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NEW SURGICAL HORIZONS

Single-incision laparoscopic TAPP mesh hernioplasty using conventional instruments: an evolving technique

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Abstract
Objective The aim of this pilot study is to assess the safety, feasibility, and short-term outcomes of single-incision laparoscopic trans-abdominal preperitoneal (TAPP) mesh hernioplasty using conventional laparoscopic instruments.
Methods During a 3-month study period, data from all consecutive patients referred for inguinal hernia repair to the general and minimally invasive surgery unit of our institution who agreed to undergo single-incision TAPP mesh hernioplasty were included in the prospective study. Outcome measures included completion rate of the attempted procedure, operative time, length of hospital stay, postoperative pain, and assessment of complications. Follow-up was done for 3 months.
Result Fifteen patients completed our protocol. Two patients had bilateral inguinal hernias while all other patients had unilateral hernia. Two patients had sliding hernia on the left side which had sigmoid colon as content. None of the patients required any additional port. There were no intraoperative complications.
Conclusions The concept of laparoscopic single-incision surgery is an attractive and understandable innovation as laparoscopic surgery has become more commonplace. Based on our experience, we believe that the procedure is feasible without additional risk. Cosmetic benefit is clear; however, beyond the actual outcome with respect to postoperative pain and long-term complications, needs to be evaluated and compared to standard laparoscopic TAPP mesh hernioplasty.

Keywords Single-incision laparoscopic TAPP hernioplasty · Single-incision laparoscopic surgery · Laparoscopic mesh hernioplasty · TAPP · TEP

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Introduction

Laparoscopic surgery has always focused on minimizing surgical trauma and improving cosmetic effect. Laparoscopic access to the gall bladder was shown to significantly lessen postoperative pain and hospitalization compared to open methods [1]. By reducing postoperative morbidity, laparoscopic approach to surgical diseases has reduced postoperative disability, and importantly, the return to full activity [2, 3].

However, laparoscopic surgery for inguinal hernia still remains a matter of debate. Some have argued that the only advantage of laparoscopic preperitoneal hernia repair is the avoidance of painful abdominal incision [4].While eminently desirable, the reduction of postoperative pain is not the sole reason for considering laparoscopic hernia repair. The laparoscopic approach offers a way to fully utilize the current knowledge of groin anatomy and pathophysiology. Specifically, laparoscopic approach offers the ability to fully expose and reconstitute the entire

myopectineal orifice, thus facilitating repair of bilateral groin hernias through a single incision. Also, repair can be performed with little disturbance to cord structures, and a thorough intra-abdominal examination can be done at the time of hernioplasty.

The standard laparoscopic approach can be performed either through a trans-abdominal approach (trans-abdominal preperitoneal; TAPP) or a totally extraperitoneal approach (TEP) [5]. Traditionally, the operation involves inserting three ports—camera port below the umbilicus and two ports bilaterally just lateral to the rectii muscle, resulting in three surgical scars [5]. In the 21st century, the rapid advancement of surgical technology has enabled the surgeons to make modifications in laparoscopic surgery by reducing the number and size of incisions. Single-incision laparoscopic surgery developed with the aim of a potential scarless surgery being performed through a single incision at the umbilicus. It has been given a number of acronyms, including single-incision laparoscopic surgery, single-port access surgery, laparoscopic endoscopic single-site surgery, natural orifice trans-umbilical surgery (NOTUS), and embryonic natural orifice trans-umbilical endoscopic surgery.

Single-incision laparoscopic appendicectomy [6] and cholecystectomy [7] was first described in 1998 and was recognized again by Hirano et al. [8] in 2005 when they used this approach in Urology. However, in procedures such as inguinal hernia, laparoscopic approach still remains a matter of debate, and single-incision laparoscopic surgery may prove to be one of the factors in its favor. We report our technique and operative outcome of single-incision laparoscopic TAPP mesh hernioplasty performed at our institution.

Methods

This is a prospective trial conducted at Fortis Escorts Hospital and Research Centre, Faridabad. Patients presenting with symptoms of groin pain and swelling and clinically confirmed inguinal hernia were given the option to undergo single-incision laparoscopic TAPP mesh hernioplasty. They consented to the technique after all the risks and benefits were properly explained. All the operations were performed by the same surgical team that has extensively performed laparoscopic mesh hernioplasty (TAPP and TEP) over the last 6 years and had an experience of over 50 cases of single-incision laparoscopic cholecystectomy. Our first single-incision laparoscopic TAPP mesh hernioplasty was performed in June 2009. Between then and August 2009, a total of 15 patients have undergone 17 inguinal hernia repairs (13 unilateral and 2 bilateral) under institutional board-approved protocol.

Operative time and intraoperative complications were monitored. Post-operative analgesia requirement and duration of stay was noted. Follow-up for 3 months at intervals of approximately 1 week, 1 month, and 3 months after date of discharge from the hospital was done in Surgery Out Patient Department. Clinical assessment was done to detect recurrence or other complications (e.g., seroma, port-site hernia). Time to return to normal activity and wound infection was also recorded.

Operative technique

Pneumoperitoneum was created with a veress needle through a 20-mm curvilinear incision at the cephalic margin of umbilical crease. A 10-mm port was placed through which a 45-cm 50° laparoscope (Richard Wolf, HD 50° Panoview) was introduced. Two 5-mm ports were placed through the same incision, piercing the sheath 1 cm caudal and to the left and right of the 10-mm port (Fig. 1).

The peritoneum was incised over the hernia and extended laterally using the monopolar hook cautery. The hernial sac was reduced meticulously and carefully, preserving the epigastric vessels and vas deferens using conventional endoscopic graspers and Maryland dissectors. The pubic symphysis was clearly defined medially. A 15× 12-cm mesh was placed medially across the pubic symphysis and laterally up to the lateral end of iliopubic tract. The mesh was fixed to cooper's ligament medially and also at the superolateral angle using Protac™. The peritoneum was approximated over the mesh with tackers or intracorporeal suturing with 3/0 vicryl suture. The suturing was commenced with a jamming knot and terminated without a knot. Both the ends of the running suture was secured with a 5-mm endoclip (Antosuture TM, US Surgical, Norwalk, CT). However, the procedure was

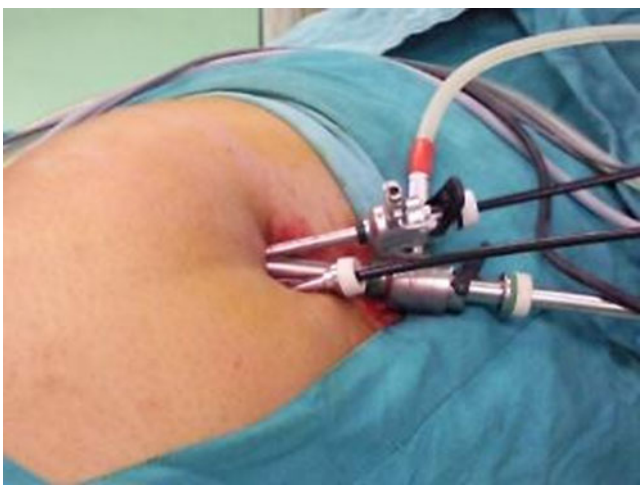

Fig. 1 Port placement for single-incision TAPP hernioplasty (operating on right inguinal hernia)

found to be technically very difficult and hence endoscopic suturing was abandoned after two cases. The pneumoperitoneum was then released under vision. The fascial and skin incisions were close using braided and coated polyglycolic acid (Truglyde, SN 2826, No 1, 1/2 circle reverse cutting, Sutures India Pvt Ltd) and undyed polyglactin suture (3-0 Vicryl rapide W9919, Ethicon), respectively.

Results

Fifteen patients underwent single-incision laparoscopic TAPP mesh hernioplasty during the period from June to August 2009. The average age of the patients was 50.33 years. Two of the patients had bilateral inguinal hernia, and all others had unilateral hernia.

Intraoperative difficulties and complications

In two patients, we encountered a sliding hernia on the left side having sigmoid colon as content of the sac. In both the patients, the sac and the contents could be safely dissected and reduced without requirement of additional port placement. Four patients had complete sac. Two patients had irreducible omentum as content on preoperative evaluation; the omentum was reduced necessitating adhesiolysis during the procedure that could be accomplished without much difficulty. There was significant technical challenge in intracorporeal suturing due to absence of triangulation.

Duration of surgery

We had 17 inguinal hernias (2 bilateral and 13 unilateral hernia). The average operative time for a single hernia was 54.11 min. The minimum and maximum duration of surgery for a unilateral hernia was 30 and 90 min, respectively. The duration of surgery for bilateral hernias was 100 and 120 min.

Postoperative stay, complications, and follow-up

The average postoperative duration of stay was 1 day (range 1–2 days). Postoperative analgesia was covered adequately by injecting Diclofenac sodium 75 mg twice daily on the day of surgery followed by oral Diclofenac tablets twice daily for 3 days. No patient required added analgesia.

Except for two patients who failed to come for the last follow-up at the third month, all the patients completed their routine 3 follow-up at Surgery OPD. None of the patients had any significant postoperative complications except for seroma formation in two patients that resolved spontaneously over about 4 weeks.

Discussion

Single-incision laparoscopic surgery is currently being performed by one of the following techniques. On one hand, a single-skin incision is made followed by multiple trocars inserted at separate points on the fascia. Alternatively, through a single-skin and fascial incision, a single-port access device is placed through which multiple trocars can be placed; however, the use of single-port access devices greatly increases the cost of surgery. Keeping this in perspective, we have used the previous method where we have placed traditional trocars though separate points in the fascia. Also, we have avoided using articulating instruments and have used conventional laparoscopic instruments without compromising the safety of the operation.

The ideal technique for inguinal hernia repair is still controversial. The benefits of laparoscopic surgery over open surgery have been reported for postoperative pain, discomfort, and earlier return to work [9–11]. Laparoscopically, inguinal hernioplasty can be performed by either trans-abdominal preperitoneal (TAPP) or totally extra peritoneal (TEP) approach.

As with any new surgical technique, there is a learning curve. We have reported our learning curve in transumbilical multiple-port laparoscopic cholecystectomy and a trend towards reduced operative times with more experience [12]. We also reported that the difficulty of the procedure was due to confined operating space, in line positioning of laparoscope, close proximity of working instruments with limited triangulation, limited range of motion of laparoscope and instruments, and decreased number of ports. However, considering the fact that we initially started with single-incision laparoscopic cholecystectomy before moving on to single-incision TAPP hernioplasty, the learning curve decreased significantly.

Rahman et al. [13] reported the first case of SIL hernia (TAPP) repair. They used roticulating dissecting instruments

Fig. 2 Incision 4 weeks after surgery

and reported loss of tactile feedback using the instruments as compared to non-roticulating instruments. Similarly, Jacob et al. [14] reported the first series of TEP single-incision laparoscopic hernia repair. However, this was done using a single-port access device and required an infraumbilical incision of 25 mm in length. Such an incision may be associated with an increased seroma formation and higher risk of incisional hernia without any significant cosmetic advantage as aptly stated by Buscher et al. [15], so they modified the technique with a 12-mm access single-port TEP repair. However, they concluded that the procedure did not offer sufficient safety even in the hands of experienced laparoscopic surgeon. On the other hand, their preliminary experience with single-site laparoscopic TAPP showed improved feasibility and safety associated with good cosmetic result.

The average operative time for standard laparoscopic unilateral TAPP mesh hernioplasty of 50 consecutive patients at our center performed by the same surgical team in the immediate retrospective period to starting single-incision TAPP was 43.3 min (range 25–90 min). On comparison with single-incision TAPP mesh hernioplasty (average time 54.11 min), it was not statistically significant (*P* value 0.06).

Although there has been sporadic case reports on extensive MEDLINE search, we have not come up with any series of single-incision laparoscopic TAPP mesh hernioplasty. Our series showed a 100% success rate of single-incision laparoscopic TAPP, and none of the patients required any additional port placement. There were no intraoperative complications and significantly even sliding hernias having sigmoid colon as content could be safely reduced. We would also like to state that restriction of movement of instruments was also not a major issue as would be expected. In fact we were able to achieve a reasonable triangulation of instruments during the cases. This would be possibly attributed to our experience in single-incision laparoscopic cholecystectomy before we started single-incision TAPP Mesh Hernioplasty. Though the obvious benefits appear to be primarily cosmetic (Fig. 2), the potential risks of developing a port-site hernia needs further study and deliberations on a long-term follow-up. Also, whether specific training is needed or credentialing specific to single-incision laparoscopic surgery is necessary, remain to be determined. Presently, its application lacks any significant level of regulation or monitoring. Clearly, some guidelines need to be implemented to avoid future complications.

Conclusion

The concept of laparoscopic single-incision surgery is an attractive and understandable innovation as laparoscopic surgery has become more commonplace. But there are important issues that need to be addressed as it is further developed and used. It is certainly still a matter of debate of the benefits of single-incision TAPP mesh hernioplasty compared to standard laparoscopic repair. To date, the apparent advantages of single-incision surgery have been mainly cosmetic and related to patient satisfaction. Our study demonstrated the safety and feasibility of single-incision TAPP mesh hernioplasty and corroborates with other case reports till date. However, further work in the form of randomized controlled trials are needed to evaluate the potential benefits of this new technique before its use can be widely recommended.

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