

Original Article

Laparoscopic and open incisional hernia repair: A prospective randomized study

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Abstract. As the number of major surgical procedures has increased in recent years, so there has been an increase in incisional hernias. With gained experience and new materials, laparoscopic repair of incisional hernia is now applied. This study was aimed to compare the results of incisional hernia repair with the open surgery or laparoscopic approach at the only center in the region for laparoscopic incisional hernia repair. A total of 55 cases of incisional hernia at the General Surgery Clinic of SDU between November 2012 and 2014 were underwent laparoscopic ventral hernia repair (L-VHR) and conventional incisional hernia repair (C-VHR). From the L-VHR group 6 cases and from the C-VHR 9 cases were excluded from the study, as they did not meet the inclusion criteria or did not wish to participate in the study. The two techniques were compared in respect of operative time, length of hospital stay, postoperative pain scores, complications and recurrence. A total of 40 cases of incisional hernia repair were evaluated. The mean follow-up period was found as 12.75±4.19 months. No difference was determined between the characteristics of the patients due to age, body mass index, American Society of Anesthesiologists (ASA) score, comorbidities, hernia size, and follow-up. In the laparoscopic repair group, the postoperative pain scores, complication rates and duration of hospital stay were found significantly superior to those of the open technique group. While there was no mortality seen and wound complications as a morbidity were 0 % in the L-VHR (n = 0) and 20 % in C-VHR group (n = 4). In the comparison of mean operative time, the duration of surgery was significantly shorter in the laparoscopic repair group (67.25±19.23 min) compared to the open technique group (91.50±24.87 min) (p=0.001). Laparoscopic repair was associated with less postoperative pain (4.35±1.03 vs 5.60±1.31, p=0.002), lesser postoperative complications (5% vs. 35%, p=0.044), and shorter hospital stay (3.45±1.79 vs. 8.3±3.08, p<0.001). The results of this study showed that laparoscopic incisional hernia repair when applied at an experienced laparoscopic surgery center, is a method which can be applied safely with a short hospital stay and high patient satisfaction in patients who are obese and have large hernias and is therefore seen to be a good alternative to open surgery.

Keywords: Incisional hernia, open repair, laparoscopic repair

Introduction

Incisional hernia, which is seen at a rate of 6-24 % occurs as a result of insufficient healing in the abdominal wall fascia and in up to 50% of these cases there is wound site infection. It is seen more often when the surgical procedures are greater and take a longer time. Despite treatment for many years, there are still significant rates of morbidity and complications. By affecting the vascular, respiratory and intestinal systems, large incisional hernias may lead to complications such as chronic pain, strangulation, obstruction in the intestinal lumen and ischemia within the hernia [1, 2].

In addition to the local effects such as the laparotomy site and the size of the incision, systemic conditions such

as diabetes mellitus, chronic steroid usage, ageing, chronic respiratory disease, malnutrition and obesity are the risk factors for incisional hernia [3]. After repair 50% recurrence is seen within the first 6 months. With the use of prosthetic mesh, although there has been a reduction in the rates of recurrence which previously reached 65% after incisional hernia, rates of from 2% to as high as 36% are still observed and prosthetic mesh has become indispensable in hernia repair [4].

Materials used to support the repair may engender new complications such as foreign body reaction, seroma, adhesions, chronic pain and intestinal erosion. In addition, even mesh infection may be seen at rates of 1-7%, which will result in the removal of the mesh [5-7]. At the same

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time, in open hernia repair, a longer period of hospital stay and morbidities such as mesh and wound infection in the extensive dissection area along a large incision line, flap preparation and drain usage reduce the satisfaction of the patient.

A laparoscopic approach in incisional hernia repair was first used in 1993 by LeBlanc and Booth. He was aimed to increase patient satisfaction by providing a shorter hospital stay with low rates of recurrence and complications due to minimal dissection. Although it is frequently encountered, there is still no uniformly accepted method for incisional hernia repair [8].

The aim of this study was to compare laparoscopic and open approaches for incisional hernia repair in terms of complications, recurrence rates and pain scores.

Materials and Methods

A total of 55 patients underwent surgery by 2 experienced laparoscopic surgeons with the diagnosis of incisional hernia between November 2012 and March 2014. A total of 15 patients were excluded from the study, 6 from the L-VHR group and 9 from the C-VHR group as they did not meet the inclusion criteria or did not want to participate. In Group 1 (L-VHR), 20 patients were treated with the laparoscopic technique using PTFE mesh and in Group 2 (C-VHR), of the total 20 patients, PTFE mesh was used on 4 and polypropylene mesh on 16, all with the conventional open technique. Approval of the study by institutional review and the consents of the patients were also obtained.

The patients were evaluated in respect of BMI, hernia characteristics (diameter, recurrence after previous repair), intraoperative complications, duration of operation, early postoperative complications, duration of hospital stay and late complications.

Surgical Technique

In both groups, no bowel preparation was used, antithrombotic prophylaxis was administered, and first generation cephalosporin was administered 30 minutes before surgery. General anesthesia was used in all cases. In all cases, nasogastric tube and bladder catheterization were used only for the duration of surgery.

In the laparoscopic group, after the induction of pneumoperitoneum with a Veres needle in the left upper quadrant, the first 12-mm trocar was inserted on the left side as far laterally as possible from the parietal defect. A 30° laparoscope was used to explore the whole abdominal cavity and the inner face of the anterior wall and under scope guidance, 2 additional 5mm trocars were placed to form a triangle. Adhesiolysis and peritoneal sac reduction were performed with blade scissors, or a 5mm ultrasonic scalpel in cases of severe adhesions.

After hernia reduction in the abdominal cavity, the size of the parietal defect was measured at the 4 cardinal points of the mesh. The mesh (Dual Mesh; Gore) was shaped accordingly, marked to facilitate intra-abdominal orientation, rolled, and introduced through the 12mm trocar. It was applied over the hernia with 4 transparietal stitches with a Berci needle, so that it overlapped the defect by at least 4 cm in all directions. Finally, the mesh was

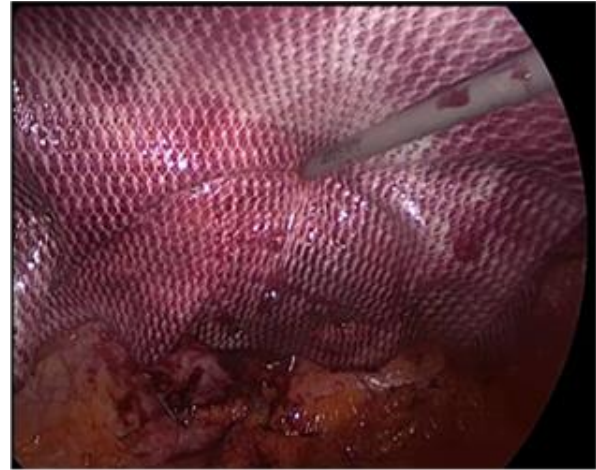


Figure 1 Intraoperative image of the mesh fixation with a double ring made of 5mm spiral titanium tacks

fixed with a double ring made of 5mm spiral titanium tacks at 1.5 cm distance from each other (Pro- Tack; Covidien, Mansfield, MA). (Figure 1)

In the open procedure (Group 2), after closure of the hernia defect with no.1 prolene, a polypropylene mesh (Surgimesh) was applied over the rectus abdominis muscle.

In some patients of Group 2, especially in those with a very large defect (xifo-pubic incisional hernia), there was a lack of posterior sheath of the rectus and a PTFE mesh was used. In all patients, a compression dressing was routinely applied for 2 days, followed by abdominal binder for 4weeks.

Data

The intraoperative data collected included the mean operative time, size of the parietal defect and complications such as intestinal injury or bleeding. Postoperative data concerned mean hospitalization, complications (pain, hematoma, seroma, granuloma, wound, or mesh infection), recurrences, and death. A visual analog scale (VAS) was used to measure pain from 0, no pain, to 10, the worst imaginable pain[9]. In the follow-up, a clinical evaluation of chronic pain was made with the Visual Assessment Scale: 2 months after surgery a value <5 is considered to be chronic pain. Follow-up evaluation consisted of physical examination at 1 week, then 1and 6 months after surgery. Ultrasonography was used only in cases of suspected complication. A total of 40 patients completed the clinical follow-up period.

Statistical Analysis

Data were expressed as mean for absolute numbers and percentages. Statistical analysis was made using the Student t test to assess differences between the 2 study groups. A value of $p < 0.05$ was accepted as statistically significant. The associations between variables were assessed by the Fisher Exact test for categorical variables.

Results

A total of 40 patients underwent surgery for a diagnosis of incisional hernia. The most common

TABLE 1
INCLUSION AND EXCLUSION CRITERIA FOR
LAPAROSCOPIC REPAIR

| Inclusion criteria | Exclusion criteria |
|--------------------------------------|-------------------------------------------------------|
| Defect >2 and <10cm | Important adhesion syndrome |
| Defect >10 and <20cm* | Skin lifting |
| Middle, lateral, and peripheral site | Anaesthesiological contraindications to laparoscopy |
| | Defect <2 and >20cm |
| | Intestinal obstruction |
| | Swiss-cheese defect |
| | Associated surgery |
| | Recurrence after extraperitoneal prosthesis placement |

* Evaluated according to the morphology and general condition of the patient.

TABLE 2
CHARACTERISTICS OF THE PATIENTS

| | |
|----------------------------------|-------------|
| Sex (M/F) | 5/35 |
| Mean age (yrs) | 58.97±10.19 |
| Mean BMI (kg/m ²) | 29.18±4.31 |
| Site (median/lateral) | 32/8 |
| Median Size (cm) | 8.15±4.46 |
| Recurrence after previous repair | 6 |

TABLE 3
CHARACTERISTIC OF PATIENTS BETWEEN THE
TWO GROUPS

| Variable | Laparoscopy (mean±SD) | Open surgery (mean±SD) | P value |
|--------------------|-----------------------|------------------------|---------|
| Age | 58.45±8.84 | 59.5±11.6 | 0.749 |
| BMI | 29.79±4.16 | 28.75±4.49 | 0.377 |
| Defect size | 7.80±4.57 | 8.5±4.44 | 0.626 |
| Operative time | 67.25±19.23 | 91.50±24.87 | 0.001 |
| Hospital stay | 3.45±1.79 | 8.3 ±3.08 | <0.001 |
| Complications | 1 (5%) | 7 (35%) | 0.044 |
| Recurrences | 0 (0%) | 1 (5%) | >0.950 |
| Follow-up (months) | 12.5±4.26 | 13±4.21 | 0.711 |

Parentheses indicate percentage.

complaints of the patients were abdominal bulging (62.5%), local pain (75%), severe constipation (37.5%) and respiratory distress (17.5%). The inclusion and exclusion criteria are shown in Table 1. The characteristics of the patients are shown in Table 2.

The median follow-up was 12.5±4.26 months in Group 1 and 13±4.21 months in Group 2. No differences were determined between the 2 groups in respect of age, body mass index (BMI), ASA score, co-morbidities, mean size of incisional hernia, or follow-up (Table 3).

A statistically significant difference was determined between the 2 groups in respect of mean operative time (Group 1, 67.25±19.23 min; Group 2, 91.50±24.87 min) and in length of hospital stay (Group 1, 3.45±1.79 days; Group 2, 8.3 ±3.08days)(p=0.001).

Postoperative pain at 24 and 48 hours after surgery was higher in Group 2 (p=0.002vs p=0.010). In Group 1, pain rated with VAS was 4.35±1.03 at 24 hours and 2.50±0.82 at 48 hours and in Group 2, 5.60±1.31 at 24 hours and 3.30±1.03 at 48 hours (Table 4). In both groups pain scores were higher in patients with larger hernia size (>10 cm), with VAS at 24 hours of 5.14±1.07 in the laparoscopic Group 1 and 6.50±1.52 in the open Group 2 (Table 4).

Table 5 shows the postoperative complications in 1 patient of Group 1 (5%) and 7 patients of Group 2 (35%) (p=0.044). In Group 1, intestinal injury was seen in 1 patient and the same patient complained of local chronic pain at 4 weeks and was then successfully treated with conservative therapy. Thus in Group 1, complications were recorded as 2 complications in 1 patient. In Group 2, the complications consisted of 1 hemorrhage requiring blood transfusion on the first postoperative day, 3 hematomas (of which 1 was treated with blood transfusion), 2 seromas (of which 1 was treated with evacuation in the outpatient clinic), 2 wound infections, 1 of which accompanied mesh infection which required the mesh to be removed. Both cases of wound infection were obese patients (BMI>30) undergoing repair of large defects (>10 cm). In Group 2, 9 complications were recorded in 7 patients.

Relapse occurred in 1 patient (5%) of Group 1 and in no patients of Group 2. No major complications developed. Chronic pain was registered in 1 patient (5%) arising from the intraperitoneal mesh fixing. Only 1 patient from the L-VHR group was transferred to the open technique group.

Discussion

As the number of surgical procedures has increased over time and within these, the rate of major surgical procedures and more obese patients undergoing surgery, so there has been an increase in the rates of incisional hernia encountered in daily surgical life. There are different opinions regarding the optimal surgical treatment. It has been claimed that the routine use of laparoscopic surgical procedures has the benefit of a minimally invasive approach in incisional hernia repair. However, despite the use of laparoscopic hernia repair for more than 20 years, there is still no fully accepted view of a repair method and only 12% of all repair procedures are made laparoscopically [10].

The majority of studies in literature are cohort or retrospective studies. Previous meta-analyses have reported short operative times and hospital stay with low perioperative complications but the results have been similar in terms of recurrence and postoperative pain [11]. Consistent with those findings, in the current study, together with a shorter operative time and hospital stay, which led to higher patient satisfaction, low postoperative pain was also determined. In addition, even with cases which led to higher patient satisfaction, low postoperative

TABLE 4
PAIN EVALUATION ACCORDING TO VISUAL ANALOG SCORE (VAS)

| Defect size | Vas 24 | | | Vas 48 | | |
|--------------|-------------|--------------|---------|-------------|--------------|---------|
| | Laparoscopy | Open surgery | P value | Laparoscopy | Open surgery | P value |
| Defect 2-20 | 4.35±1.03 | 5.60±1.31 | 0.002 | 2.50±0.82 | 3.30±1.03 | 0.01 |
| Defect 2-10 | 3.92±0.76 | 5.21±1.05 | 0.001 | 2.15±0.69 | 3.07±1.0 | 0.011 |
| Defect 10-20 | 5.14±1.07 | 6.50±1.52 | 0.086 | 3.14±0.69 | 3.83±0.98 | 0.166 |

which led to higher patient satisfaction, low postoperative pain was also determined. In addition, even with cases within the learning curve, the operative time was shorter than in the open technique.

Covering the defect, particularly in wide incisional hernias, increases the risk of recurrence as intra-abdominal pressure is increased and operative time is extended. There are studies which claim it is not necessary to cover the defect. In the current study, inlay prosthetic mesh was placed without covering the defect in the laparoscopic repair cases. The prosthesis should be especially produced to prevent adhesions and thereby, early and late complications can be avoided. In the patients undergoing the open technique, dual mesh repair was made in only 4 cases where the defect was large.

Postoperative pain, measured with VAS scale was determined as significantly high in Group 2. This was higher in particular due to the wide incision and dissection area in defects larger than 10cm. As the number of incisions did not vary according to the size of the hernia, laparoscopic repair made with 3 trocars achieved more satisfactory results (Table 4). As stated by Perrone et al, the use of small mesh and insufficient mesh fixation by inexperienced surgeons are significant factors for recurrence.

Interestingly, among the several techniques of mesh fixation, the application of both single-crown and double-crown spiral tacks at 0.5 to 1 to 2 cm from each other is universally accepted by surgeons, whereas transfascial sutures have been reported to be used by 26% to 97% of investigators[12]. With the use of double-crown titanium tacks in the current cases, decreasing the unit tension on each tack, it was aimed to prevent the mesh tearing. Double-crown titanium tacks were used and at least 4 transabdominal non-absorbable stitches at the cardinal points of the mesh applied with the aid of a suture passer (Berci needle). The combined use of single-crown tacks and transabdominal stitches can be considered to reduce postoperative pain and relapses respectively [13].

Studies have been made related to extended pain when the suture fixation technique or the combined technique is used for prosthesis fixation. To avoid this potential complication, which can affect the patient's quality of life and result in long-term use of analgesics, only the fixation technique with Tucker was used in the current cases. During the follow-up period, this complication was encountered in only 1 patient with pain in a single point

which was relieved with simple analgesia which was then terminated at the end of the 6th month. The incidence of postoperative chronic pain was among the lowest described in literature (5%) [14].

In patients who have previously undergone prosthetic repair and experienced recurrence, intestinal injury may be seen during surgery associated with advanced adhesions. In the current series, 8 patients were operated on laparoscopically for prosthetic repair due to recurrence. Intestinal injury which formed in 1 L-VHR patient was repaired intracorporeally. To avoid this type of complication, when injury is determined, repair can be made using mini-laparotomy as it may not be an option to operate laparoscopically on a previously repaired prosthesis. Otherwise, with developed laparoscopic experience, intracorporeal repair can be made. Although operative time varies according to experience, it is shorter compared to the open technique as experience increases. Time is saved as there is no dissection of the hernia sac and surrounding tissue as is made in open surgery [15].

The risk of mesh infection, which continues until prosthesis removal, is very important in these kinds of operations. As has been shown in inguinal hernias, the laparoscopic approach is safer in terms of mesh infection. Compared to open surgery, the size of the incision is much smaller and the use of 3 fixed incisions almost independent of the defect significantly reduces the risk of postoperative infection and associated wound complications. As reported by Rives and Stoppa, the high wound infection rate associated with open anterior repair (12% to 0%) seems to be due to extensive tissue dissection and drainage placement. Laparoscopic repair is likely to be a better approach avoiding direct contact of the mesh with the skin and not requiring wide lateral dissection and postoperative drainage[16, 17]. While no complications such as hematoma, seroma or wound site infection were seen in the laparoscopic patients of the current study, more wound site infections were seen in patients with a large defect where extensive decoliation was made.

As one of the main aims of laparoscopy, a shorter hospital stay is particularly noticeable in incisional hernia repair. A high level of patient satisfaction was achieved with the difference between the two methods of 3.45±1.79 days with a laparoscopic approach and 8.3±3.8 days with open surgery. The main reason for a monitoring period this long in open surgery is the use of a drain. Using a drain for this length of time also increases the risk of infection [16].

TABLE 5
INTRAOPERATIVE AND POSTOPERATIVE
COMPLICATIONS BETWEEN THE TWO GROUPS

| Complications | Laparoscopy | Open surgery | P value |
|--------------------|-------------|--------------|---------|
| Intestinal injury | 1(5%) | 1(5%) | >0.950 |
| Hemorrhage | 0(0%) | 1(5%) | >0.950 |
| Hematoma | 0(0%) | 3(15%) | 0.231 |
| Seroma | 0(0%) | 2(10%) | 0.487 |
| Chronic local pain | 1(5%) | 0(0%) | >0.950 |
| Granuloma | 0(0%) | 0(0%) | 0 |
| Wound infection | 0(0%) | 2(10%) | 0.487 |
| Mesh infection | 0(0%) | 1(5%) | >0.950 |
| Mortality | 0(0%) | 0(0%) | 0 |
| Total | 1(5%) | 7(35%) | 0.044 |

While no drains were used in any of the patients who underwent laparoscopic repair in the current study, a subcutaneous negative pressure drain was used in all the patients in the open surgery group.

Postoperative compression applied after laparoscopic repair is important in the prevention of seroma formation. No seroma were observed in any of the laparoscopic repair patients. Generally, in open surgery, seroma are observed at the same rate because of the wide dissection area, but the risk of infections which are difficult to monitor and treat is higher due to the deep and larger incision line [18]. Seroma, which were observed in 2 patients in the open surgery group were overcome with simple needle drainage or a conservative approach without increasing the risk of infection. When applied appropriately, the recurrence rate following laparoscopic repair is below 5%, which is similar to the rate of open surgery. Recurrence is seen particularly in patients with a defect >10cm and /or who are obese [19]. In the follow-up period of the current series, no recurrence was determined, which may be due to the short follow-up period or the low number of patients.

When the complication rates of the current study are compared with those in literature, that they are a little higher, especially in the open surgery group, can be considered to be associated with the low number of patients. The development of a standardized technique would make it possible to perform hernia repair in difficult anatomic regions, such as the suprapubic area. Some authors have reported good results using the laparoscopic approach in the repair of wall defects in this anatomic area [20]. The findings of the current study seem to confirm these results. Hernia was determined in the suprapubic area in 4 patients and laparoscopic repair was applied to 2. No recurrence was determined in any patient.

In conclusion, laparoscopic incisional hernia repair can be considered superior to open surgery repair for all patient groups with shorter hospital stay and high patient satisfaction, superior short and long-term results and a low risk of infection and should therefore be considered for primary use. However, further studies with greater patient numbers and careful monitoring throughout a longer

follow-up period are needed to better analyze these preliminary results.

Conflict of Interest

The authors declare no conflicts of interest.

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