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# Single-port access prosthetic repair for primary and incisional ventral hernia: toward less parietal trauma

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**Abstract**
*Background* Although still under development, single-port access (SPA) approach may be of interest in patients prone to port-side incisional hernia, ensuring absence of increased fascial incision. This forms the basis for evaluating SPA for prosthetic ventral hernia repair. We report a new SPA technique of ventral hernia repair using working-channel endoscope, standard laparoscopic instruments, and 10-mm port.
*Methods* Prospective experience with SPA prosthetic repair of primary and incisional ventral hernia in 52 patients for 55 ventral hernias is presented. Median (range) patient age was 46 years (26–85 years), and BMI was 28 kg/m$^2$ (20–38 kg/m$^2$). Mean fascial defect was 16.2 cm$^2$ for primary hernia ($n = 23$) and 48.3 cm$^2$ for incisional hernia ($n = 32$). Intraperitoneal composite mesh repair was achieved through single 10-mm flank port using working-channel endoscope. Meshes were fixed using absorbable tackers and transfascial stitches.
*Results* SPA repair of primary and incisional ventral hernia was completed in all cases without conversion to standard laparoscopy. Median (range) operative time was 54 min (39–95 min). Mesh size ranged from 118 to 500 cm$^2$. No intra- or postoperative complications were recorded, except two seromas. Median (range) hospital stay was 1 day (1–5 days). One patient presented prolonged postoperative pain on mesh fixation that resolved after 3 months. No recurrence or port-site incisional hernias have been recorded at median (range) follow-up of 16 months (3–28 months).
*Conclusions* SPA prosthetic repair of primary and incisional ventral hernia is easily feasible according to natural exposition by pneumoperitoneum and gravity. In the present series, SPA ventral hernia repair appears to be safe for experienced SPA surgeons. It may decrease parietal trauma and scarring in patients prone to incisional hernia. SPA repair may be associated with a decrease in rate of port-site incisional hernia compared with multiport laparoscopy, but this has to be verified by randomized trial with standard laparoscopic approach on long-term follow-up.

**Keywords** Single-port access (SPA) · Laparoendoscopic single-site surgery (LESS) · Single incision · Laparoscopy · Ventral hernia · Incisional hernia

Laparoscopic ventral hernia repair has been shown to be safe, efficient, and associated with shorter recovery compared with open approach [1–4]. However, the risk of incisional hernia at port access after these surgeries remains a concern, and seems non negligible according to the literature (1–22%) [1, 5]. Moreover, it has been demonstrated that patients presenting primary or incisional hernia are prone to develop further hernia due to extracellular matrix and wound healing deficiencies [6]. Among factors affecting trocar-site incisional hernia occurrence, port size, type of fascial closure, and port mobilization (for mesh insertion) have been reported [1, 5, 7]. Single-port access ventral hernia repair may be advantageous, as it may reduce the number of incisions in these patients at high risk

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for incisional hernia, as long as the single-access incision is not too large.

Single-port access (SPA) laparoscopy has made its way into clinical practice [8]. Many visceral laparoscopic procedures have been proved to be feasible through SPA, such as cholecystectomy, colectomy, and others [9–12]. However, only a few reports on ventral hernia surgery through single incision have been published [13–15].

The aim of this study is to evaluate the feasibility and safety of single-port access laparoscopic primary and incisional ventral repair with prosthetic mesh using conventional laparoscopic instrumentation.

## Materials and methods

Prospective experience with single-port access laparoscopic repair of primary and incisional ventral hernia in 52 patients is presented. Forty-eight patients presented a single hernia, while four presented two hernias (two cases with linea alba and umbilical hernias, one case with incisional and umbilical hernias, and one case with median incisional and right indirect inguinal hernias). The total number of hernias treated was 56: 32 incisional hernias, 14 umbilical hernias, nine hernias of the linea alba, and one inguinal hernia. Median (range) patient age was 46 years (26–85 years), and BMI was 28 kg/m$^2$ (20–38 kg/m$^2$). Median (range) follow-up was 16 months (3–28 months) and complete. Patients were all reviewed at outpatient clinic. All patients were offered this approach after having given their informed consent under institutional review board (IRB)-approved protocol. SPA technique was considered and explained as being an adaptation of the laparoscopic approach (reduced port laparoscopy). All patients received information about surgical technique and risks associated with mesh hernia repair, and were informed that the complication rates of single-port access hernia repair may be higher than those of standard laparoscopy.

### Surgical technique

Single-port access (SPA) laparoscopic ventral hernia repair was performed using surgical technique similar to standard laparoscopic repair, except that it was conducted through a single 12-mm flank incision (Fig. 1). A single 10-mm port (Endopath Xcel trocar; Ethicon Endo-surgery, Spreitenbach, Switzerland) was inserted midway between the anterior superior iliac spine and the costal margin on left or right flank. The port was placed either by open approach or under direct visual control through working-channel endoscope. Patients were positioned in dorsal decubitus position, with surgeons standing on either left or right side. Urinary bladder catheter was placed during surgery in patients with

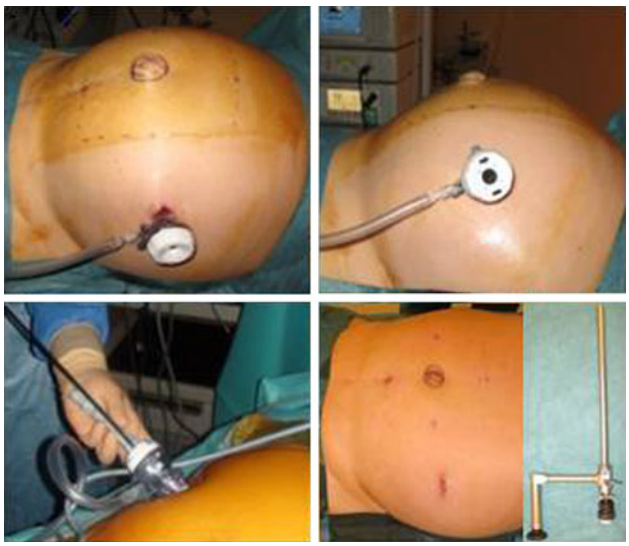

**Fig. 1** Operative installation for prosthetic ventral hernia repair through single-port access. *Top pictures*: single 12-mm port placement. *Bottom left picture*: mesh introduction through flank port. *Bottom middle picture*: skin incision at procedure end. *Bottom right*: working-channel endoscope used for all cases

infraumbilical hernia and removed at the end of procedure. A 10-mm laparoscope with a 6-mm working channel (ref. S26034AA; Richard Wolf GmbH, Knittlingen, Germany) was used. Standard 5-mm straight laparoscopic instruments were used: Johann grasper (MicroFrance, Saint Aubin le Monial, France), scissor (Microline PENTAX, Beverly, MA, USA), and bipolar coagulation (MicroFrance, Saint Aubin le Monial, France). Section of adhesions when needed was achieved with scissor. Freeing of hernia contents was always achieved with the aid of extra-abdominal counterpressure by assistant hands. Dissections of perihepatic ligaments and urachal structure were achieved similarly to the current technique of multiport laparoscopic ventral hernia repair. In all cases, hernia repair was achieved by placement of a composite bilayer mesh (Proceed$^{TM}$ surgical mesh; Johnson & Johnson) with at least 5 cm coverage of normal abdominal wall all around defect. Median (range) mesh size used was 235.6 cm$^2$ (118–500 cm$^2$). Meshes were fixed with at least four absorbable transfacial sutures and double crown of absorbable tacks (AbsorbaTack$^{TM}$; Covidien). Port-site facial incisions were always closed using 2/0 absorbable stitches under direct vision.

## Results

### Primary ventral hernia

Twenty-three primary ventral hernias were treated by SPA prosthetic repair (Table 1, Fig. 2). Two patients had

combined umbilical and linea alba hernias. Mean fascial defect was 16.2 $cm^2$ for primary hernia. All cases were completed without insertion of additional trocar. No morbidity was encountered in this group, except one patient who presented pain on mesh fixation that resolved spontaneously after three months. None of the patients have presented recurrence or trocar-site hernia to date at median (range) follow-up of 19 months (28–6 months).

**Table 1** Characteristics of primary hernia by location

| | Umbilical | Linea alba |
|---|---|---|
| Number | 14 | 9 |
| BMI ($kg/m^2$), median (range) | 32 (25–38) | 28 (26–27) |
| Size ($cm^2$), mean | 15.8 | 17.1 |
| Operative time (min), median (range) | 52 (43–78) | 68 (53–90) |

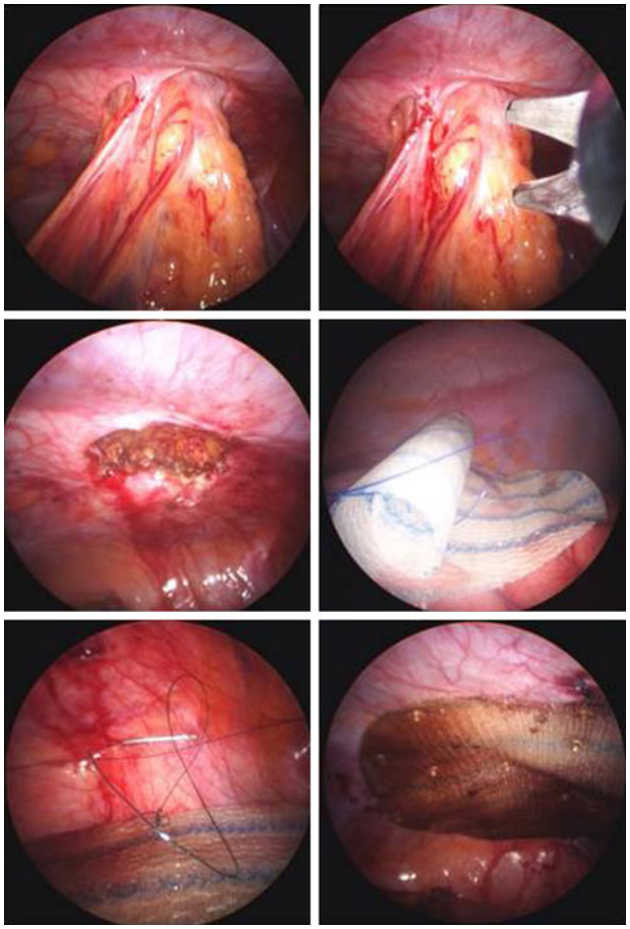

**Fig. 2** Intraoperative view of primary umbilical hernia prosthetic repair through single-port access

## Incisional hernias

Thirty-two incisionnal hernias were treated through SPA prosthetic repair (Table 2, Fig. 3). Two patients had an umbilical hernia or an inguinal hernia associated with incisional hernia. Mean fascial defect was 48.3 $cm^2$ for incisional hernia. Previous surgeries were: right colectomy, gastrectomy, Caesarian delivery, small bowel surgeries, hysterectomy, bariatric surgery, appendectomy, and vascular surgery. Six of these previous surgeries were performed through laparoscopy (port-site incisional hernia). Significant intra-abdominal adhesion treatment was needed in 21 patients. All cases were completed without need for additional port or conversion to open surgery. No intraoperative complications were encountered. No morbidity was recorded after incisional hernia repair, except two seromas treated conservatively. Median (range) hospital stay was one day (1–3 days). No recurrence or trocar-site

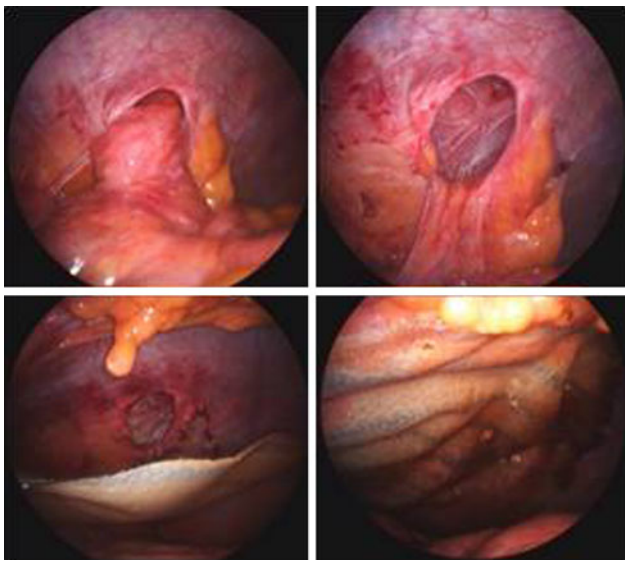

**Fig. 3** Intraoperative view of incisional (McBurney incision) ventral hernia prosthetic repair through single-port access

**Table 2** Characteristics of incisional hernia by location

| | Midline | McBurney and trocar port | Pfannenstiel |
|---|---|---|---|
| Number | 21 | 8 | 3 |
| BMI ($kg/m^2$), median (range) | 27 (25–38) | 24 (20–33) | 32 (31–33) |
| Size ($cm^2$), mean | 68.6 (16.3–93) | 20.6 (6.3–20.7) | 19.6 (9.8–26.6) |
| Operative time (min), median (range) | 59 (42–95) | 54 (45–64) | 50 (49–50) |

hernias were recorded during median (range) follow-up of 16 months (26–3 months).

## Discussion

An innovative technique of single-port access laparoscopic repair of primary and incisional hernia using composite mesh is presented. SPA repair of ventral hernia has been shown in this series to be safe and feasible by this approach while minimizing transparietal access without increasing operative cost. SPA may results in less parietal scarring in these patients prone to incisional hernia at trocar port site.

Laparoscopic repair of ventral hernia has become popular, being associated with decreased postoperative pain and shorter recovery compared with open approach, while allowing complete revision of the abdominal wall [1–4, 15]. However, the rate of incisional hernia at trocar port site after laparoscopic hernia repair is non negligible according to the literature (1–22%) [1, 5]. The port-site incisional hernia rate is influenced by patient factors; higher incidence of collagen and extracellular matrix deregulations in hernia patients make them prone to hernia recurrence or incisional hernia after abdominal wall incision [6]. Factors negatively affecting the rate of port-site incisional hernias are port size, fascial closure method, and port mobilization (for mesh insertion, for example) [1, 5, 7]. The principal advantage of SPA ventral hernia repair over multiport laparoscopic approach is the decreased number of ports, thus reducing parietal trauma and scarring [14]. For this purpose, the single access should not be larger than a conventional laparoscopic port, which is the case with the present technique (using only a 10-mm port). In the future, this advantage may prove to be associated with a lower rate of port-site incisional hernia.

Interestingly, one of the advantages of SPA laparoscopic incisional hernia repair may be the use of on-axis vision with working-channel endoscope, generally seen as a handicap [16]. First, this combination avoids difficulties encountered in patients with severe intra-abdominal adhesion during port placement due to poor visual control. Second, dissecting instrument is always under visual control during adhesion section, which may decrease the risk of inadvertent bowel lesion [14]. However, this technique is single-hand surgery, which may be viewed as a disadvantage of this technique. In practice, it should be noted that exposition of structure is achieved by pneumoperitoneum and gravity, which allows operating table mobility to be used to recover natural triangulation.

A major concern with the introduction of new techniques may be an inherent cost increase due to introduction of new instrumentation [17]. However, with the present technique, costs are not increased and are in fact decreased by the use of a smaller number of disposable ports. This is achieved by using conventional laparoscopic instrumentation and "old-fashioned" working endoscope.

While SPA laparoscopic repair of ventral hernia was found to be effective and safe in the present report, we acknowledge that this series is small and the study design not appropriate to draw definitive conclusions on this new technique. However, according to its potential advantages, this emerging approach may be a strong candidate as a valuable choice for ventral hernia treatment. These encouraging results should prompt us to carry out a randomized trial comparing SPA and multiport laparoscopic ventral hernia repair.

In conclusion, SPA prosthetic ventral hernia repair is easily feasible and seems safe for experienced SPA surgeons. It may offer advantages in postoperative pain and cosmesis compared with multiport laparoscopic repair. At least, SPA ventral hernia repair decreases parietal trauma in patients prone to port-site incisional hernias compared with laparoscopic approach. Single-port access prosthetic ventral hernia repair now has to be compared with standard laparoscopic approach by randomized trial.

**Disclosures** Authors Pascal Bucher, Francois Pugin, and Philippe Morel have no conflicts of interest or financial ties to disclose.

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