

Laparoscopic correction of umbilical hernias using a transabdominal preperitoneal approach: results of a pilot study

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Abstract

Background Laparoscopic repair of umbilical hernias is usually based on the open underlay procedure in which the mesh is placed intra-abdominally. To prevent complications such as adhesions, bowel obstruction and fistula formation we developed a new laparoscopic approach, placing the mesh in the preperitoneal space.

Methods Our laparoscopic approach concerns a standardised procedure with introduction of three intra-abdominally placed trocars. The ventral abdominal wall is incised in a lengthwise manner approximately 5 cm from the umbilical defect, followed by development of the preperitoneal space, reposition of the umbilical peritoneal sac and placement and fixation of a Prolene™ mesh. The mesh is secured using transfascial Prolene™ sutures; the peritoneal defect is closed with a running Vicryl™ suture. Data on 17 patients with primary umbilical hernias laparoscopically operated on between April 2002 and March 2006 are presented.

Results The 11 men and 6 women had a mean age of 57.8 years (range 37–91 years) and a mean body mass index (BMI) of 30.6 kg/m² (range 23.7–37.9 kg/m²). Mean hernia size was 1.95 cm (range 1–3 cm), average mesh size was 110 cm² (range 100–150 cm²). Mean operating time was 85.6 min (range 60–120 min). Mean hospital stay was 2.2 days (range 1–3 days). No major complications were seen. No recurrences were observed during a mean follow-up of 36.2 months (range 13–62 months).

Conclusions The preperitoneal laparoscopic technique for umbilical hernia repair combines the advantages of a laparoscopic, minimally invasive, approach, avoiding the potential complications related to intra-abdominal mesh position.

Keywords Umbilical hernia · Laparoscopy · Preperitoneal · Mesh · Surgical technique

Adult umbilical hernia is a relatively frequent condition with a prevalence of 2% and is most likely to occur in the fifth and sixth decades of life [1, 2]. The vast majority of cases occur due to increased intra-abdominal pressure. Umbilical hernias in adults are three times more common in women than in men, more common in overweight persons with weak abdominal muscles, in patients with cirrhosis and in women during pregnancy or after giving birth to multiple newborns [1–3]. Umbilical hernias have a reported incarceration rate of 17.7% [4] and are responsible for 13% of all incarcerated hernias [5], therefore repair is proposed for the majority of the symptomatic and asymptomatic umbilical hernias.

Many hernia repair methods have been described. Although open repair, preferably with mesh [3, 6–10], has long been the standard approach, laparoscopic repair is becoming more popular among surgeons and patients. Several observational studies [11–17] have raised the possibility that laparoscopic ventral and umbilical hernia repair may be associated with fewer complications, decreased length of postoperative hospital stay and lower recurrence rates. These laparoscopic techniques are usually based on the same physical and surgical principles as the open underlay procedure, in which the mesh is implanted intra-abdominally. Because intra-abdominal placement of a

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mesh is associated with complications such as the formation of intestinal adhesions, bowel occlusion and enterocutaneous fistulas [15, 18, 19], we developed a new laparoscopic technique in which the mesh is positioned in the preperitoneal space. In the present report we describe the outcomes of a pilot study.

Materials and methods

Patients

Between April 2002 and March 2006, 17 patients underwent laparoscopic umbilical hernia repair with implantation of a mesh in the preperitoneal space.

For each patient, retrospectively, the following demographic, peri- and postoperative data were collected: sex, age, body mass index (BMI), American Society of Anaesthesiologists (ASA) classification, estimated blood loss during surgery, operative and postoperative complications and hernia recurrences. At operation, size of the fascial defect, size of prosthetic mesh used, technique of mesh fixation and operating time were recorded. For extra follow-up and history taking, patients were interviewed by telephone in June 2007.

Surgical technique

Surgery was performed by the same surgeon (I.H.O.) in all patients. At the time of induction of anaesthesia, 1,500 mg cefuroxime antibiotic prophylaxis was administered preoperatively. Patients were operated on in supine position with the surgeon standing on either the left or right lateral side, according to the surgeon's preference. The ipsilateral arm was placed over the head of the patient, away from the surgeon. Three trocars were used: one 10–12-mm trocar for the endoscope, a 10–12-mm trocar and a 5-mm trocar as working channels. The trocars were placed in the anterior axillary line: in the upper, middle and lower quadrant on the ipsilateral side of the patient with the middle slightly more lateral than the other two (Fig. 1). A 30° laparoscope (Karl Storz, Tuttlingen, Germany) was used. After installing pneumoperitoneum in an open fashion and introduction of the trocars, the ipsilateral side of the peritoneum of the ventral abdominal wall was incised in a lengthwise manner, within a margin of 5 cm of the umbilical defect (Fig. 2). The preperitoneal space was developed, thereby reducing the umbilical peritoneal sac (Fig. 3). External pressure on the abdominal wall by one hand of the assistant was considered helpful in order to facilitate laparoscopic extraperitoneal dissection. A polypropylene mesh (Prolene™, Ethicon INC, Somerville, NJ, USA) was introduced in the preperitoneal space to cover the defect

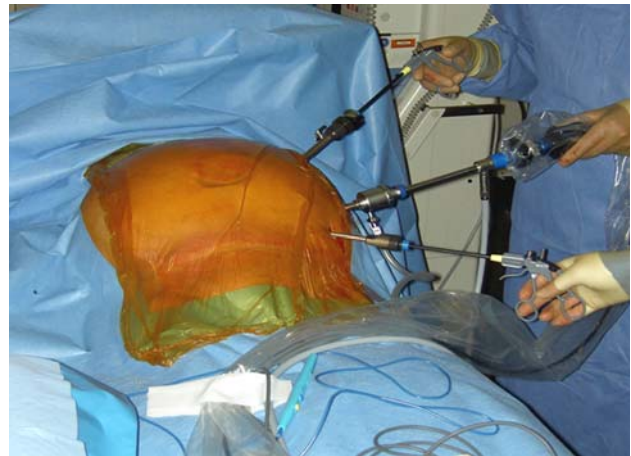


Fig. 1 Placement of the trocars

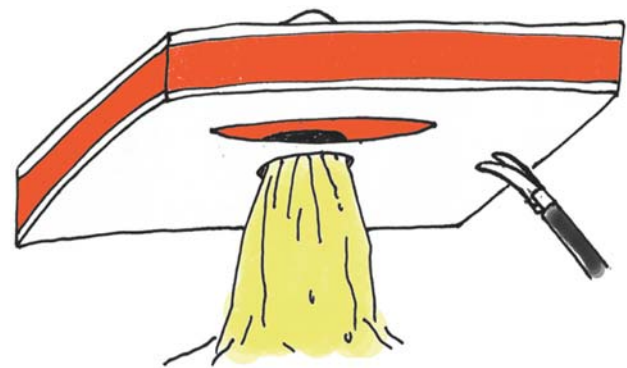


Fig. 2 Incision of the ventral abdominal wall

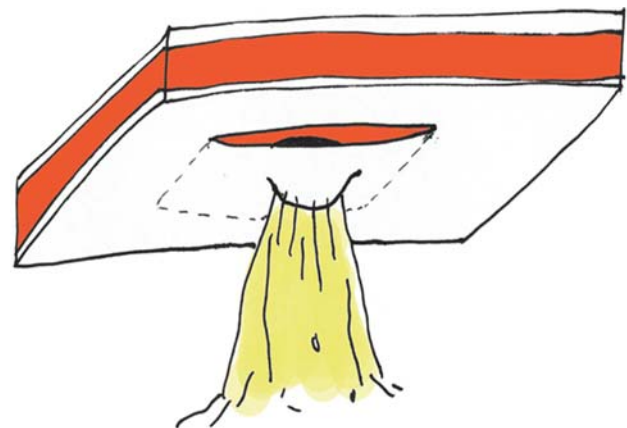


Fig. 3 Development of the preperitoneal space

with at least 3 cm overlap in all directions [20] (Fig. 4). Using the Endoclose™ device (Autosuture, Tyco Healthcare, Norwalk, USA), four transfascial Prolene™ sutures were placed intra-abdominally to secure the corners of the mesh to the fascia. The peritoneal defect was closed with a running Vicryl™ suture (Ethicon INC, Somerville, NJ,

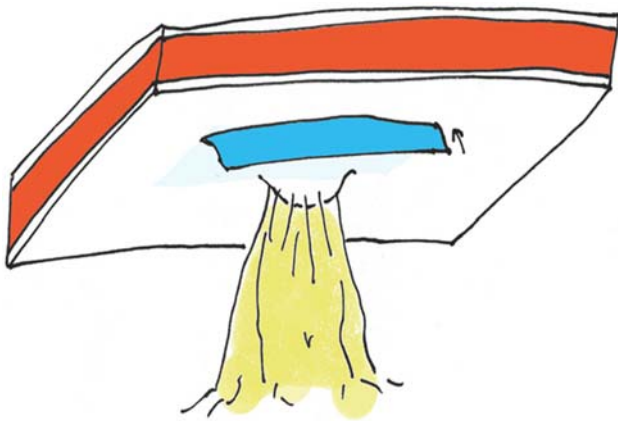


Fig. 4 An appropriately sized mesh covering the defect is placed in the preperitoneal space

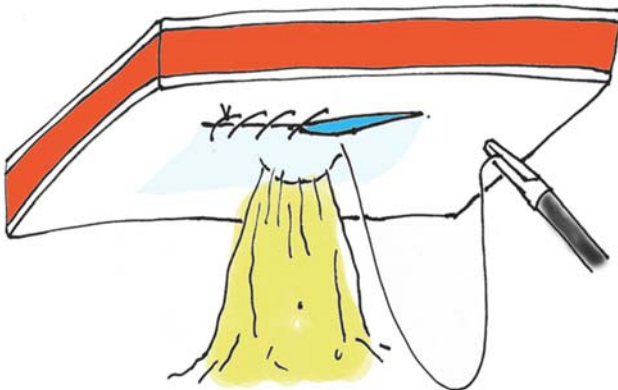


Fig. 5 Closing the peritoneal defect with a running Vicryl™ suture

USA) (Fig. 5). Removal of the trocars and desufflation was performed under direct view. The skin was closed with Monocryl™ sutures (Ethicon INC, Somerville, NJ, USA).

Data

Data are expressed as mean \pm standard deviation (SD).

Results

Demographic, peri- and postoperative data are shown in Table 1. The population consisted of 11 males and 6 females with a mean age of 57.8 ± 14.5 years (range 37–91 years) and a mean BMI of 30.6 ± 4.0 kg/m² (range 23.7–37.9 kg/m²). Mean ASA classification was 1.7 ± 0.6 (range 1–3). None of the repairs was performed for a recurrent hernia. Mean hernia size was 1.95 ± 0.6 cm (range 1–3 cm), average mesh size was 110 ± 17.7 cm² (range 100–150 cm²). All repairs were performed with a Prolene™ mesh. Mean operating time was 85.6 ± 24.7 min (range

Table 1 Patient characteristics

Characteristic	Value, mean \pm SD (range)
Male/female	11/6
Age (years)	57.8 ± 14.5 (37–91)
Body mass index (kg/m ²)	30.6 ± 4.0 (23.7–37.9)
ASA classification	1.7 ± 0.6 (1–3)
Previous hernia repairs	0
Fascial defect (cm)	1.95 ± 0.6 (1–3)
Mesh size (cm ²)	110 ± 17.7 (100–150)
Operating time (min)	85.6 ± 24.7 (60–120)
Hospital stay (days)	2.2 ± 0.6 (1–3)
Follow-up (months)	36.2 ± 14.8 (13–62)
Recurrence	0

Table 2 Postoperative complications

Complication	Number of patients
Seroma	1
Hematoma	1
Urinary retention	1
Total	3

60–120 min) and estimated blood loss insignificant. No conversions to open surgery were necessary. Hospital stay averaged 2.2 ± 0.6 days (range 1–3 days).

Three out of 17 patients developed a complication, as shown in Table 2. No major complications were seen. Complications included seroma ($n = 1$), hematoma ($n = 1$) and urinary retention ($n = 1$). No recurrences were observed during a mean follow-up of 36.2 ± 14.8 months (range 13–62 months).

Discussion

Adult umbilical hernia is a common surgical condition and many techniques have been described for its repair. This may be achieved through simple suture repair, double-breasting Mayo repair [21] or the use of a mesh. For the Mayo repair, recurrence rates up to 30% have been described [8]. After introduction of mesh material, hernia recurrence rates have been dramatically reduced to 1% [3, 8, 17, 22]. However, the combined use of synthetic material and extensive dissection in the abdominal wall implicates a risk for local abdominal wall complications such as prolonged postoperative pain, wound infection and seroma or hematoma formation [23]. These drawbacks might be counteracted by a laparoscopic approach with minimal surgical trauma to the abdominal wall. Compared with the Mayo repair, the laparoscopic approach avoids

extensive local dissection. In addition, the umbilicus can be preserved in a more natural way, giving better cosmetic outcome.

Several studies comparing laparoscopic and open ventral abdominal hernia repair suggest that laparoscopic repair is safer and more effective than open repair, although long-term benefits remain to be proven [11–17]. The feasibility of laparoscopic umbilical hernia repair has been established and reported in a few series and case reports [13, 16, 24]. These publications, however, concerned intra-abdominal mesh placement. Intra-abdominal placement of the mesh is associated with complications such as formation of intestinal adhesions, bowel occlusion and enterocutaneous fistulas [15, 18, 19]. Losanoff et al. [19] reported a patient who presented with an enterocolocutaneous fistula 10 years after prosthetic mesh repair of an incisional hernia. Other meshes are available with known less tendency to stimulate adhesions or fistulization, but these carry other disadvantages such as less ingrowth in the abdominal wall and/or higher price [18, 24, 25]. The goal of our repair was to use a mesh known for its superior ingrowth with technique that reduced the risk of its disadvantages.

To our knowledge, there is only one previous report of a laparoscopic method using preperitoneal approach, describing a total preperitoneal approach for the treatment of incisional and primary ventral hernias [23]. In that study of 15 patients, the mesh was placed between the rectus muscle and its dorsal fascia, which involves extensive dissection. Our method requires less trauma to the abdominal wall.

In our study, the defects we operated on were relatively small. There is debate in the literature about whether small defects should be closed with primary suture repair or with a mesh. Arroyo et al. [3] compared in a randomized trial suture and mesh repair in conventional umbilical hernia reconstruction, using surgeon-fabricated mesh plugs to close fascia defects smaller than 3 cm. These results were in favor of mesh hernioplasty for all sizes of umbilical hernias, since they found a clearly lower recurrence rate after mesh repair (1%, versus 11% in suture repair) and no increase in associated morbidity. A similar technique has been employed by Kurzer et al. [27]. Schumacher on the other hand described favorable results of primary herniorraphy in umbilical hernias smaller than 2 cm [26]. One might argue that use of mesh in small hernias as well as laparoscopic approach are time consuming. We therefore feel our technique is most beneficial in the repair of defects greater than 2 cm.

In conclusion, the results of our pilot study of laparoscopic transabdominal preperitoneal mesh placement in umbilical hernias show this approach to be a feasible operation with low morbidity and no recurrences. The main advantage of this method is avoidance of contact between

the mesh and visceral organs. We therefore believe this technique should be compared with open mesh repair in a randomized trial.

References

- Velasco M, Garcia-Urena MA, Hidalgo M, Vega V, Cohen M, Camero FJ (1999) Current concepts on adult umbilical hernia. *Hernia* 3:233–239
- Jackson OJ, Moglen LH (1970) Umbilical hernia. A retrospective study. *Calif Med* 113:8–11
- Arroyo A, García P, Pérez F, Andreu J, Candela F, Calpena R (2001) Randomized clinical trial comparing suture and mesh repair of umbilical hernia in adults. *Br J Surg* 88:1321–1323
- Hjaltason E (1981) Incarcerated hernia. *Acta Chir Scand* 147: 263–267
- Kulah B, Kulacoglu IH, Oruc MT, Duzgun AP, Moran M, Ozmen MM, Coskun F (2001) Presentation and outcome of incarcerated external hernias in adults. *Am J Surg* 181:101–104
- Burger JW, Luijendijk RW, Hop WC, Halm JA, Verdaasdonk EG, Jeekel J (2004) Long-term follow-up of a randomized controlled trial of suture versus mesh repair of incisional hernia. *Ann Surg* 240:578–585
- Eryilmaz R, Sahin M, Tekelioglu MH (2006) Which repair in umbilical hernia of adults: primary or mesh? *Int Surg* 91:258–261
- Luijendijk RW, Hop WC, van den Tol MP, de Lange DC, Brakksma MM, IJzermans JN, Boelhouwer RU, de Vries BC, Salu MK, Wereldsma JC, Bruijninx CM, Jeekel J (2000) A comparison of suture repair with mesh repair for incisional hernia. *N Engl J Med* 343:392–398
- Sanjay P, Reid TD, Davies EL, Arumugam PJ, Woodward A (2005) Retrospective comparison of mesh and sutured repair for adult umbilical hernias. *Hernia* 9:248–251
- Halm JA, Heisterkamp J, Veen HF, Weidema WF (2005) Long-term follow-up after umbilical hernia repair: are there risk factors for recurrence after simple and mesh repair. *Hernia* 9:334–337
- Goodney PP, Birkmeyer CM, Birkmeyer JD (2002) Short-term outcomes of laparoscopic and open ventral hernia repair: a meta-analysis. *Arch Surg* 137:1161–1164
- Heniford BT, Park A, Ramshaw BJ, Voeller G (2003) Laparoscopic repair of ventral hernias: nine years' experience with 850 consecutive hernias. *Ann Surg* 238:391–400
- Lau H, Patil NG (2003) Umbilical hernia in adults. *Surg Endosc* 17:2016–2020
- McGreevy JM, Goodney PP, Birkmeyer CM, Finlayson SR, Laycock WS, Birkmeyer JD (2003) A prospective study comparing the complication rates between laparoscopic and open ventral hernia repairs. *Surg Endosc* 17:1778–1780
- Nguyen NT, Lee SL, Mayer KL, Furduliu GL, Ho HS (2000) Laparoscopic umbilical herniorrhaphy. *J Laparoendosc Adv Surg Tech A* 10:151–153
- Wright BE, Beckerman J, Cohen M, Cumming JK, Rodriguez JL (2002) Is laparoscopic umbilical hernia repair with mesh a reasonable alternative to conventional repair? *Am J Surg* 184:505–509
- Yavuz N, Ipek T, As A, Kapan M, Eyuboglu E, Erguney S (2005) Laparoscopic repair of ventral and incisional hernias: our experience in 150 patients. *J Laparoendosc Adv Surg Tech A* 15:601–605
- Balique JG, Benchetrit S, Bouillot JL, Flament JB, Gouillat C, Jarsaillon P, Lepère M, Mantion G, Arnaud JP, Magne E, Brunetti F (2005) Intraperitoneal treatment of incisional and umbilical hernias using an innovative composite mesh: four-year results of a prospective multicenter clinical trial. *Hernia* 9:68–74

19. Losanoff JE, Richman BW, Jones JW (2002) Entero-colocutaneous fistula: a late consequence of polypropylene mesh abdominal wall repair: case report and review of the literature. *Hernia* 6:144–147
20. Knook MT, van Rosmalen AC, Yoder BE, Kleinrensink GJ, Snijders CJ, Looman CW, van Steensel CJ (2001) Optimal mesh size for endoscopic inguinal hernia repair: a study in a porcine model. *Surg Endosc* 15:1471–1477
21. Mayo WJ (1901) An operation for the radical cure of umbilical hernia. *Ann Surg* 34:276–280
22. Arroyo Sebastián A, Pérez F, Serrano P, Costa D, Oliver I, Ferrer R, Lacueva J, Calpena R (2002) Is prosthetic umbilical hernia repair bound to replace primary herniorrhaphy in the adult patient? *Hernia* 6:175–177
23. Miserez M, Penninckx F (2002) Endoscopic totally preperitoneal ventral hernia repair. *Surg Endosc* 16:1207–1213
24. Jarsaillon P (2000) Laparoscopic treatment of an umbilical hernia using a new composite mesh. *Hernia* 4:S17–S21
25. DeMaria EJ, Moss JM, Sugerman HJ (2000) Laparoscopic intraperitoneal polytetrafluoroethylene (PTFE) prosthetic patch repair of ventral hernia. Prospective comparison to open prefascial polypropylene mesh repair. *Surg Endosc* 14:326–329
26. Schumacher OP, Peiper C, Lörken M, Schumpelick V (2003) Long-term results after Spitzzy's umbilical hernia repair. *Chirurg* 74:50–54
27. Kurzer M, Belsham PA, Kark AE (2004) Tension-free mesh repair of umbilical hernia as a day case using local anaesthesia. *Hernia* 8:104–107