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The pros and cons of suturing the ventral hernia defect using the intraperitoneal onlay mesh technique

Prednosti i mane suture defekta prilikom korišćenja intraperitonealne *onlay mesh* tehnike kod ventralnih kila

Bojan Jovanović, Dejan Rančić, Ljubiša Rančić, Miljan Krstović

University Clinical Center Niš, Center for Minimally Invasive Surgery, Niš, Srbija

Abstract

Background/Aim. Laparoscopic ventral hernia surgery, including intraperitoneal onlay mesh (IPOM), is as effective and safe as open surgery, with a lower recurrence rate. Some surgeons advocate laparoscopic primary fascial closure (PFC) with intraperitoneal mesh placement to reduce recurrence rates. The aim of this study was to compare the treatment outcome between two laparoscopic techniques: the PFC technique and mesh placement without suture closure (IPOM technique) for defects under 4 cm in patients with ventral hernias. **Methods.** The study sample was comprised of 50 patients who underwent laparoscopic ventral hernia surgery from January 1, 2018, until December 31, 2020. Half of the patients underwent only the IPOM technique (group of patients without the suture), while in others, this was preceded by the closure of the hernial ring (group of patients with the suture). All hernias were midline and all defects were under 4 cm. The studied groups were homogeneous according to gender and age. Comorbidities, complications, and postoperative comfort were monitored. **Results.** The most common (76%) hernias were primary, and the most common comorbidity was arterial hypertension (28%). One (2%) patient had intraoperative bleeding, and the most common postoperative complication was pain in 7 (14%) patients. After a three-year follow-up, there were 10 (20%) patients with complications – one hernia recurred, while 9 (18%) patients died. There was no difference in the types of occurrence of hernias, comorbidities, and intraoperative complications. The distribution of postoperative complications differed significantly ($p = 0.007$) between the groups. Pain was statistically significantly more prevalent in patients with sutures. During the first three months postoperatively, significantly more patients with sutures had chronic pain ($\chi^2 = 8.140$; $p = 0.004$). **Conclusion.** We recommend the application of the PFC technique in selected ventral hernia repair cases, although it can lead to more frequent postoperative pain (which, fortunately, is easily treated).

Key words:
fascia; hernia, ventral; laparoscopy; postoperative period; quality of life; surgical mesh; surgical procedures, operative; suture techniques.

Apstrakt

Uvod/Cilj. Laparoskopska operacija ventralne kile, uključujući intraperitonealnu *onlay mesh* (IPOM) tehniku, efikasna je i sigurna kao i otvorena operacija, ali sa nižom stopom recidiva. Neki hirurzi zagovaraju primenu primarnog zatvaranja fascije (*primary fascial closure* – PFC) sa postavljanjem intraperitonealne mreže, kako bi se smanjila stopa recidiva. Cilj rada bio je da se uporedi ishod lečenja kod bolesnika sa ventralnom hernijom za defekte ispod 4 cm, između dve laparoskopske tehnike: PFC tehnike i postavljanjem mrežice bez zatvaranja šava (IPOM tehnika). **Metode.** Istraživanjem je obuhvaćeno 50 bolesnika laparoskopski operisanih zbog ventralne kile u intervalu od 01. januara 2018. do 31. decembra 2020. godine. Polovina bolesnika bila je podvrgnuta samo postavljanju mrežice IPOM tehnikom (grupa bolesnika bez suture), dok je kod preostalih tome prethodilo zatvaranje kilnog prstena (grupa bolesnika sa suturom). Sve kile bile su medijalne a svi defekti ispod 4 cm. Ispitivane grupe bile su homogene prema polnoj i starosnoj strukturi. Praćene su komplikacije, komorbiditeti i postoperativni oporavak bolesnika. **Rezultati.** Najveći broj kila bile su primarne (76%), a najčešći komorbiditet bila je arterijska hipertenzija (28%). Jedan (2%) bolesnik imao je intraoperativno krvarenje a najčešća postoperativna komplikacija bio je bol kod 7 (14%) bolesnika. Posle trogodišnjeg praćenja, 10 (20%) bolesnika imalo je komplikacije – jednom bolesniku se vratila hernija, dok je 9 (18%) bolesnika preminulo. Nije bilo razlike u vrstama pojave kila, komorbiditetima i intraoperativnim komplikacijama.

Correspondence to: Bojan Jovanović, University Clinical Center Niš, Center for Minimally Invasive Surgery, Blrd "Dr. Zorana Đinđića" 48, 18 000 Niš, Serbia. E-mail: bokistet@gmail.com

Distribucija postoperativnih komplikacija značajno se razlikovala među grupama (p = 0,007). Bol je bio statistički značajno zastupljeniji kod bolesnika sa suturom. Tokom prva tri meseca posle operacije, značajno više bolesnika sa suturom imalo je hronični bol (χ^2 = 8,140; p = 0,004). **Zaključak.** Preporučujemo primenu PFC tehnike u odabranim slučajevima operacija ventralnih hernija, mada može dovesti do povećanja postoperativnog bola (koji se, srećom, lako tretira).

Ključne reči:
fascija; hernija; laparoskopija; postoperativni period; kvalitet života; hirurška mrežica; hirurgija, operativne procedure; šavovi, tehnike.

Introduction

Ventral incisional hernias can be operated on either through an open or laparoscopic approach. The incidence of incisional hernias is up to 30%, and they are one of the more frequent long-term complications after laparotomy [1].

The main issues after hernia surgery are recurrence and pain, and the technique used in the hernia repair procedure affects both the rate of recurrence as well as postoperative pain.

Laparoscopic ventral hernia surgery has progressed in terms of performance and safety of the procedure. It has been shown to be as effective and safe as open surgery, with a lower recurrence rate. Laparoscopy, especially the intraperitoneal onlay mesh (IPOM) technique, is a popular method used for ventral hernia surgery [2]. While laparoscopy has reduced the incidence of surgical site infection (SSI) and recurrence rates, some surgeons advocate laparoscopic primary fascial closure (PFC) with intraperitoneal mesh placement to reduce recurrence rates. Certain studies indicate that in patients undergoing laparoscopic ventral hernia repair, PFC, compared to mesh placement without defect closure, reduces the rate of hernia recurrence but increases postoperative pain [3, 4]. In general, fascial defects larger than 4 cm always require suturing. However, the choice of whether to suture the defect is up to the surgeon when the defects are under 4 cm in diameter. As the dilemma about whether to perform PFC in these cases persists in the surgical community, the aim of this article was to compare the pros and cons of suturing the abdominal wall fascial defect between the patients who underwent PFC and those who did not, ultimately aiming to reduce the recurrence rates, SSIs, and postoperative pain, while providing adequate cosmetic results for our patients.

Methods

The research was comprised of 50 patients who underwent ventral hernia repair with a small defect (< 4 cm) done laparoscopically from January 1, 2018, until December 31, 2020, in the Center for Minimally Invasive Surgery, University Clinical Center Niš, Serbia. The study was approved by the Ethics Committee of the University Clinical Center Niš (Decision No. 19486/5, from July 7, 2023).

The study included 25 (50%) male and 25 (50%) female patients, with a mean age of 54.84 ± 6.86 years. The patients included in the study had a midline ventral hernia (either umbilical or epigastric), classified as a primary ventral hernia, postoperative incisional hernia, or a recurrent one. The patients were divided into two groups according to the type of surgery: in 25 (50.0%) patients, the hernial opening was closed with a suture, followed by placement of prosthetic material (i.e., the IPOM-plus technique), and in the other 25 (50.0%), the hernial opening was not closed, and only a mesh was placed using the standard IPOM technique. In all patients, after carbon dioxide insufflation at 12 mmHg utilizing a Veress needle at Palmer's point, a 10 mm camera port was placed in the anterior axillary line on the right side in the projection of the umbilicus. Then, a 12 mm port was placed under direct vision in the medioclavicular line below the right costal margin. Finally, a 5 mm port is placed in the anterior axillary in the projection of the anterior superior iliac spine.

When there were adhesions to the anterior abdominal wall, they were divided with the UltraScision™ device. A polypropylene composite mesh was used in all patients, with absorbable tacks along with non-absorbable sutures used for mesh fixation. When done, intracorporeal laparoscopic interrupted sutures were used for PFC (in 50% of patients). During the period when the studied operations were performed, the hernia sacs were not removed in any patients. While performing the IPOM-plus technique, when closing the defect, the hernia sac was sutured along with the edges of the fascial defect in order to reduce the dead space. As for the IPOM technique, the dead space was reduced by postoperative compression on the skin using a packet of gauze. Since all hernias had a minor fascial defect, no surgical cosmetic treatment of excess skin was required.

The patient's comorbidities were monitored – the presence of diabetes, chronic obstructive pulmonary disease, renal insufficiency, hypertension, and smoking. Complications monitored were: intraoperative bleeding, postoperative seroma, hematoma, and pain. Patients were also monitored for the presence of mesh bulging; however, there were no cases of bulging during the study period, which is why it was excluded from the monitored complications. The perioperative data was collected from the patient's electronic medical records, while the postoperative complications and quality of life (QoL) data were obtained at the follow-up examination after three and six months, and then after one, two, and three years, when the patients answered questions about comfort and postoperative pain. The questions stem from a modified iteration of the EuraHS QoL questionnaire, designed for

evaluating patients' QoL. In this modified rendition, alterations were made to the scale of the answers, with the traditional 0 to 10 scale being replaced by a more concise scale, spanning from 0 to 5, prompting patients to provide their responses within this refined framework [5]. The groups were compared according to the type of operation and QoL [6].

Statistical calculations were performed using SPSS version 22. Of the basic descriptive statistical parameters, standard statistical methods were used for qualitative and quantitative assessment of the obtained results. The normality of the distribution was tested with the Kolmogorov-Smirnov test. Sample comparison was performed with the Student's *t*-test and the Mann-Whitney *U* test for cases of irregular data distribution. The Chi-square and Fisher test were used to test the statistical significance of absolute frequency differences between samples. A difference between samples was considered significant if $p < 0.05$.

Results

The basic characteristics of two compared groups of patients with ventral hernias are shown in Table 1. Only the distribution of postoperative complications differed significantly among the studied groups ($\chi^2 = 12.105$; $p = 0.007$). A total of 10 (20%) patients had complications. Seromas and hematomas were more common in patients who did not have sutures of the hernial defect but without statistical significance, while pain was statistically significantly more prevalent in patients with the sutures.

A comparison between the groups regarding the QoL is shown in Table 2. When asked about the pain at the hernia site at rest, it was determined that there was a significant difference in the answers in the examined groups ($\chi^2 = 7.053$; $p = 0.029$). Concerning the answers regarding pain at the site of the hernia during activity, a significant difference was found in the responses by the examined groups ($\chi^2 = 15.797$; $p = 0.003$). Patients in whom a suture was performed gave answers 3, 4, and 5 in a significantly higher number compared to patients without a suture. There was no significant difference in the answers to the questions about activity restriction and aesthetic discomfort (Table 2).

Table 3 shows the results of patient follow-up in the first three years. It was found that there was a significant difference between the studied groups during the first three months ($\chi^2 = 8.140$; $p = 0.004$), where patients with sutures had chronic pain in a significantly greater number. There were a total of 7 patients who died after three years (non-significant value) under the diagnosis of COVID-19 infection. In all subsequent periods, there was no significant difference between the groups.

Table 1

Comparison of patients with and without defect suturing

Parameter	With a suture (n = 25)	Without a suture (n = 25)	*p*-value
Gender			
female	14 (56.0)	11 (44.0)	
male	11 (44.0)	14 (56.0)	0.396[1]
Age, years	55.44 ± 7.69	54.24 ± 6.01	0.542[2]
Type of occurrence			
incisional	4 (16.0)	3 (12.0)	
primary	18 (72.0)	20 (80.0)	
recurrence	3 (12.0)	2 (8.0)	0.799[1]
Comorbidities			
without	5 (20.0)	6 (24.0)	
diabetes mellitus	5 (20.0)	4 (16.0)	
COPD	1 (4.0)	4 (16.0)	
renal disease	3 (12.0)	2 (8.0)	
hypertension	7 (28.0)	7(28.0)	
smoker	4 (16.0)	2 (8.0)	0.720[1]
Intraoperative complications			
no	25 (100.0)	24 (96.0)	
bleeding	0 (0.0)	1 (4.0)	1.000[3]
Postoperative complications			
no	18 (72.0)	20 (80.0)	
seroma vulneris	0 (0.0)	3 (12.0)	
hematoma	0 (0.0)	2 (8.0)	
pain	7 (28.0)	0 (0.0)	0.007[1]

COPD – chronic obstructive pulmonary disease. [1]Chi-square test. [2]Student's *t*-test. [3] Fisher test. All values are given as numbers (percentages) or mean ± standard deviation.

Table 2

Comparison of quality of life of patients with and without defect suturing

Questions	Response	With a suture (n = 25)	Without a suture (n = 25)	p^1-value
1. Do you feel pain at the site of hernia in rest?	1	10 (40.0)	15 (60.0)	
	2	9 (36.0)	10 (40.0)	
	3	6 (6.0)	0 (0.0)	0.029
2. Do you feel pain at the site of the hernia during activities?	1	8 (32.0)	15 (60.0)	
	2	5 (20.0)	10 (40.0)	
	3	2 (8.0)	0 (0.0)	
	4	5 (20.0)	0 (0.0)	
	5 (worst pain imaginable)	5 (20.0)	0 (0.0)	0.003
3. Do you experience restrictions of activities/daily activities?	2	5 (20.0)	8 (32.0)	
	3	0 (0.0)	3 (12.0)	
	4	6 (24.0)	6 (24.0)	
	5 (completely)	14 (56.0)	8 (32.0)	0.149
4. Do you experience esthetical discomfort concerning the shape of your abdomen?	1	17 (68.0)	17 (68.0)	
	2	8 (32.0)	8 (32.0)	1.000

[1]Chi-square test. All values are given as numbers (percentages).

Table 3

Follow-up of patients with and without defect suturing

Time	Complication	With a suture (n = 25)	Without a suture (n = 25)	p^1-value
Follow-up				
3 months	chronic pain	7 (28.0)	0 (0.0)	0.004
6 months	chronic pain	2 (8.0)	0 (0.0)	0.149
1 year	death	1 (4.0)	0 (0.0)	0.312
2 years	death	2 (8.0)	3 (12.0)	0.637
3 years	reccurence	3 (12.0)	6 (24.0)	
	death	0 (0.0)	1 (4.0)	0.301

[1]Chi-square test. All values are given as numbers (percentages).

Discussion

The laparoscopic intraperitoneal approach with IPOM was first described in 1993. At that time, little was known about the foreign body reaction of the IPOM-mesh, which covered the defect of the parietal peritoneum. This is becoming increasingly important, as the IPOM procedure with resection of the hernial sac and closure of the hernial opening (IPOM-plus) is increasingly being utilized [1].

Despite excellent results of laparoscopic repair of ventral hernias, numerous controversies are associated with the procedure – how to create the pneumoperitoneum, how to perform adhesiolysis, how to adequately deal with the hernial sac, the evolution, and complications related to a postoperative seroma, the type and size of the mesh, as well as the method of insertion and fixation of the mesh and postoperative pain [2, 3].

There are arguments for and against the utilization of the IPOM technique as a method of solving defects in ventral hernias. The surgeon makes only a few smaller incisions for placing laparoscopic ports (ranging from 5 mm to 10–12 mm in size), which reduces the risk of infection, bleeding, and other complications associated with open techniques. Due to the minimally invasive nature of the IPOM technique, patients often have a faster recovery. Smaller incisions mean less pain, less blood loss, and a shorter hospital stay. Furthermore, the IPOM technique involves strengthening the abdominal wall using special prosthetic implants, which provide firm support and reduce the risk of hernia recurrence after surgery [7].

Arguments against the IPOM technique are that it requires advanced surgical skills and specific equipment. The IPOM technique can be more expensive when compared to other conventional methods of hernia repair. This can be problematic for patients who do not have insurance or have limited financial means. Since the IPOM technique is relatively new, there is a lack of meta-analyses that would provide solid evidence of its long-term efficacy and safety. More research is needed to get more substantial verification of the long-term results of this technique [8].

The IPOM with the suturing of the hernial defect involves a suture or sutures on the hernial opening to close it

before placing the mesh. The surgeon joins the edges of the defect using sutures or other closure techniques. It was established that chronic pain might be related to non-absorbable suture material. Additionally, sutures used for closing the fascial defect pass through the excellently innervated peritoneum and also carry the risk of injuring vessels and nerves in the anterior abdominal wall, both of which may lead to increased postoperative pain [9, 10]. The pain was relieved with non-steroidal anti-inflammatory drugs or, in more severe cases, with local anesthetic injections. After the defect is closed, the mesh is placed over the defect with an additional 1.5 cm on each side of the defect and fixed in place with sutures, tackers, or other fixation methods. This technique aims to strengthen the abdominal wall and provide additional support to prevent the hernia from recurring.

IPOM without suturing the hernial defect is an approach in which the hernial opening is not sutured or closed before placing the mesh. Instead, the mesh is placed directly over the defect without any closure. This technique relies on the mesh itself to provide support and prevent hernia recurrence without relying on the closure of the defect [11, 12]. Furthermore, as there is dead space left, this can lead to seroma formation postoperatively. In our series, there were both more seromas and more recurrences in patients who underwent IPOM without PFC, although without statistical significance, which may be caused by the size of the samples. Other authors' findings demonstrate higher rates of seroma formation and recurrence following IPOM without PFC, although evidence is still inconsistent [13, 14]. Mesh bulging is a relatively common complication following IPOM ventral hernia repair. The fact there was no bulging in our series might be the consequence of a small number of patients included. There is conflicting data regarding differences between IPOM and IPOM-plus concerning mesh bulging – some authors' results suggest more bulging occurs following IPOM, while others indicate similar rates for both techniques, which necessitates further research [13, 15].

The choice between IPOM with suturing the defect or without depends on various factors such as the size and location of the hernia, the surgeon's expertise, the patient's condition, and other individual considerations [12].

Postoperative complications that occur after large opening hernia surgeries are most commonly seroma formation [16]. Late complications include chronic pain and mesh bulging. Seroma formation often compromises the patient's aesthetic appearance and causes discomfort, pain, and/or infection. The true incidence of seroma formation after IPOM is unknown because its presence is variable and depends on many factors [9]. In our series, seroma occurred in 12% of patients without a hernia defect suture, although this is a small series of patients, and the hernias were M1 (≤ 4 cm). In the comparison between the two study groups, patients with an unstitched hernia had statistical significance in the occurrence of seroma compared to patients in whom the hernia was closed with a suture [6]. The diagnosis of seroma in the literature is based on different diagnostic criteria of different authors. In a comparative study by Suwa et al. [9], the ratio of the occurrence of seroma in IPOM with and without sutures is 14% vs. 25%.

Following the recurrence results after IPOM, in our series, one (2%) recurrence occurred after three years. There was no statistical significance of recurrence in the laparoscopic IPOM group in relation to the open IPOM group [17]. In other studies, the percentage of recurrence was 16% in large M3 hernias; the most common cause was insufficient overlapping of the mesh over the hernial opening [10]. In our series, 18% died after three years with the diagnosis of COVID-19 infection.

Another issue with laparoscopic IPOM is chronic pain. It is defined as pain lasting more than three months. This complication occurs in 2–9.5% of cases of laparoscopic IPOM surgery [18]. The pain is related to the method of fixation of the mesh, especially with non-absorbable material, and in our series, it was observed in 14% of cases.

Conclusion

In summary, despite the ongoing conflicting evidence and the need for further investigation, the authors advocate for the use of PFC in selected cases of ventral hernia repair. This approach is suggested due to its potential to mitigate occurrences of seromas and reduce recurrence rates, albeit at the expense of heightened postoperative pain. Nonetheless, given the manageable nature of postoperative pain, we assert that the benefits outweigh the associated trade-offs.

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