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Laparoscopic Versus Open Mesh Repair for Ventral Hernia – A Population Based Matched Case Control Study

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Abstract

Objective: Laparoscopic repair of a ventral hernia is a feasible alternative to conventional surgery but it is not known whether there are definite advantages with this approach. The present study was performed to compare laparoscopic Intraperitoneal Onlay Mesh repair (IPOM) with Open Mesh Repair (OMR).

Methods: In total 46 patients were operated with IPOM within the surgical departments in Uppsala county, Sweden 2009-2013. The outcome was compared with 46 randomly selected patients undergoing elective surgery with OMR matched for gender, age (+/- 6 years), and type of hernia (umbilical, incisional or epigastric).

Results: There was no difference between the groups concerning age, gender, ASA classification, or hernia defect size. BMI was slightly higher in the IPOM group (mean 29.7 vs 27.9, p=0.048) and mesh size was larger in the IPOM group (246 cm2 vs. 153 cm2, p=0.0006). Duration of surgery was longer in the IPOM group (mean 110 vs 85 min, p=0.014). Mean hospital stay was longer in the IPOM vs the OMR group, (mean 1.8 vs. 1.1 days, p=0.035). The incidence of complications (Clavien Dindo classification) was 14/46 (30%) in both groups. Sick leave was mean 3.5 weeks in the IPOM group vs 3.9 weeks in the OMR group, p=0.72. Four recurrences were diagnosed in the IPOM group and seven among OMR patients. Totally 5/40 (13%) patients with incisional hernias and 6/52 (12%) with epigastric or umbilical hernias recurred.

Conclusion: Outcome did not differ between IPOM and OMR in this study. Either technique could be used to match the individual patient.

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Introduction

Ventral hernia is one of the most common surgical entities. The etiology is either a previous incision or herniation through a spontaneous defect in the abdominal wall usually located in the umbilical or epigastric region. In total 10–20% of patients undergoing abdominal surgery may subsequently develop an incisional hernia [1,2], and recent studies have shown even higher figures [3,4]. Umbilical hernias develop through the physiological defect in the umbilical region. The third common form of ventral hernia is epigastric which extends either through small gaps in the linea alba or by diastasis of the rectus muscles. Several surgical options are available for the treatment of abdominal wall hernias. Mesh repair has in principle replaced suture repair for large defects since about 20 years [5-7].

Laparoscopic alternatives to conventional surgery has gained increasing popularity to treat various abdominal conditions. The laparoscopic approach to incisional hernia repair was first described in 1993 [8] and has evolved considerably in recent years. Laparoscopic repair of a ventral hernia is a feasible alternative to open hernia repair but it is unknown whether there are definite advantages with this approach. The aim of the present study was to compare laparoscopic Intraperitoneal Onlay Mesh Repair (IPOM) with Open Mesh Repair (OMR) with respect to morbidity and recurrence rates.

Patients and methods

A total of 46 patients underwent IPOM for ventral hernias within the surgical departments in Uppsala County, Sweden. The outcome for this group was compared with 46 randomly selected patients undergoing elective surgery with OMR during an adjacent period of time. The groups were matched for gender, age (+/- 6 years), and type of hernia (umbilical, incisional or epigastric). Patient characteristics were registered and included BMI, concomitant diseases, medications, tobacco smoking, ASA-grade, theatre time, size of the hernia sac-, defect- and mesh, mesh type, method of mesh fixation, hospital stay, sick leave, complications and recurrence. Complications were registered and graded according to the Clavien-Dindo classification [9]. The study was approved by the ethical committee of Uppsala County.

Surgical technique OMR

The open hernia repairs were done under general anaesthesia and the patient had a single iv

injection of antibiotic prophylaxis (Cloxacilline 2 g). In this study, all operations were performed using a sublay prosthetic technique, i.e. placement of a mesh covering the hernia in the space between the rectus muscle and the posterior rectus sheath or (in the lower abdomen) the peritoneum. Totally 38 patients (83%) received a Prolene® (polypropylene, Ethicon, Somerville, NJ) mesh, five (11%) had a Ventralex™ (polypropylene/ePTFE, Bard Davol, Warwick, RI) patch and three (6%) had an Ultrapro™ (prolene/monocryl, Ethicon) mesh.

After proper cleaning and draping an appropriate skin incision was made according to the site and size of the hernia. The hernia opening was dissected and the hernia margin was cleared from fat and if considered necessary a circumferential excision of the fibrous tissue of the hernia opening was performed to obtain well vascularized tissue for healing of the defect. The hernia sac with content was mobilised and repositioned to the abdominal cavity. The posterior rectus sheet / peritoneum could in all cases be closed, using 0.0 polydiaxone (PDS, Ethicon) sutures. The space behind the rectus muscle was opened and dissected to accommodate the mesh. A mesh of adequate sixe was positioned in this space and fixed with single, interrupted sutures. The aim was always an overlap distance of 4-5 cm. The total incision was reinforced with the mesh if the surgeon perceived a weakness or bulging of the incision. If the previous incision was felt stable or even invisible, only the obvious defect with overlap was covered with the mesh. The anterior fascia was closed if possible without tension, otherwise the edges were fixed down to the mesh. The surgical wound was finally sutured with subcutaneous and cutaneous stitches.

Surgical technique IPOM

All operations were performed under general anesthesia and all subjects had a single antibiotic iv injection (Cloxacilline 2g) and a sc injection of low molecular heparin analog (Enoxaparin sodium). Pneumoperitoneum up to 10 mm/Hg was induced through a 5 mm port inserted under direct vision (Visiport optical troacar, Covidien, Dublin, Ireland) in the contralateral upper flank for lateral hernias. After insertion of a further 5 mm port in the ipsilateral lower fossa, a 12 mm port was introduced between these two ports under direct vision. For midline defects, the left flank was the preferred site for port placement. Adhesiolysis was performed with scissors. An energy device was avoided at this stage to prevent thermal injury. Any hernia sac content was dissected and reduced and all fatty tissue was cleared from the edges of the musculofascial defect to allow for an overlap of at least 5 cm. Glue (Tisseel, Baxter Healthcare corporation, CA, USA) was used at the surgeons discretion.

An oval Physiomesh (polypropylene/polydioxanone coated with poliglecaprone film, Ethicon) 15 x 20cm or 10 x 15 cm was inserted through the 12 mm port and fixed to cover the defect using absorbable tackers with a double crown technique (Securestrap (Ethicon) or Absorbatack (Covidien), glue (Tisseel, Baxter) or transfixation sutures added in some cases at the surgeons discretion, Table 2).

The hernia defect was closed in 20/46 cases (44%). prior to mesh placement using 3-5 single

polypropylene sutures 1,0 inserted by an Endostich device (Covidien). Closure was not done in case of small defects or when closure was believed to cause tension. 1-2 ml glue (Tisseel, Baxter) was applied into the hernia sac before tying. Drains were not used. A regular diet and free mobilization using a girdle was used from the first postoperative day.

Statistical methods

Variables are presented as means and ± SD or medians and (Range). Comparative analyses were performed with Students T-test or Chi square test for categorical variables. The time to recurrence curve was constructed with the actuarial method. Statistica software (Statistica, Statsoft v 10, Ok, USA) was used for statistical analyses. A p-value of <0.05 was considered statistically significant.

Results

Patient characteristics

There was no difference between the groups concerning age, gender, ASA classification,

hernia type (20 incisional , 20 umbilical, and 6 epigastric) or hernia defect size. BMI was slightly higher in the IPOM group (mean 29.7 vs 27.9, p=0.048, Table 1). Median follow-up was 32 months (range 12-57) in the IPOM group and 99 months (range 73-122) in the OMR group.

Surgical characteristics

The mean size of the abdominal wall defect was 3.1 cm (range 1-12) in the IPOM group and 3.3 cm (range 1-8) in the OMR group. The average diameter of the hernia sac was 5.7 cm (range 1-12) in the IPOM group versus 5.9 cm (range 2-15) in the OMR group. Mesh size was larger in the IPOM group (246 cm2 vs. 153 cm2, p=0.0006). Duration of surgery was longer in the IPOM group vs. the OMR group (mean 110 vs 85 min, p=0.014, Table 2).

Clinical results

Mean hospital stay was longer in the IPOM vs the OMR group, mean 1.8 vs. 1.1 days, p=0.035). Totally 14 complications were recorded in each group (Table 3). In the IPOM group two patients developed grade 3a complications (one laparoscopic adhesiolysis because of severe pain and one ultrasound guided drainage of intraabdominal abscess). One patient in the OMR group developed a grade 4 complication since she was diagnosed with pulmonary embolism requiring intensive care. Grade 2 complications occurred in three subjects in each group: IPOM one epididymitis and two cases with prolonged postoperative ileus: OMR one postoperative ileus and two wound infections requiring antibiotics. Sick leave was mean 3.5 weeks in the IPOM group vs 3.9 weeks in the OMR group, p=0.72). Four recurrences were diagnosed in the IPOM group after a mean follow-up of 32 months. Three underwent reoperation and one was treated conservatively. Seven patients in the OMR group were diagnosed with recurrent hernia after a mean follow-up months of 99 months (Figure 1). Five recurrences (13%) were diagnosed in incisional hernias and six in epigastric/umbilical hernias (12%). Four of the patients with recurrent hernia have so far been reoperated.

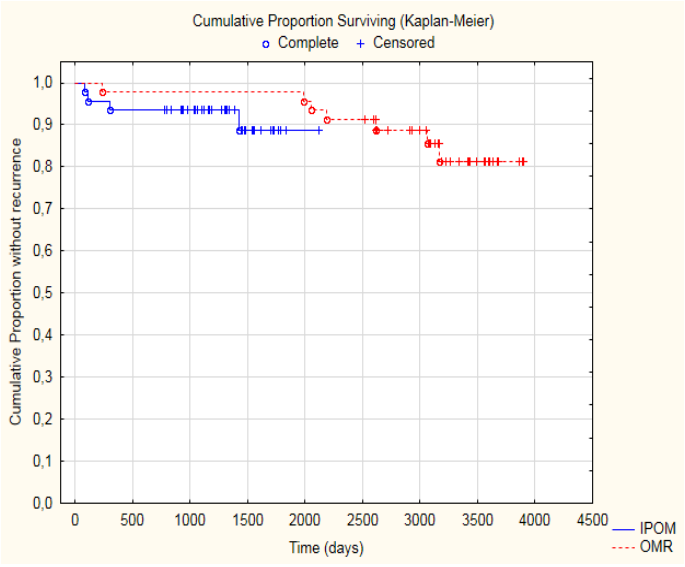

Figure 1: Proportions of patients without recurrence in the IPOM and OMR groups.

Table 1: Baseline characteristics in the IPOM and OMR groups.

	IPOM*'	OMR+
Female	27:19	27:19
Age, mean (range)	56 (23-74)	51 (21-75)
BMI§, mean (range)	29.7 (19.8-41.5)	27.9 (20.0-35.3)
ASA** class 1	35	23
2	31	18
3	0	5
Daily smoking	6	7

*Laparoscopic mesh repair, +open mesh repair, §body mass index, **American society of anaesthesiology classification.

Table 2: Surgical and hernia characteristics in the IPOM and OMR groups.

	IPOM*	OMR+	p-level
Duration of surgery (min)	110 ± 28.7	85 ± 59.7	0.014
Diameter of defect (cm)	3.1 ± 2.2	3.3 ± 1.9	0.63
Diameter of sack (cm)	5.7 ± 2.9	5.9 ± 3.3	0.83
Mesh size (cm2)	246 ± 73.4	153 ± 157	0.0006
Mesh fixation			
Interrupted sutures	-	32	
Continuous sutures	-	14	
Absorbatack	11	-	
Securestrap	35	-	
Glue	20	8	
Transfixation sutures	11	2	

*Laparoscopic mesh repair, +open mesh repair

Table 3: Postoperative complications graded according to Clavien Dindo in the IPOM and OMR group.

Grade	IPOM (n=46)	OMR (n=46)
I	9	10
II	3	3
IIIa	2	-
IIIb	-	-
IV	-	1
Total	14 (30)	14 (30)

Discussion

For many other conditions the introduction of laparoscopy in surgery has reduced complications, and sick leave, eg. laparoscopic operation for inguinal hernia has been shown to reduce postoperative pain and to shorten recovery without negative effects on recurrences [10]. Laparoscopic repair of a ventral hernia is a feasible alternative to conventional surgery but it is not known whether there are definite advantages with this approach.

Several studies have attempted to compare outcome after laparoscopic versus open repair of abdominal wall hernia [11-15], but so far no definite advantage has been demonstrated for either technique and in a recent systematic review it was concluded that operation time tended to be longer with the laparoscopic approach but the infection rate was lower [16]. An increased infection rate could be detrimental in surgery involving implant of an unresorbable mesh [17], but a superficial skin infection is usually without significance. In fact severe consequences after wound infections are rare in hernia surgery and in the present study, no patient required explant of the mesh because of infection. In theory, IPOM is associated with an increased risk of bowel adhesions to the mesh and in a worst case scenario, also intestinal erosion of mesh and an enteric fistula. However, this type of complication was not observed in our study. From the present and previous studies it is clear that results after OMR and IPOM are more or less equal concerning short and mid-term outcomes but long term recurrence rates are still to be investigated. A somewhat unexpected finding in this study was the longer hospital stay after laparoscopic hernia repair.

Besides the longer duration of surgery and implant of larger meshes, a ”safety-attitude” connected with a fear of missing complications possibly associated with new surgical techniques could explain this finding.

Which factor should then be decisive for choice of procedure? Large defects (diameter>10 cm) and loss of domain have been considered more suitable for the open technique [18]. However for small and intermediate sized defects which was the dominating pathology in this study the techniques are optional, and general criteria for procedure selection prevail, eg. multiple previous abdominal surgeries, body constitution, anaesthetic considerations, cosmesis etc.

The importance of mesh overlap beyond the defect for hernia recurrence was addressed in a recent metaanalysis. Intrestingly, a clear correlation between the length of overlap and recurrence rate was found in laparoscopic repair but not in open hernia surgery [19]. The overall recurrence rate in this series of 12% deserves a comment. In 6/92 (6.5%) patients the hernia was recurring after previous hernia surgery, 13/92 (14%) were daily smokers, and 11 (12%) had a diagnosis of chronic obstructive pulmonary disease. Finally, only four of the recurrences have so far been reoperated indicating that also asymptomatic and subtle recurrences were included in the figure. All these aspects might have contributed to the comparably high rate of recurrent hernias in the present series.

There are limitation with this study. The study is retrospective and IPOM was introduced shortly before start of the study period and operations were partially performed during the learning curve period which might have influenced the results. Another limitation is the relatively small size of the study and a larger material might have revealed more clear differences between the groups. However since the magnitude of most of the endpoints were unknown, a formal power calculation was not performed. Finally, it must be emphasized that the results of this study could only be applied to small and moderate-sized hernias and not to larger and more complex hernias. A strength of the study is the underlying population which was strictly defined and based on Uppsala county, a mixed rural and urban region. The series of IPOM surgery was consecutive and there was no flawed selection since the subjects in the IPOM group was selected because of a special interest for laparoscopic surgery in one of our units. The subjects in the OMR group was randomly selected from a large pool of patients operated with conventional technique. A potential criticism is that the patients were selected for the procedure based on hernia size and concomitant diseases. However, the defect and hernia sizes were almost identical in the groups and the ASA class distribution was also comparable. The OMR group was operated slightly earlier than the IPOM group but the periods overlapped and there was no definite difference in the management except for the approach – laparoscopic versus open.

In conclusion, results after laparoscopic and open mesh repair of small and moderate-sized abdominal wall hernia did not differ with respect to postoperative complications and recurrence rate in the short- and mid-term perspective and general criteria for laparoscopic surgery could be applied for selection.

BD declares no conflict of interest, SW declares no conflict of interest, ML declares no conflict of interest, and WG declares no conflict of interest.

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