Comparison between Hand Suture and Carter-Thomason Needle Closure of Port Sites in Laparoscopy

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Purpose: To compare between hand closure and Carter-Thomason technique with respect to following parameters, time taken for port site closure, wound infection, wound dehiscence, seroma formation, port site herniation, and ascitic fluid leak.

Materials and Methods: In this study, 200 cases who underwent laparoscopic donor nephrectomy were selected and divided into two groups based on closure technique. First 100 cases underwent port closure by the standard hand closure technique and next 100 cases by Carter-Thomson needle technique. Subjects included in this group are healthy individuals with no co morbid illness. This might help to reduce the bias of complications arising from other than technical issue.

Results: In our study Carter-Thomason serves as a better mode of port site closure with respect to time reduced, wound and bowel related complications compared to hand closure technique.

Conclusion: In this study closure of trocar site is better with the Carter-Thomason method when compared to hand closure technique.

Keywords: sutures; treatment outcome; suture techniques; abdominal wound closure techniques; fascia; laparoscopy.

INTRODUCTION

The importance of closing port sites has been well established.[1] Port-site hernias in laparoscopic surgeries have been frequently reported and complications related to port site closure have been reported in 0.23% to 6.3% of patients.[2] These complications include wound infection, dehiscence, herniation of the small bowel, entrapment of omentum and incarcerated Richter's hernia.[1,2] A significant complication like hernia for the patient results in a second surgical procedure to fix the defect. It's a financial burden and impairs quality of life. The benefits of laparoscopic surgery in terms of quick and rapid recovery are questioned. Main complication is bowel herniation and obstruction.[3,4] Fear was first to report port site herniation.[5,2] Trocar related complication is seen in 1% to 6% of patients.[6] To prevent these complications, 10 mm port or more should be closed in adults and 5 mm or more in children.[7] Port site herniation for 10 mm is 0.23% and for 12 mm is 1.9%. Its incidence is increased to 6.3% for body mass index (BMI) greater than 30 kg/m^2.[8] For trocar diameter 10 mm or more the incidence of hernia was around 86.0%.[8]

Various types of port closure are available. They are usually divided into two groups. First group where closure is done using laparoscopic visualization. The second group includes methods involving direct visualization. Carter-Thomason device, Maciol needles, Grice needle, Auto stitch, modified Veress needle, GORE-TEX® device, Reverdin and Deschamps needles, Semms emergency needle with a distal eyelet, Endoclose device, exit disposable puncture closure, Tahoe Surgical device and long 14-gauge angiocatheter with looped polypropylene suture mainly in the first group. Lowsley retractor with hand-sutured closure, fish hook needle, dual hemostat technique, port plug technique and hand-sutured closure requires direct visualization of the surgeon, and tactile feedback plays an important role in the closure.

MATERIALS AND METHODS

After ethical committee clearance and standard work-up protocol for donor nephrectomy, 200 donors underwent laparoscopic procedure with no open conversion. Donors with a history of diabetes mellitus, coronary artery disease and hypertension were excluded from the study. First 100 cases underwent port closure by the standard hand closure technique and next 100 cases by Carter-Thomson needle technique. None of the cases had an open conversion All donors had two 10 mm ports and three 5 mm ports and the organ extraction site was Pfannenstiel incision as shown in **Figure 1**. All patients underwent left laparoscopic donor nephrectomy. Bladeless Trocars (Endopath Xcel, Ethicon; Ethicon Endo-Surgery, Cincinnati, Ohio, USA) was used. After organ extraction Pfannenstiel incision was closed by standard technique.

Pneumoperitonum introduced, kidney bed and extraction site examined. Drain kept in flank 5 mm port. Port closure was done at the end of procedure by operating surgeon. Its time taken from fascial closure of two 10 mm port to port site skin closure. Ten mm port site closed with 2-0 Vicryl by Carter-Thomason. Subcutaneous tissue with

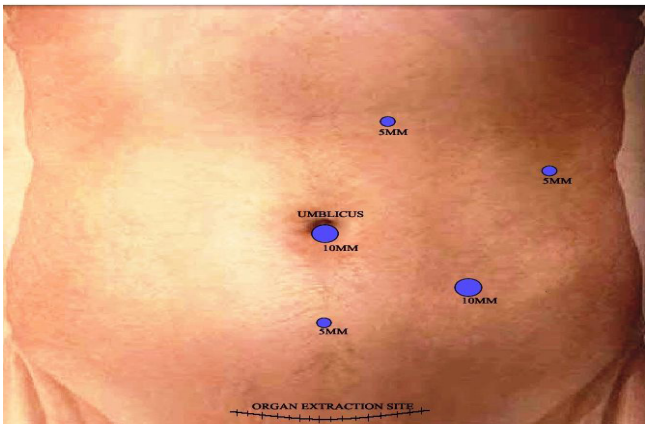

Figure 1. Representing port sites in left laparoscopic donor nephrectomy.

3-0 Vicryl. Skin was closed using 4-0 interrupted Monocryl stitches. Hand closure was done after deflating abdomen and other technique utilized laparoscopic visualization retaining pneumoperitoneum. In Carter-Thomson needle technique, pilot guide (**Figure 2**) was inserted with holes aligned perpendicular to the trocar wound. The suture passer is used to push suture material through the pilot guide, fascia, muscle and peritoneum into the abdomen then drop the suture and remove the suture passer. On the opposite side of the pilot guide, push the suture passer through all of the layers and pick up the suture with the hinged jaw. Pull the suture up through the peritoneum, muscle, fascia and pilot guide. Remove the pilot guide and tie off the suture. Once the surgery is finished, all the instruments were removed carefully under vision. All the accessory ports were removed after deflating the abdomen. The camera port was taken out at last, with telescope introduced in and the cannula is pulled over telescope to prevent herniation of omentum or bowel. The trocar site was cleaned with 10% povidone iodine solution before closure. Closure of the fascial defect and skin were performed for all 10 mm ports and skin in 5 mm ports. Port site infection information's were taken from patients who developed a port site hernia, witness of pus inside the wound indicate infection, information about seroma collection, ascitic fluid leak and wound dehiscence. Patients were followed-up to 2 years. Post-operative follow-up was 1, 3, 6, 12 and 24 months with serum creatinine report. The following parameters were observed, time taken for port site closure, wound infection (requires opening up of stich for pus drainage

Figure 2. Carter-Thomason needle.

and antibiotics), wound dehiscence, wound collection (requiring aspiration, which shows clear fluid or subsiding without treatment), port site herniation and ascitic fluid leak. Statistical analysis was done by chi-square test.

RESULTS

In hand port closure group 10 and 21 subjects were obese (BMI between 30-35 kg/m^2) and overweight (BMI between 25-29 kg/m^2), respectively, rest 69 had normal BMI. Similarly in other group 9 and 19 were obese and overweight, respectively, rest 72 had normal BMI. Carter-Thomason method resulted in less incidence of wound infection, wound dehiscence, wound collection, port site herniation and ascitic fluid leak. In obese patients the closure was technically challenging in hand port technique, whereas in Carter-Thomason there was no much technical issue. There was lot of tissue handling in case of hand port technique. There was no incidence of vascular or bowel injuries during use of Carter-Thomason needle (**Table**).

Patient with wound infection and collection underwent incision and drainage in the outpatient department and treated with oral antibiotics. It resolved within a week. The cases of wound dehiscence underwent secondary suturing in the outpatient department. Ascitic fluid leak was from umbilical port. With local dressing and antibiotic it resolved within four days. A case of port site herniation underwent explorative laparotomy and bowel anastomosis to correct bowel obstruction. Ascitic fluid or gas leakage was not seen in the Carter-Thomason technique (**Table**).

DISCUSSION

Since the early days of laparoscopy, port site hernias have been reported.[9-11] Cause of trocar site hernias mainly attributed to large trocar size, incomplete fascia closure at the trocar site, midline trocars, trocar site stretching, suction effect while port withdrawal, being overweight, malnutrition and vitamin and mineral deficiencies are known factors contributing to these hernias.[11-16] Other factors that could play a role in the formation of trocar-site hernias in addition to the trocar site and trocar diameter including its design, existing defect in fascia and operations and patient-related factors like age, wound infection rate, diabetes mellitus and other co-morbidities, such as smoking and greater BMI.

Fascia closure of trocar sites more than 10 mm has led to reduced herniation and significantly reduced and postoperative morbidity.[11,15,16] Some also advocate that 5 mm port sites subjected to extensive manipulation should have closure of the fascia as well.[17] Removal of ports after deflation of pneumoperitoneum and proper fascial closure reduce the chances of port site herniations.[7,18,19] Lower incidence of hernias with the non-bladed trocars has not been proven yet.[20-22] The preperitoneal space can be closed incorporating the peritoneum into the fascial closure to reduce the chances of port site herniation.[7,23,25] Z-tract or inserting port in oblique fashion will reduce incidence of hernia.[26,27]

Blunt conical trocar–cannula systems resulted in smaller fascial defects when compared to pyramidal and two cutting-dilating trocar-cannula systems.[28] Trocar site hernia in closed laparoscopy was lower than in open first access technique.[15] Forced dilation of the fascial layer and the effects of pneumoperitoneum might push abdominal contents through the port site by creating a partial vacuum when the port is withdrawn.[29-31] The abdominal contents like omentum or bowel loops might then be trapped by contractions of abdominal muscle. Substantially pannus and high intra-abdominal pressure in obese patients leads to increased chances of hernia.[32]

CONCLUSION

In this study closure of trocar site is better with the Carter-Thomason method when compared to hand closure technique in terms of faster closure, wound infection and port site herniation.

CONFLICT OF INTEREST

None declared.

Table. Representing compared values.

Variables	Hand Closure Technique	Carter-Thomason	*P* Value
Total case	100	100	-----
Time taken (min)	15 (9-25)	8 (7-12)	.02
Wound collection	10	1	.005
Wound infection	2	1	.56
Wound dehiscence	2	None	.45
Port site herniation	1	None	.003
Ascitic fluid leak	6	None	.012
Body Mass Index	24.28	25.96	.475
Male to female ratio	58:42	47:53	-----

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