site infection. The technique is a cost effective and convenient alternative to single port laparoscopic cholecystectomy.

CONSENT

All authors declare that written informed consent was obtained from the patient for publication of this study and accompanying images.

ETHICAL APPROVAL

This study was reviewed and approved by the Ethics Committee of Theodore Bilharz Research Institute (TBRI).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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