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# Study of etiopathogenesis and various surgical techniques used in incisional hernia

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## ABSTRACT

**Background:** Incisional hernia is the only abdominal hernia that is iatrogenic. For many years, the repair of incisional hernia was associated with a high recurrence rate. Laparoscopic technique of hernia repair has revolutionized the treatment of incisional hernia repair by reducing the morbidity and less hospital stay to the patient. With the above background we performed a study to analyse various etiological factors, study the age and sex incidence, time of occurrence of incisional hernia following various abdominal incision and to compare various surgical modalities based on size of incisional hernia.
**Methods:** Patients admitted with incisional hernia during October 2017 to September 2019 at S. C. B. Medical College and hospital are taken up for study with the help of relevant history, clinical examination and appropriate investigations.
**Results:** The mean age of the patients in open group is 45.66 years and 44.3 years in laparoscopy group. Out of the 51 patients in open group 13 (25.5%) are male while 38 (74.5%) are females where as in laparoscopy group, out of the 31 patients 10 (32.3) are males while 21 (67.7) are females. Out of 82 patients, maximum number of patients presented with swelling 60 (73.3%) followed by swelling and pain 19 (33.3%). The overall complication rate in open group was 45.09%, while in laparoscopy group it is 19.4%.
**Conclusions:** The main etiological factors identified for the occurrence of incisional hernia were wound related complications, faulty techniques, comorbid conditions. Hence the incidence of the incisional hernia can be decreased by preventing these factors.

**Keywords:** Incisional hernia, Etiological factors, Laparoscopic surgery

## INTRODUCTION

An incisional hernia after open or laparoscopic surgery is an abdominal wall defect that develops at the site of previously made incision through the abdominal wall with or without a bulge visible and palpable when the patient is standing and often requires support or repair.[1] Incisional hernia is the only abdominal hernia that is result of diagnostic and therapeutic procedure. It was described analogous with post operative ventral hernia, as large majority of such hernias do occur after midline, paramedian and oblique incisions in anterolateral region of abdominal wall. Many factors associated with incisional hernia like age, sex, obesity, chest infections, type of

suture material used and most important wound infection.[2] All these present a challenging problem to the surgeon.

Incisional hernia usually starts early after surgery, as a result of failure of the lines of closure of the abdominal wall following laparotomy. If left unattended they tend to attain large size and cause discomfort to the patient or may lead to stifling of abdominal contents. Furthermore, an incisional hernia can incarcerate, obstruct, perforate or can cause skin necrosis all of which markedly increase the risk to patient's life. Highest incidences of incisional hernia occur in the lower abdominal incisions, from where most of the gynaecological operations are being done. The posterior rectus sheath is deficient below the arcuate line and pressure in lower abdomen is more than upper abdomen and the stress and strain on the lower abdomen predispose for herniations.[3] There are multifarious aetiological factors in the development of incisional hernia but wound infections and increased intra-abdominal pressure are the most important causes.

The repair of incisional hernia was associated with a high recurrence rate. In present day, the introduction of synthetic prosthetic materials has provided the opportunity to perform a tension free repair, thereby reducing the rate of recurrence. Laparoscopic technique of hernia repair has improved the treatment of incisional hernia repair there by reducing the morbidity and less hospital stay to the patient. The use of non-absorbable mesh may lead to build-up of clear fluid, an abnormal connection between two body parts and infection in short term and to foreign-body reaction, chronic inflammation, pain, abnormal sensation like tingling or pricking stiffness and mesh shrinkage as long-term complications. Mesh material, pore size, filament structure, mesh position during surgery whether onlay, inlay, sublay, or intraperitoneal. The use of autodermal tissues and other factors (drainage, antibiotics) influence mesh safety.

With the above background we performed a study to analyse various etiological factors, study the age and sex incidence, time of occurrence of incisional hernia following various abdominal incision and to compare various surgical modalities based on size of incisional hernia.

## METHODS

Patients admitted with incisional hernia during October 2017 to September 2019 at S. C. B. Medical College and hospital, Post Graduate Department of Surgery, were taken up for study with the help of relevant history, clinical examination and appropriate investigations. In the present study the patients are grouped into two groups.

Group 1 included patients undergoing open mesh repair for incisional hernia.

Group 2 included patients undergoing laparoscopic intra peritoneal mesh repair for incisional hernia.

The total number of subjects are 82.

51 patients underwent open mesh repair. Among the 51 patients 2 patients underwent abdominoplasty. 31 patients underwent laparoscopic intra peritoneal mesh repair. 1 patient converted to open surgery due to dense adhesions.

Both the groups are evaluated and compared for duration of surgery, intra operative complications, post operative pain using the visual analog score (VAS), post operative complications like seroma, hematoma, mesh infection, post operative ilieus, length of hospital stay, return to normal activity, reoperation, recurrence.

### *Inclusion criteria*

Patients presenting with fascia or muscle defect at the site of incision detected clinically or by ultrasound who are managed in our hospital are included after taking a written consent.

### *Exclusion criteria*

Patient presenting in the emergency department with obstructed or strangulated incisional hernia.

The objectives of study were to compare open incisional hernia repair with laparoscopic incisional hernia with regard to the following factors: duration of surgery, post operative pain, post operative complications, post operative hospital stay, return to normal activity, and recurrence.

### *Preoperative evaluation*

All the patients are evaluated by proper history and detailed physical examination. Data collected by proforma. All the patients underwent the routine blood investigations and, in our study, we got ultrasound abdomen done for all our patients to know the size, number of defects, contents and any other abdominal pathology.

### *Preoperative preparation*

Patients were kept NPO for about 6-8 hrs. All patients received antibiotic prophylaxis half an hour before surgery.

### *Procedure for open surgery*

Almost all the patients were operated under spinal anaesthesia. Foleys catheterization and nasogastric tube were occasionally used. Patients were placed in supine position. Skin incision was made according to the site and size of the defect and type of hernia. The hernia sac was dissected out and reduced and the defect assessed. When there were adhesions, sac was opened and contents were reduced.

In onlay repair, polypropylene mesh is sutured over the anterior rectus sheath, while in sublay technique, the mesh is placed in the retrorectus space. The mesh is fixed at its four corners with non-absorbable sutures. Anterior rectus sheath was closed over the mesh by non-absorbable sutures. Suction drain was placed in few cases based on the surgeon 's choice. Skin and subcutaneous tissue closed in layers.

***Procedure for laparoscopic surgery***

All the patients were operated under general anaesthesia. Nasogastric tube was placed for upper abdominal hernia and a Foleys catheter for lower abdominal hernias. Both are removed after the procedure on the operating table.

***Patient position***

Patient is in supine position without any tilt.

***Position of surgical team***

The operating surgeon stands to the left of the patient with the camera man on his right or left depending on the location of hernia.

***Operative technique***

Pneumoperitoneum established by veres needle in palmers' point, 2 to 3cm below the left costal margin in the midclavicular line. A 10 mm camera port is place at this point and the intraabdominal pressure is maintained at 12 mm Hg. Two additional 5 mm ports are placed depending on the type of hernia under direct vision. Adhesiolysis was done using sharp dissection or monopolar diathermy. Defect is delineated. A thread was passed through the 5 mm port and the defect size measured intracorporeally. The size of the mesh required is assessed.

The area to be covered by the mesh is marked after the pneumoperitoneum is released and the sites for transfacial sutures marked with the defect at its centre. The mesh is prepared, 2 non-absorbable ethilon sutures on either side at the upper end and two polypropylene sutures at the opposite end. This is mainly done for the easy denitrification based on color difference. The mesh is rolled around the grasper and inserted through the 10 mm port.

Mesh is opened intraperitoneally and with the use of a spinal needle or cobbler and mesh is anchored to the anterior abdominal wall. In some cases, we also used tackers in a double crown fashion.

At the completion of the procedure, the ports are withdrawn under vision. 10 mm port is closed with 2-0 polyglactin. Skin closed with ethilon 3-0. A compression dressing is placed in the area of defect to reduce the incidence of post operative seroma.

***Mesh used***

In most of the cases we used a composite mesh. It is composed of three-dimensional multifilament polyester on the parietal side enhancing tissue integration. On the visceral side the mesh is covered by an absorbable collagen film composed of porcine collagen, polythene glycol and glycerol, in order to minimize visceral adhesions. In a few of the cases we used light weighted titanized proline mesh.

***Fixation devices***

The meshes were anchored to the inside of the abdominal wall by tacker. Two types of tackers were used. One is a non-absorbable titanium tack, with a spiral helix shape. Each fixation device consists of 30 non absorbable tacks titanium tacks. Second is an absorbale vicryl tacker. Each fixation device consists of 30 absorbable tacks. The trocar diameter of the fixation device is 5 mm.

***Post-operative management***

During post-operative period all patients received intravenous aqueous diclofenac injections 12 hourly for 1 day unless contraindicated and there after oral analgesics are given on the patient demand. All the patients are ambulated within 12 hours of surgery and are encouraged for oral feeds. Initially the feeds were sips of liquids followed by normal diet after the resolution of post-operative ileus (indicated by passing of flatus and normal bowel sounds on auscultation and return of appetite).

In patients with persistent ileus, they were kept NPO and whenever required a nasogastric tube is passed only to be removed once the resolution of the ileus. The wounds were inspected for any seroma, hematoma or any infection. In open group drains were removed when the collection was less than 30 ml for 2 consecutive days. Patients were discharged after complete ambulation and tolerating normal diet.

***Follow up evaluation***

After discharge, patients were encouraged to take normal diet and return to their normal activities as early as possible. After the discharge, patients were followed up at 1 week, 1 month, 3 months, and 6 months intervals. In the initial follow up, the patients were evaluated for short term complications like seroma or hematoma, wound infection and wound dehiscence. During subsequent visits, chronic pain at the operated site, return to normal activity and recurrence were noted.

***Post-operative assessment of pain***

The pain experienced by the patients in the post operative period has been graded according to the visual analogue scale (VAS) which ranges from no pain to the worst possible pain on the scale of 0 to 10.

***End points of the study***

The end points measured in both the groups are duration of surgery, intra operative complications, incidence of post operative complications like seroma formation, wound infection, and postoperative ileus, duration of post operative pain using the VAS, length of hospital stay, return to normal activity, reoperation and recurrence rates during the follow up.

***Statistical methods***

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on mean±standard deviation (SD) (min-max) and results on categorical measurements are presented in number (%). Significance is assessed at 5 % level of significance. Chi-square/Fisher exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

***Ethical approval***

The study was approved by the institutional ethics committee.

***Type of study***

The study was a clinical type of study.

## RESULTS

The maximum number of patients in open group i.e. 28 (54.6%) are in the age group of 41-60, while in the laparoscopy group there are in the age group of 31-50 i.e. 21 (67.7%). The mean age of the patients in open group is 45.66 years whereas in laparoscopy group it is 44.3 years and p value is 0.056 (Table 1).

In open group, 26 (50.9%) patients the post operative pain evaluated by VAS score lasted for 6-10 days, while in laparoscopy group 30 (96.8%) patients it was for 1-5 days. The mean duration of pain was 6.9 days in open group while it is 2.35 days in laparoscopy group (Table 2). On day 1, 87% patients in laparoscopy group had a VAS score of 1-5, while 82% patients in open group had a score of 6–10. Almost all the patients were pain free by 5 days in laparoscopy group, while 32 (62.7%) had pain even after 5 days (Table 3). Out of 82 patients, 38 patients had no complication, followed by 27 patients were obese and 27 patients had wound infection (Figure 1).

**Table 1: Age distribution.**

| Age in years | Open group (N=51) | | Laparoscopy group (N=31) | |
|---|---|---|---|---|
| | N | % | N | % |
| **21-30** | 8 | 15.7 | 1 | 3.2 |
| **31-40** | `9 | 17.6 | 12 | 38.7 |
| **41-50** | 15 | 29.4 | 9 | 29.0 |
| **51-60** | 13 | 25.5 | 3 | 9.7 |
| **61-70** | 6 | 11.8 | 6 | 19.4 |
| **Mean age (years)** | 45.66 | | 44.3 | |

**Table 2: Distribution of post-operative pain.**

| Duration (days) | Open group | | Laparoscopy group | |
|---|---|---|---|---|
| | N | % | N | % |
| **1–5** | 19 | 37.3 | 30 | 96.8 |
| **6–10** | 26 | 50.9 | 1 | 3.2 |
| **11–15** | 6 | 11.8 | - | - |
| **Total** | 51 | 100 | 31 | 100 |
| **Mean (days)** | 6.9 | | 2.35 | |

**Table 3: Distribution of visual analog score.**

| VAS score | Day 1 (%) | Days 2-5 (%) | Days 6-10 (%) | Days 11-15 (%) |
|---|---|---|---|---|
| **Open group** | | | | |
| 1-5 | 9 (17.6) | 19 (37.3) | 20 (39.2) | 6 (11.8) |
| 6-10 | 42 (82.3) | 32 (62.7) | 12 (23.5) | - |
| **Laparoscopy group** | | | | |
| 1-5 | 27 (87.1) | 30 (96.8) | 1 (3.2) | - |
| 6-10 | 4 (12.9) | - | - | - |

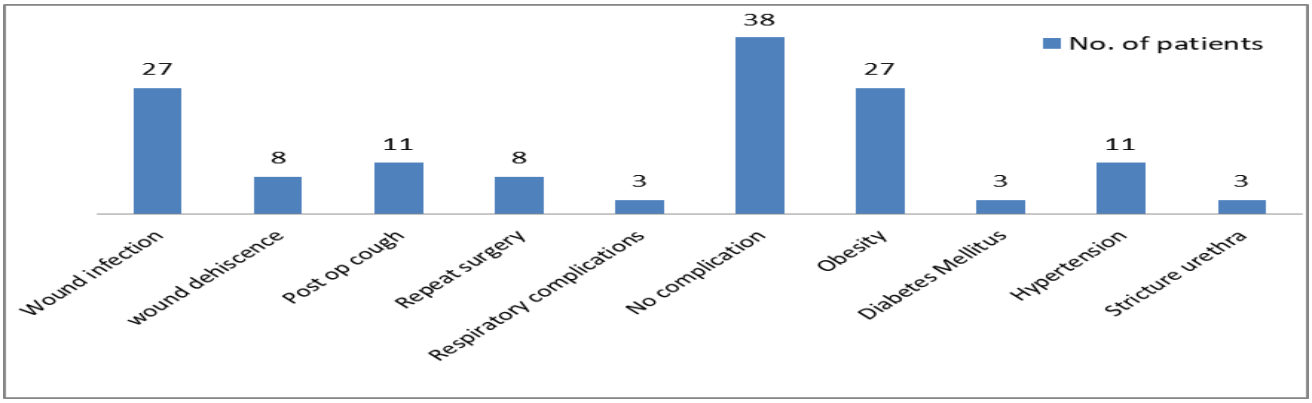


**Figure 1: Risk factors.**

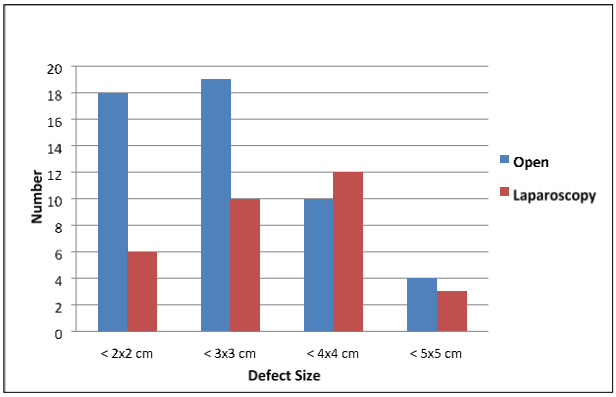


**Figure 2: Distribution of size of defect.**

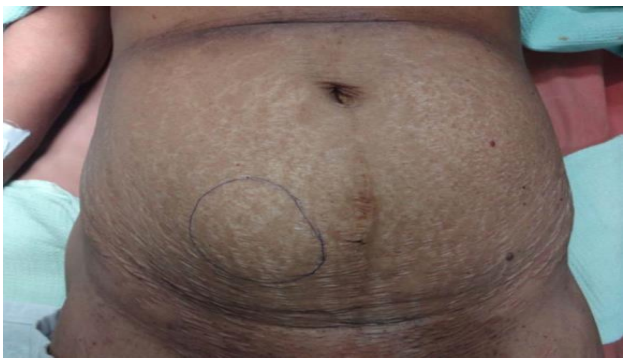

**Figure 3: Incisional hernia.**

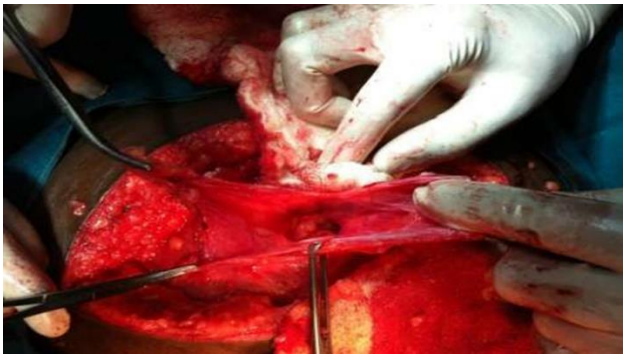

**Figure 4: Sac opened.**

**Figure 5: Mesh fixation.**

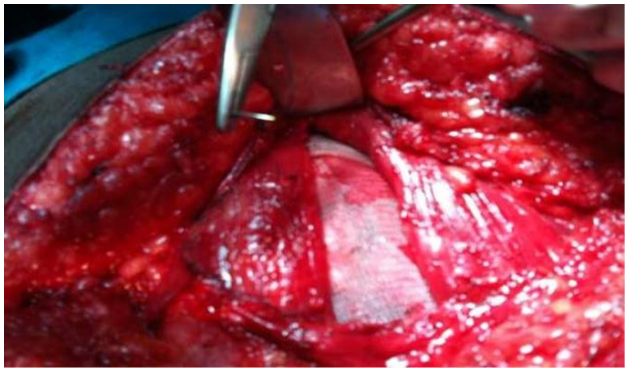

**Figure 6: Rectus being closed over mesh.**

**Figure 7: Post-operative seroma- open surgery.**

In open group maximum number of patients i.e. 37 (72.6%) had defect size less than 3×3 cm whereas in laparoscopy group 10 (32.3%) patients and 12 (38.7%) patients had defect size less than 3×3 cm and 4×4 cm respectively.

## DISCUSSION

The present study is a prospective non randomized study comparing the various surgical techniques in a short-term period. In the present day, prosthetic mesh repair has become the gold standard for hernia surgery. This has played a pivotal role in reducing the recurrence rates. The worldwide acceptance of laparoscopic surgery, has paved the way for an alternative to open hernia surgery. Ever since the first laparoscopic ventral hernia surgery by Blanc et al the procedure has faced many challenges and underwent many modifications till date.[4]

The present study includes a total of 82 patients, 51 in the open group and 31in the laparoscopy group. In one of the largest studies conducted by Ramshaw there were a total of 253 patients, 174 in open group and 79 in laproscopy group.[5] In one of the recent RCT conducted by Itani, a total of 146 patients are randomized such that 73 patients underwent conventional repair and 73 underwent laparoscopic repair.[6]

In the present study, the mean age is comparable between the two groups: 45.66 years. in open group and 44.3 years in laparoscopy group. In the study conducted by Misra et al the mean age of the patients in open group is 45.2 years and laparoscopy group are 45.96 years.[7] In the study conducted by Itani et al the mean age in laparoscopy group was 61.2 years and in open group was 59.6 years.[6]

In the present study most of the patients were females in both open (74.5%) and laparoscopy groups (67.7%). In the study conducted by Itani majority were men in both open (91.8%) and laparoscopy (91.8%) groups.[6] In the study conducted by Misra about 80% were females in both the groups.[7]

In the present study, almost all patients presented with abdominal swelling and pain (96.6%). Only 3 out of 82 patients (3.3%) presented with pain as the only symptom.

In the present study 40 (48.7%) of the incisional hernia occurred in lower midline incision.

This may be because of the following features: intraabdominal hydrostatic pressure is higher in lower abdomen compared to upper abdomen in erect position, absence of posterior rectus sheath below arcuate line, and this incision is used in gynaecological surgeries who have poor abdominal wall musculature.

This is comparable with Thakore et al 38 studies (67.1%) and Goel et al 37 studies (44.6%).[8,9] Over 46 (56%) of cases occurred following gynaecological procedure (hysterectomy, tubectomy, and caesarean sections). This may be because most of these procedures were done through lower midline incision. Ponka in his study noted 36% incidence and Goel et al noted 28.76% incidence among gynaecological procedures.[9]

In considering the risk factors promoting incisional hernias, wound infection accounted for 27 (32.9%). The other risk factors observed were wound dehiscence 8 (9.7%), repeat surgery 8 (9.7%), diabetes mellitus 3 (3.6%), hypertension 11 (13.4%), obesity 27 (32.9%) and respiratory complications and cough 14 (17%), and stricture urethra 3 (3.6%).

This is comparable with that of Bose et al studies in which wound infection (59 out of 110 patients-53.63%), obesity (33/110-30%), COPD (23/110-20.90%) and stricture urethra (10/110-9.09%).[10] 3 patients (10%) had undergone more than one operation previously which is also one of the risk factors in our study which can be compared with Ponka series (25%).

In our study 46 (56%) of patients developed incisional hernia within 1 year of previous surgery, 22 (26.8%) within 1-3 years and 14 (17%) after 3 years. In Akman's series more than 65% of the incisional hernias occurred within 1 year after previous surgery. None of the patients required perioperative blood transfusion.

7 patients required preoperative preparation in the form of controlling skin infection, diabetic control and COPD management.

In the present study, in open group 18 (35.3%) had defect size less than 2×2 cm, 19 (37.3%) had defect size less than 3×3 cm, 10 (19.6%) had defect size less than 4×4 cm, 4 (7.8%) had defect size less than 5×5 cm whereas in laparoscopy group 6 (19%) had defect size less than 2×2 cm, 10 (32.3%) had defect size less than 3×3 cm, 12 (38.7%) had defect size less than 4×4 cm, 3 (9.6%) had defect size less than 5×5 cm. In the study conducted by Mishra et al the mean defect size was 42.12 $cm^2$ in open group and 65.66 $cm^2$ in laparoscopy group.

The size of the defect does not hold the criteria for the selection of the procedure. Very small hernias less than 2-3 cm are better repaired by conventional methods without using a mesh. During an incisional hernia repair, effort should be made to cover the whole length of incision with the mesh. This helps in prevention of recurrence at a new site along the previous scar.

The present general recommendation is a minimum of 5 cm overlap from the fascial defect. The main reason for this is the probability of shrinkage of the mesh. In the present study we ensured a minimum of 5 cm covering in all our cases.

In the present study, open group 34 (66.7%) patients had omental adhesions while 14 (25.5%) had intestinal

adhesions. Both omental and intestinal adhesions were found in 3 (5.8%) patients, and in one case transverse mesocolon was seen as the adhesion. In laparoscopy group, 19 (61.3%) had omental adhesions while 10 (32.3%) had intestinal adhesions. Both were seen in 2 (6.5%) patients.

In the present study, in open group, most of the patients i.e. 37(45.1%) underwent sublay while 14 (17%) patients underwent onlay repair. 31 (37.8%) patients underwent laparoscopy surgery.

Initial laparoscopic incisional hernia repair series established a direct correlation between recurrence and the absence of transfascial sutures. But many authors argue that the earlier series did not consider many other factors which were potentially responsible for recurrences. The main disadvantages of transfascial sutures are longer surgery time, more incisions in the skin, poorer cosmetic rates, greater infection rates, pain during early post operative period and also chronic pain. With the advent of tacking devices, the titanium non absorbable spiral tacks and the recent vicryl absorbable tacks and the double crowning technique the concept of transfascial sutures came under lot of questions.

In a randomised study 3 methods of mesh fixation were studied for 4 years- absorbable transfacial sutures, non-absorbable transfacial sutures and double crown technique of tacker fixation concluded that none of the technique have pain reduction advantage over the others. Bansal, in a study concluded that suture fixation was much cost effective compared to tacker fixation and statistically less significant post operative pain.[11]

Blanc et al stated-use of transfascial sutures is a must for proper fixation of the prosthetic material and also most of the earlier studies emphasized the need for transfascial sutures.[4] In the recent times, studies are emerging with double crown technique using tacking devices which resulted in similar if not less recurrence rates. The main reason for this is the better understanding on the conditions responsible for recurrence like the area of coverage and the type of mesh.

Some surgeons believe that use of tacking devices is equally effective and also reduces operating time and probably less post operative discomfort. In the present study, we employed transfascial sutures in all the patients and sutures and tackers in 24 patients.

The operating time is one of the detrimental factors in the assessment of the effectiveness of the procedure. In the present study, the mean operating time was 92.65 mins in open group and 94.35 mins in laparoscopy group. the study conducted by Ramshaw and Asencio, reported lesser operating times in laparoscopy group.[5,12] In other studies by Mishra et al and Pring et al haven‘t shown any significant difference between the two procedures.[7,13] In the studies conducted by Olmi et al and Carbajo et al showed significant reduced time in laparoscopic surgery when compared to conventional surgery.[14,15]

In the present study 3 events of intra operative complications have occurred. Two enterotomy are reported in open group when compared to none in laparoscopy group. Carbajo et al in his RCT reported similar results.[15] Asencio et al and Barbaro et al reported one event of enterotomy each in the laparoscopy group when compared to none in open group.[12,16] The one intra operative complication that occurred in the laparoscopy group is the bleeding from the inferior epigastric artery, which was controlled by transfascial suture.

Laparoscopic surgery is generally associated with reduced pain. In 4 RCTs (Asencio et al, Barbaros et al, Misra et al, and Pring et al) all reported almost equal incidence of postoperative pain scores in both the groups.[7,12,13,16] In the present study, the mean duration of post operative pain in open group is 6.9 days, while in laparoscopy group is 2.35 days.

One of the main advantages of laparoscopic repair is the decreased wound related complications. Almost all the RCTs except Asencio reported decreased wound related complications with laparoscopic repair.[12] Amongst all, the most common complications are seroma formation and wound infection. Seroma rates are higher in laparoscopy group in the studies conducted by Asencio et al, Misra et al and Pring et al, while Itani et al reported lower seroma rates in laparoscopy group.[6,7,12,13] Wound infection rates are higher in open group in all the studies.

In the present study, the overall complication rate is 45.09% in open group when compared to 19.45 in laparoscopy group. The seroma rate is 41.1% in open group when compared to 6.4% in laparoscopy group. The wound infection rate in open group is 17.6% in open group when compared to 3.2% in laparoscopy group. Mesh infection is not observed in any of the cases in our study. Hence removal of the mesh was not warranted.

The other complications observed are persistent post operative ileus, which is seen in 4 cases each in open (7.8%) and laparoscopy (12.9%) and chronic pain (>3-6 months) is observed in 9.7% patients in open group when compared to 3.2% in laparoscopy group. In the study conducted by Heinford et al with 850 cases, postoperative ileus was reported in 3% of cases undergoing laparoscopic surgery.[17] In the meta-analysis conducted by Sains et al, there was no significant difference between laparoscopy and open groups with regard to post operative ileus.[18]

In the present study, the mean length of hospital stay was 15.17 days in open group compared to 4.64 days in laparoscopy group. In two RCTs conducted by Holzman et al and Ramshaw et al showed significant difference between the two groups and favoured laparoscopy, while most of the other studies didn’t show much difference between the two groups.[5,19]

In the present study, in open group, majority of the patients i.e. 28 (58.9%) patients took more than 20 days to return to their normal activity, while in laparoscopy group almost all the patients i.e. 29 (93.6%) took less than 20 days for the same. The mean duration for return to normal activity in open group is 29.7 days, and in laparoscopy group is 11.6 days.

***Limitations***

In cases where there is a huge defect or in patients who have lax abdominal wall, open procedure fares better over laparoscopy as the rectus can be repaired better using open technique. Additional procedures like abdominoplasty are also possible, which cannot be done in laparoscopy. Sublay technique of of open incisional hernia repair is the ideal technique of choice.

## CONCLUSION

The main etiological factors identified for the occurrence of incisional hernia were wound related complications, faulty techniques, comorbid conditions. Hence the incidence of the incisional hernia can be decreased by preventing these factors. Incidence of incisional hernia is more common in the age groups 30-50 years. Incidence of incisional hernia is more common in females especially in obese and multiparous women. Majority of incisional hernia occurred within first one year of previous operation. Incidence of incisional hernia is more common in midline infra umbilical incision. Laparoscopic repair of incisional hernia is showing promising results and is being widely practiced nowadays. Postoperative pain is less, lesser incidence of wound infection, seroma formation is less and hospital stay is shorter when compared to open repairs. Laparoscopy also directs visualization of the hernia defects which are not clinically apparent and there is a possibility to treat multiple hernias located in various quadrants of the abdomen through the same incision, which is not possible by open technique. In cases where there is a huge defect or in patients who have lax abdominal wall, open procedure fares better over laparoscopy as the rectus can be repaired better using open technique. Additional procedures like abdominoplasty are also possible, which cannot be done in laparoscopy. Sublay technique of open incisional hernia repair is the ideal technique of choice.

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## REFERENCES

1. Abrahams JI, Jonassen OT. The use of polyvinyl sponge in the repair of abdominal wall hernias. Surgery. 1957;42(2):336-41.
2. Adloff M, Arnaud JP. Surgical management of large incisional hernias by an intraperitoneal Mersilene mesh and an aponeurotic graft. Surg Gynecol Obstet. 1987;165(3):204-6.
3. Adler RH, Firme CN. Use of Pliable Synthetic Mesh in the Repair of Hernias and Tissue Defects. Surg Gynec Obstet. 1959;108:199.
4. LeBlanc KA, Booth WV. Laparoscopic repair of incisional abdominal hernias using expanded polytetrafluoroethylene: preliminary findings. Surg Laparosc Endosc. 1993;3(1):39-41.
5. Ramshaw B, Shuler FW, Jones HB, Duncan TD, White J, Wilson R, Lucas GW, Mason EM. Laparoscopic inguinal hernia repair: lessons learned after 1224 consecutive cases. Surg Endosc. 2001;15(1):50-4.
6. Itani KMF, Hur K, Kim LT, Anthony T, Berger DH, Reda D, Neumayer L. Veterans Affairs Ventral Incisional Hernia Investigators. Comparison of laparoscopic and open repair with mesh for the treatment of ventral incisional hernia: a randomized trial. Arch Surg. 2010;145(4):322-8.
7. Misra MC, Bansal VK, Kulkarni MP, Pawar DK. Comparison of laparoscopic and open repair of incisional and primary ventral hernia: results of a prospective randomized study. Surg Endosc. 2006;20(12):1839-45.
8. Parekh JN, Shah DB, Thakore AB. Incisional hernia-A study of 76 cases. Indian J Surg. 1988;50:49-53.
9. Goel TC, Dubey PC. Abdominal incisional hernia Anatomical technique of repair. Indian J Surg. 1981;43:324-7.
10. Bose SM, Lal R, Kalra M, Wig JD, Khanna SK. Ventral hernia: A review of 175 cases. Indian J Surg. 1999;61(3):180-4.
11. Bansal VK, Krishna A, Manek P, Kumar S, Prajapati O, Subramaniam R, et al. A prospective randomized comparison of testicular functions, sexual functions and quality of life following laparoscopic totally extra-peritoneal (TEP) and trans-abdominal pre-peritoneal (TAPP) inguinal hernia repairs. Surg Endosc. 2017;31(3):1478-86.
12. Asencio F, Aguiló J, Peiró S, Carbó J, Ferri R, Caro F, Ahmad M. Open randomized clinical trial of laparoscopic versus open incisional hernia repair. Surg Endosc. 2009;23(7):1441-8.
13. Pring CM, Tran V, Rourke NO, Martin IJ. Laparoscopic versus open ventral hernia repair: a randomized controlled trial. ANZ J Surg. 2008;78(10):903-6.
14. Olmi S, Magnone S, Erba L, Bertolini A, Croce E. Results of laparoscopic versus open abdominal and incisional hernia repair. JSLS. 2005;9(2):189-95.
15. Carbajo MA, Martín del Olmo JC, Blanco J. What is the appropriate mesh for laparoscopic intraperitoneal repair of abdominal wall hernia? Surg Endosc. 2000;14(4):408.
16. Barbaros U, Asoglu O, Seven R, Erbil Y, Dinccag A, Deveci U, Ozarmagan S, Mercan S. The comparison of laparoscopic and open ventral hernia repairs: a prospective randomized study. Hernia. 2007;11(1):51-6.

17. Heniford BT, Park A, Ramshaw BJ, Voeller G. Laparoscopic ventral and incisional hernia repair in 407 patients. J Am Coll Surg. 2000;190(6):645-50.
18. Sains PS, Tilney HS, Purkayastha S, Darzi AW, Athanasiou T, Tekkis PP, Heriot AG. Outcomes following laparoscopic versus open repair of incisional hernia. World J Surg. 2006;30(11):2056-64.
19. Holzman MD, Purut CM, Reintgen K, Eubanks S, Pappas TN. Laparoscopic ventral and incisional hernioplasty. Surg Endosc. 1997;11(1):32-5.

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