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# Incisional Hernia Repair: Laparoscopy versus Open Surgery - A Prospective Study

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## ABSTRACT

***Objective:*** *To assess the feasibility of laparoscopic incisional hernia repairs and to examine possible differences in operative time, morbidity, recurrence rates and length of hospital stay compared to repairs performed by open surgery.*

***Patients:*** *Between January 2016 and June 2019, sixty patients who underwent parietal repair were enrolled in this study. Patients were divided into two non-randomised groups. Data were collected prospectively and recorded in a database. The statistical analysis was performed using SPSS24 biomedical statistics software and Microsoft Excel. The statistical analysis was performed using the chi-two test, with calculation of the P value (Pearson test).*

***Results:*** *Thirty patients who underwent parietal repair by laparoscopic preperitoneal prosthesis placement (first group), and 30 patients who underwent open repair (2nd group). The two groups were comparable in terms of gender distribution and body mass index. No significant differences were observed in age and comorbidities between the two groups.*

*In the first group, implantation of an intraperitoneal bifacial prosthesis was possible in 93.3% of patients. In the second group, the prosthesis was placed retromuscularly in 56.6% of patients and perifascial in 41% of patients. The conversion rate to open surgery was 6.6%. The average operating time was (81mn vs 92min). The complication rate was (26.6% vs 43.3%). The average length of hospital stay was 2 days 5.6 days. The recurrence rate at 3 years is (3.3% 6.6%; P< 0.05).*

***Conclusion:*** *The results of this study suggest that parietal repair by laparoscopic intraperitoneal prosthesis placement has some advantages over open surgery.*

## Keywords

Incisional hernia, Laparoscopic repair, Open surgeon repair, Morbidity, Hospital stay, Recurrence.

## Introduction

Significant progress has been made in the treatment of ventral incisional hernias, thanks to the use of adapted prosthetic material that allows the implantation sites on the abdominal wall to be enlarged according to their physicochemical characteristics [1-3]. Over time, several surgical techniques have been validated depending on the nature and type of prosthesis used.

Tension-free parietoplasty with prosthetic reinforcement is considered the technique of choice for the repair of incisional and primary ventral hernias by open surgery. In contrast, the repair of ventral incisional hernias by laparoscopy consists of parietoplasty by intraperitoneal composite prosthesis, aimed at filling the parietal defect by overlapping the edges of the defect by 3-5 cm, without deterioration of the wall. This technique is currently considered a quality reference because of its feasibility, cost-effectiveness, reduced morbidity and improved quality of life [1,2].

The main challenge in repairing ventral hernias is to reduce the rate of recurrence, and the effectiveness of each technique is evaluated according to the incidence of recurrence. Based on recent data from the literature and in order to contribute to the development of new minimally invasive techniques in our hospital, we chose the technique of parietal repair of incisional hernias by laparoscopy using the intraperitoneal site. To reinforce the value of this prospective study, we compared this technique to other open surgery parietal repair procedures performed during the same study period.

The main objective of this prospective comparative study is to evaluate the feasibility of this technique on a scarred abdomen in patients who have undergone several surgical procedures, except for patients with a recurrent hernia already treated with a prosthesis. In addition, we sought to analyze the rate and causes of conversion, the rate of recurrence, and to evaluate the advantages of this technique compared to other procedures.

The use of minimally invasive incisional hernia repair using the intraperitoneal site with adapted prostheses aims to reduce the rate of recurrence on the one hand and to improve quality of life and reduce economic costs on the other hand. Since our department is a training center, we tried, during the study period, to allow other surgeons and residents to learn this technique.

It should be noted that other surgical techniques are still used. Overall, the aim of this prospective study is to evaluate the feasibility of repairing ventral eventrations using intraperitoneal prostheses by laparoscopy, and to compare the results obtained with those of repairs performed by open surgery. Endpoints assessed in this study include duration of surgery, rate of conversion to open surgery, incidence of complications, length of hospital stay, and recurrence rate.

## Patients and Method

This is a prospective, non-randomized controlled study of sixty patients who underwent surgery for ventral incisional hernia. Thirty patients underwent laparoscopic surgery and thirty patients underwent open surgery from January 2016 to June 2019. Inclusion criteria in this study included all ventral incisional hernias of the anterolateral wall, recurrent abdominal eventrations not treated with prosthesis, incisional hernias on trocar orifice, and eventrations with a diameter greater than 6 cm. IBM SPSS24 and Microsoft Excel biomedical software were used, as well as the chi-two test with p-value calculation (Pearson test), to analyze the study results.

An abdominal ultrasound was performed in all patients, mainly to look for associated intraperitoneal pathology. In addition, a CT scan of the abdominal wall was performed to clarify the exact dimensions of the hernia, the nature of the hernial contents, measure the diastasis of the rectus muscles of the abdomen and assess the thickness of the adipose tissue.

Risk factors and comorbidities were considered and assessed. Patients who are candidates for laparoscopic surgery were informed during the preoperative consultation about the advantages and disadvantages of this technique, as well as the possibility of conversion to open surgery if necessary. Patients' consent was obtained regarding the surgical technique chosen and the possibility of discharge from hospital on the first post-operative day in the absence of complications. The intraperitoneal site has been used in laparoscopic repairs, while the retromuscular site has been preferred in the majority of cases during open surgery repairs.

## Results

In this study, a total of sixty patients were operated on for a ventral incisional hernia, divided into two groups of thirty patients each. The first group was operated on by laparoscopic surgery and the second group by open surgery. The mean age of patients was 52.53 years, with an age range of 27 to 82 years. Women accounted for 78% of cases, a sex ratio of 3.61. The majority of females were housewives (68.3%) of cases. Not all patients included in the study were morbidly obese, but all had at least one predisposing factor for hernia. In the majority of cases, eventration was secondary to anterior laparotomy (83.3%), followed by hernia on a trocar orifice (10%). The most common type of hernia was type M2, accounting for 60% of cases and evenly distributed between the two groups (Table1).

**Table 1:** Features of patients and hernia.

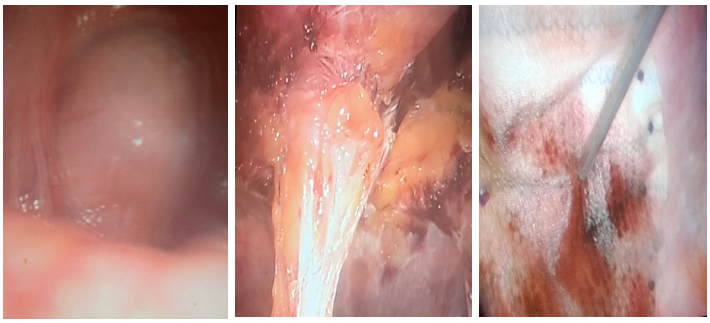
| Features of patients and hernia | | Laparoscopy | | Open Surgery | | P |
|---|---|---|---|---|---|---|
| | | N | (%) | N | (%) | |
| Gender | M | 07 | (23) | 06 | (20) | *0.07* |
| | F | 23 | (76.6) | 24 | (80) | |
| Age (Years) | 27-42 | 11 | (36.6) | 03 | (10) | *0.1* |
| | 43-65 | 12 | (40) | 13 | (43.3) | |
| | 66-82 | 07 | (23.3) | 14 | (46.6) | |
| kg/m$^2$ | ≤ 25 | 9 | (30) | 8 | (26,6) | |
| | ≥ 25 ≤ 30 | 14 | (46,6) | 17 | (56,6) | |
| | ≥30 ≤35 | 7 | (23,3) | 5 | (16,6) | |
| **Respiratory disorder** | | 21 | (70) | 14 | (46) | |
| Topography | M1 | - | - | 06 | 20 | *P 0.3* |
| | M2 | 18 | 60 | 18 | 60 | |
| | M3 | 03 | 5 | 03 | 10 | |
| | M4 | - | - | 02 | 6.6 | |
| | L1 | 01 | 3.3 | 01 | 3.3 | |
| | L3 | 02 | 6.6 | - | | |
| | OR | 06 | 20 | - | | |
| Defect size | < à 05 cm | 14 | (46.6) | 09 | (30) | *NS* |
| | 05 à 10 cm | 13 | (43.3) | 19 | (63.3) | *p : 0,03* |
| | Double orifice | 01 | (3.3) | 01 | (3.3) | *NS* |
| | Multiorifice | 02 | (6.6) | | | *NS* |

The size of the hernial collar ranged from 5 to 10 cm, with 23 patients having a collar less than 5 cm, and 32 patients having a collar between 10 and 15 cm. Two patients had double-orifice hernias and two other patients had multi-orificial hernias (Table1).

The creation of pneumoperitoneum was achieved by an opening in the abdominal wall (open laparoscopy) in 27 patients and by a Veress needle in three patients. In the laparoscopic repair group, hernia repair was performed by three trocars in 96.6% of cases, with dissection and hernial sac release required in 16.6% of patients.

Adesiolysis was difficult in two patients operated by laparoscopy and seven patients operated by open surgery. In two cases, conversion to open surgery was required, representing a conversion rate of 6.6%. The size of the parietal defect, measured during surgery, was identical to radiological data in 17 patients, underestimated in 42 patients and overestimated in a single patient. The average duration of surgery was 81.51 minutes for laparoscopic repairs and 92.06 minutes for open surgery repairs.

In the first group, repair of incisional ventral hernias was performed using intraperitoneal prostheses in 28 patients (46.66%), (Figures 1 a, b, and c). However, in two patients in this group, laparoscopic repair was impossible due to dissecting difficulties in one patient and an iatrogenic intestinal wound in the other. Both cases required conversion to retromuscular repair in one of the patients, while the other patient did not receive immediate repair.



a b c

**Figure 1:** Laparoscopic hernia repair.
a. M3 hernia
b. Adhesiolysis and hernia content reduction
c. Fixation of the prosthesis

In the second group, implantation of the prosthesis was performed using an extraperitoneal technique in 29 patients. In one patient in this group, parietal repair was delayed due to an iatrogenic intestinal wound.

In laparoscopic repairs, the size of the prosthesis used ranged from 15 to 20 cm. In the open repair group, 30 cm prostheses were used in 11 patients. An intestinal wound occurred during adhesiolysis in one patient in each group, which resulted in the postponement of incisional hernia repair. Two patients operated by laparoscopy experienced significant postoperative pain (3.5%), requiring first-level analgesics. Only two patients in the first group developed wall sepsis, while six patients in the second group developed wall sepsis. The average length of hospital stay was 2 days for laparoscopic surgery and 5 to 6 days for open surgery. The overall recurrence rate was 5%, with one recurrence in the first group and two recurrences in the second group (Table 2).

**Table 2:** Complications and recurrences.

| Complications | Laparoscopy | | Open | | Total | | Khi-deux |
|---|---|---|---|---|---|---|---|
| | N | (%) | N | (%) | N | (%) | |
| Persistent pain" | 2 | (7) | 3 | (10) | 5 | (8.6) | **NS** |
| Seroma | 2 | (7) | 0 | (0) | 2 | (3.4) | NS |
| Parietal hematoma | 1 | (3.5) | 2 | (6.6) | 3 | (5) | NS |
| Parietal infection" | 1 | (3.5) | 6 | (20) | 7 | (12) | <0.05 |
| **Rate of complications** | 6 | (21.4) | 11 | (36.6) | **17** | (29.3) | NS |
| **Recurrence** | | | | | | | |

## Discussion

Incisional hernia is a major complication of any abdominal surgery. Its incidence varies between 13% and 20% after a laparotomy and is common in the first five years postoperatively. About 50% of cases occur within the first two years [2-6].

The predominance of women is found in most studies published in the literature [5,6]. Obesity is one of the main causes of postoperative complications affecting cardiorespiratory and metabolic function and can be life-threatening with an insignificant mortality rate. The laparoscopic approach offers the possibility of incisional hernia repair in patients with morbid obesity with a significant reduction in postoperative complications especially those related to parietal infection [7,8]. Previous research has demonstrated the feasibility and safety of laparoscopic repair of VIH in obese patients and those with morbid obesity (BMI $\geq$ 35kg/m$^2$) [9,10].

In some situations where difficulties prevent the continuation of laparoscopic surgery, it is sometimes necessary to resort to perform open surgery. In our study, we encountered two situations where we were no longer able to continue the procedure laparoscopically, resulting in conversion to open surgery. The conversion rate generally varies between 2.1% and 3.2% [5,11]. Dissection difficulties, intestinal wounds and intraoperative hemorrhages are the most common causes of conversions to open surgery. The incidence of iatrogenic intestinal wounds that require conversion to open surgery typically ranges from 1% to 3%. In contrast, intraoperative bleeding as a cause of conversion is not often reported by most practitioners and researchers. In some series, conversions relating to the occurrence of intraoperative complications are clearly indicated and range from 1% to 5% [5,10-13].

In our study, the conversion rate is 6.6%. This is due to an iatrogenic wound of the small intestine in one case, where parietal repair was performed by simple plasty and final repair was postponed. In another case, dissection proved impossible due to enteroparietal adhesions, and as a precaution, we preferred to complete the

procedure with open surgery. The conversion rate in some series remains low, ranging from 0.5 to 1% [14-16].

The duration of surgery for laparoscopic hernia repairs is usually shorter than that of open surgery. However, the duration of the operation can vary depending on several factors, including the experience of the surgeon. In our study, the average duration of the intervention was 81.51 minutes, with a range of 40 to 185 minutes. For open surgery, the operating time ranged from 40 to 150 minutes, with an average duration of 92.02 minutes. These results are consistent with those reported in the literature [10,13,14,17]. It's worth noting that the reported duration of HIV surgery in a large series of 1029 laparoscopic procedures was 40 minutes. However, this result might not have taken into consideration the learning curve of the techniques [13]. In another series of 819 laparoscopic cures reported by Herniford, the average duration was 120 minutes [17].

Postoperative complications of primary or incisional ventral hernia repairs by laparoscopic surgery mainly include seromas, persistent postoperative pain at 3 months, surgical site infection, and hemorrhage. It is important to note that the prevalence of these complications may vary depending on the surgeon's experience [18]. *The American Hernia Society* confirms the decrease in the rate of postoperative complications after laparoscopic incisional hernia repair compared to open surgery repairs (05% to 30% versus 27% to 34%), the same findings are made by Mc Greey et al., in a prospective study published in 2003 [19]. Similarly, in our study, the postoperative complication rate of laparoscopic parietal repairs is significantly lower than the complication rate of open repairs ($P<0.005$).

The duration of postoperative hospitalization is one of the advantages of laparoscopic surgery. In our study, the average hospital stay in the laparoscopic repair group was 2 days, but the stay in patients operated on by the open route was longer (5.63 days). This benefit of laparoscopic incision hernia surgery is reported by the majority of authors [15, 20-22]. This route first makes possible the application of the ambulatory concept in the treatment of incisional hernias, the duration of hospitalization in fifteen patients of our study did not exceed 24 hours (*Single Night*).

The reoperation rate for postoperative surgical complications varies from 0 to 3.5% depending on the series [6,15,17,23]. The main causes of revision surgery are mainly postoperative hemorrhages, unknown intestinal wounds, and intestinal obstructions. Persistent pain resistant to medical treatment was also reported as a cause of early postoperative recovery, this pain is usually related to stapling the prosthesis [6,24].

The operative mortality of laparoscopic incisional ventral hernia repairs is low, in addition to medical complications, such as pulmonary embolism, unknown intraoperative intestinal wounds discovered at the stages of advanced peritonitis are the most common mortality factors [14,17,23].

Postoperative comfort is one of the major advantages of laparoscopic parietal repairs of incisional hernias. Patients who have undergone this surgical approach usually express great satisfaction and recommend this method to their relatives. In addition, the early resumption of social activities is also an objective of this technique. The main goal of laparoscopic parietal repairs of incisional hernias is to reduce the rate of postoperative recurrence. This rate can vary from one series to another in a large series of 7516 laparoscopic ventral incisional hernia repairs. Moreau [23], finds a recurrence rate of 4.6%, comparable to the results obtained by Heniford [17]. The recurrence rate is lower in Cardin's study [5], but this rate is 13.5% in the Levard study [12].

The difference in the prevalence of complications after laparoscopic repair of incisional ventral hernias depending on the modalities of fixation of the prosthesis is not very significant. Postoperative complications are related to adhesions. The detection of these adhesions radiologically is possible thanks to high-resolution ultrasound [6,24-27]. The effectiveness of laparoscopic repair of incisional ventral hernias in large hernias in obese patients is possible and even with encouraging results [6,28].

In a comparative meta-analysis of retrospective studies based on several outcomes, Rudmik et al. [25] have proven the optimal approach for laparoscopic repair of incisional ventral hernias. The repair of incisional ventral hernias has become a *gold standard*. The effectiveness and safety of this technique is based on its advantages over open repair, regardless of the site of implantation, in terms of the incidence of early complications, and especially the rate of recurrence. Other factors were also analyzed, mainly operating time, hospital stay, and resumption of postoperative activities [3,20,29,30].

The laparoscopic approach in the repair of incisional ventral hernias is considered a valid and safe technique. Some consider it the best technique. Although, the financial impact related to the prosthetic equipment used is high, the good results expected, in terms of length of stay, the resumption of activities, and especially a low rate of postoperative complications and recurrence, has put the balance of the financial cost in its favor compared to open surgery techniques [29]. All these benefits have led surgeons to use this route, and thus the increased incidence of laparoscopic ventral incision hernia repairs over the years compared to open surgery [29,30].

## Conclusion

Laparoscopic repair of ventral incisional hernias offers many benefits. This technique is feasible and easy to perform by respecting the protocols and tips specific to hernia repair. It is particularly suitable for obese patients. In addition, it allows a reduction in the duration of hospitalization, with the possibility of a discharge the day after the intervention for the majority of patients - "single night". The reduction in the incidence of postoperative complications, especially hernia recurrences, as well as the early

resumption of usual social activities, contribute to the overall satisfaction of operated patients.

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