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Original Research Article

Modified retrorectus procedure for repair of midline incisional hernias

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ABSTRACT

Background: Incisional hernias develop after abdominal operations. Primary closure procedures carry high recurrence rates. Prosthetic repairs with different modifications have reduced the recurrence rates and are the procedures of choice for incisional hernia repair.
Methods: Our study is a prospective study conducted on 30 patients of midline incisional hernia. Hernia repair was done by modified retrorectus technique with in which the mesh is placed between the rectus abdominis muscle and the posterior rectus sheath.
Results: In our study, the hernia defect ranged from 25-40 cm^2.The mesh size used ranged from 15×15 to 30×20 cm. Mean duration of hospital stay was 9.9±2.3 days. Operative time ranged from 90-150 minutes. Follow up period ranged from 3-15 months. There were no post-operative complications in 73.3% cases. Seroma formation occurred in 10% cases and wound infection was seen in 10% cases. One patient developed mesh infection which required partial removal of mesh. There was no recurrence, no mortality, no bowel injury or adhesion obstruction. Wound related complications and morbidity was higher in patients with risk factors and comorbidities like diabetes, obesity, anaemia, COPD, hypoalbuminemia and patients on steroids.
Conclusions: The retrorectus technique for the repair of midline incisional hernia using polypropylene mesh is a safe and durable procedure with excellent long-term results, minimal comorbidities and least recurrence rates and is an open procedure of choice for the repair of large incisional hernias.

Keywords: Incisional hernia, Mesh reconstruction, Retrorectus procedure

INTRODUCTION

Incisional hernias develop after open abdominal operations. The incidence increases if the abdominal incision is complicated by postoperative wound infection.[1-3] The causes of incisional hernias can be difficult to determine but obesity, older age, primary wound healing defects, malnutrition, ascites, pregnancy, COPD, diabetes, prostatism, multiple prior procedures, prior incisional hernias, smoking, and technical errors during repair may all be contributory. Wounds closed under excessive tension are prone to fascial closure disturbance. Therefore a continuous closure is advocated to disperse the tension throughout the length of wound. Medications such as corticosteroids and chemotherapeutic drugs can also contribute to poor wound healing and increase the risk of developing an incisional hernia.[4-7] Emergency surgery and wound infection are important risk factors for incisional hernia.[4,8] Transverse incisions are associated with reduced risk of incisional hernias than midline laparotomies.[6,9]

The surgical management options include primary versus mesh repair and open versus laparoscopic repairs. Repair of a complex hernias by primary closure carries a

recurrence rate of more than 50% and autologous tension free repair using the various techniques of component separation have reported recurrence rates of about 10-30%.[3,10-18] Repairs that use permanent prosthesis onlay technique have reported recurrence of as high as 23% and laparoscopic approach with an intraperitoneal sublay have a reported recurrence of about as high as 11%.[3,19]

Mesh repair have become the gold standard in the management of incisional hernias. It is associated with low incidence of perioperative complications and lower rates of recurrence than open non-mesh repair. Mesh repair can be categorized according to the way in which mesh is placed as well as its relation to the abdominal wall fascia. Mesh can be placed as an underlay deep to the fascial defect- Intra-peritoneal or pre-peritoneal, as an interlay either bridging the gap between the defect edges or within the abdominal wall musculoaponeurotic layers (intra-parietal) or as an onlay (superficial to fascial defect).

The Rives Stoppa technique of hernia repair is a well described procedure in which the mesh is placed extra-peritoneally as a sublay wide overlapping coverage (>10cm) of the fascial defect to achieve a tension free closure; that also maximizes the surface area for tissue growth through the mesh.[20-22] The original description of Stoppas repair noted the mesh placement in the intraparietal (intramural) plane deep to the transversalis fascia and superficial to peritoneum.[23] A later modification of the original technique placed the mesh anterior to posterior rectus sheath and posterior to rectus abdominis muscle.[24] These techniques popularized by Stoppa and colleagues achieve three goals of hernioraphy.

- Extensive overlap between the mesh and the fascial edges allows tension free closure as well as large surface area for tissue incorporation,
- The mechanical strength of the synthetic prosthesis reinforces the abdominal wall,
- Placement of mesh adjacent to the vascular rich rectus muscle facilitates tissue incorporation, promotes resistance to mesh infection and allows interposition of autologous tissues between the mesh and the skin/subcutaneous tissues anteriorly and peritoneum posteriorly. This approach has recurrence rates of 1.1 to 2.8% in large incisional hernia.[25,26]

Laparoscopic repair use an intraperitoneal underlay technique. It was first described by Le-Blanc and Booth in 1993.Initially laparoscopic repairs were associated with high complication rates especially bowel injuries and adhesion obstruction. Because of the skill enhancement and with the availability of advanced prosthetic meshes, the recurrence rates and complication rates have decreased. However, long term randomised trials are required in this regard. It is less commonly used for the repair of large, cicatrical hernias with redundant skin and is considered to be less attractive cosmetically because of redundant skin in large hernias.

The major complications of hernia repair surgeries is recurrence. Rate of recurrence following primary non-mesh repair is as high as 50%.[11-15] Onlay techniques have reported a recurrence rate of 23% and laparoscopic intraperitoneal sublay techniques have a reported recurrence rate of about 11%.[3,27] Recurrence in mesh repair is usually due to the appearance of an additional unrecognized hernia site or an improperly placed mesh.

Seroma formation and wound infection is an important complication of the hernia repair. Infection of the mesh necessitates removal of the mesh and replacement by a non-synthetic biological mesh. Wound infection in open mesh repair is approximately 5%, several studies have shown the laparoscopic repair have low incidence of seroma formation, mesh infection and recurrence rate ranging from 0-11%. Large scale multicentric trials are currently underway to definitely evaluate the mesh and laparoscopic repair techniques and to formulate the best management for incisional hernia repair. Our study will be a part of this ongoing research and will definitely help in formulating the best treatment strategy for repair of incisional hernias.

Aims and objectives

The study is a prospective study to evaluate the outcome of the midline incisional hernia repair using modified retrorectus technique primarily in terms of surgical technique, complications and recurrence. The secondary objective is to assess operative duration, post-operative pain, hospital stay and cosmetic outcome.

METHODS

This study is a prospective study conducted in department of general surgery at Government Medical College, Srinagar on 30 patients of midline incisional hernia who presented to the out-patient department. The patients were operated by modified retrorectus technique, placing the mesh in a retro-muscular position. The study was conducted after getting the necessary approval from the ethics and scientific committees of the institution.

The study was conducted over a period of two years from from July 2010 to June 2012 on all the patients of midline incisional hernia who fulfilled the inclusion and exclusion criteris. Over all the study was conducted on 30 patients. No formal sample size calculation was done.

Inclusion criteria

All patients with midline incisional hernias who presented to the out-patient department were included in the study.

Exclusion criteria

Those patients who were unfit for general anaesthesia, pregnant ladies and females who had not completed their family were excluded.

The procedure and complications were explained to patients and patients were operated only after obtaining a proper valid and informed consent. The part was properly cleaned and draped. A midline elliptical incision was made, excising the previous scar back to healthy skin and exposing the hernia sac and its associated fascial defects. Careful examination of the fascia was carried out routinely to identify the multiple or other discrete defects.

Hernia sac was preserved whenever possible to provide another layer of autogeneous tissue interposed between intraperitoneal contents and posterior surface of mesh. The sac was opened only if it was adherent to the underlying bowel, all the adhesions were lysed, contents reduced and peritoneum closed back with absorbable sutures. The anterior rectus sheath was incised longitudinally bilaterally about 1 cm from its medial edge and a plane created between the posterior rectus sheath and rectus muscle or when below the arcuate line, between the fascia transversalis and rectus muscle. Dissection was carried out laterally for upto10cm, cranially upto the xiphoid and costal margins (in some cases) and caudally upto the symphysis pubis, providing at least 5-10 cms margin between the edge of the plane and hernia defect to minimize the risk of recurrence. The medial edge of the anterior sheaths were sutured together using non-absorbable sutures, thus creating a neo-linea alba and placing an autologous layer of tissues between the mesh and intraperitoneal contents. Prosthetic mesh was then placed in the space created behind the rectus muscle. Once the prosthesis was in appropriate position, its lateral edges were secured using non-absorbable sutures.

Minimal subcutaneous dissection was done anterior to the anterior rectus sheath. This maneuver would lead to a much larger subcutaneous space and further devascularize the skin/subcutaneous tissues lateral to the incision. Closure of the fascia overlying the mesh is recommended to protect the mesh from contamination if skin breakdown occurs. Tissues anterior to the mesh were approximated in the midline whenever possible to cover the anterior surface of the mesh. This step was omitted if the closure was thought to be under excessive tension. Two closed suction drains were kept in the subcutaneous tissues or just anterior to the mesh prior to the closure. Excessive skin and fat was excised to give good cosmetic result. Drains were removed once the drainage output decreased markedly. Clinically significant seromas were aspirated repeatedly in relevant cases.

Additional standard postoperative care like analgesia for pain management was given as and when required. DVT prophylaxis was given to high risk patients. Postoperatively deep breathing exercises and limb movements were advised as soon as the patients recovered from anaesthesia. Early limited ambulation was done once the patients were able to bear the pain. Sutures were removed mostly on 10th day and sometimes after 10th day, depending on the condition of the wound. Patients were discharged and kept on regular follow up. All patients were advised to avoid lifting heavy weights and were given abdominal belt/binder. Patients were reviewed after one week, two weeks and one month in all cases and few cases upto 15 months. Patients were reexamined to observe the wound healing process and detect haematoma, infection and recurrence. Telephonic interviews were conducted to assess long term results like abdominal wall pain, degree of satisfaction, recurrence and return to daily routine activities.

These cases were then analysed and results were compared with the existing literature. An extensive review of literature was carried out.

Outcome measures

The primary outcome measures were the 30 day perioperative morbidity and mortality rates, together with the overall recurrence rate. All perioperative complications were reported with particular attention towards wound infection, mesh infection, clinically important seroma or haematoma formation and recurrence. Secondary outcomes included the duration of hospital stay, post-operative pain, operative time and satisfaction with the results.

Statistical analysis

Data was described as mean±SD and percentages. The intergroup comparisons were done by Mann Whitney U test at 95% confidence interval. Statistical significance was defined as $p<0.05$. Software SPSS-19.0 was used for data analysis. MS Excel and MS Word was used for graphs, tables etc.

RESULTS

The age distribution of these 30 cases ranged from 42-72 years (mean=56.4±8.3 years) with a peak incidence in 51-60 years age group (43.3%, n=13) with a female preponderance (male=40%, n=12 and female 60%, n=18). Majority of the patients belonged to rural areas (rural 70%, n=21 and urban 30%, n=9). Mean age for males was 53.2±7.6 years with a peak incidence in the age group of 41-50 years (33.3%, n=4). Mean age for females was 58.6±8.2 years with a peak incidence in the age group of 51-60 years (50%, n=9). Table 1 and 2 summarizes the socio-demographic characteristics of the patients.

On examination, swelling was reducible in 28 patients (93.3%) and irreducible in 2 patients (6.66%). Two patients also had skin changes in the form of skin

ulceration. We had 6 patients (20%) with early onset incisional hernia (within one year of surgery) and 24 patients (80%) with late onset incisional hernia (after one year). Hernia size was 31.2±4.5 cm^2 (25, 40). Of all the 30 cases, 18 patients (60%) had a lower midline hernia, 11 patients (36%) had an upper midline hernia. One patient had multiple defects. One patient had already undergone a tissue repair in the past and was a case of recurrent hernia. The hernia defect ranged from 25 to 40 cm2 with a mean of 31.2±4.5. (Table 3). The mesh size in the study ranged from 15×15 cm to 30×20 cm.

Table 1: Socio-demographic characteristics of the studied subjects.

Socio-demographic characteristics		N	%
Age (year)	41 to 50	9	30.0
	51 to 60	13	3.3
	>60	8	6.7
	Total	30	100.0
	Mean±SD: 56.4±8.3 (42, 72)		
Gender	Male	12	40.0
	Female	18	60.0
Dwelling	Rural	21	70.0
	Urban	9	30.0
Occupation	Unskilled	10	33.3
	Semi-skilled	14	46.7
	Skilled	6	20.0

Table 2: Age and gender distribution of the studied subjects.

Age (yrs)	Male		Female		Total		P value
	N	%	N	%	n	%	
41 to 50	6	50	3	16.7	9	30	0.079
51 to 60	4	33.3	9	50	13	43.3	(NS)
>60	2	16.7	6	33.3	8	26.7	
Total	12	40	18	60	30	100	
Mean ±SD	53.2±7.6 (42, 67)		58.6±8.2 (43, 72)		56.4±8.3 (42, 72)		

Table 3: Hernia characteristics.

		N	%
Site of hernia	Infraumbilical	18	60.0
	Supraumbilical	11	36.7
	Multiple defects	1	3.3
On examination	Reducible	28	93.3
	Irreducible	2	6.6
	Skin changes (ulceration)	2	6.6
Time from surgery	Early onset	6	20
	Late onset	24	80
Size of hernia (sq cm)		31.2±4.5 (25, 40)	

In the study 16 patients (53.33%) developed hernia after gynaecological procedures of which 10 were LSCS and 6 were hysterectomies, 9 patients (30%) developed hernia after emergency surgery for peritonitis of which 6 were for perforated duodenal ulcer and 3 were for ileal perforation. One patient (3.3%) was operated for cancer of stomach in the past. Three patients (10%) had developed hernia after surgery for trauma. One patient was a case of recurrent incisional hernia (Table 4).

Table 4: Surgery which led to incisional hernia.

Nature of surgery		N	%
Gynaecological	LSCS	10	33.3
	Hysterectomy	6	20.0
	Total	16	53.3
Peritonitis	Duodenal ulcer	6	20.0
	Ileal perforation	3	10.0
	Total	9	30.0
Trauma		3	10.0
Cancer		1	3.3
Failed primary repair (recurrent hernia)		1	3.3

Table 5: Pre-operative risk factors/comorbidities.

	N	%
History of wound infection in postoperative period	10	33.3
Obesity (BMI >30)	9	30.o
Smoking	7	23.3
Anaemia (Hb <10.0 gm/dl)	6	20
Diabetes	3	10
Constipation	3	10
Hypertension	2	6.7
COPD	2	6.7
Chronic cough	2	6.7
Hypoalbuminemia	2	6.7
Corticosteroids	2	6.7
Grand multiparity	2	6.7
Anticancer drugs	1	3.3

In the study there were no post-operative complications in 73.3% cases (22 patients). Only 10% cases (n=3) had wound infection, out of which two patients healed by secondary intention and one patient required secondary suturing and 10% (n=3) patients had seroma formation in the post-operative period in hospital. Seromas were treated by repeated aspirations. One patient (3.3%) developed mesh infection which required partial removal of the mesh.

Diabetes, obesity, smoking and hypoalbuminemia were the important risk factors for wound infection. One patient with history of COPD developed post-operative respiratory distress and hypoxia which was managed conservatively (Table 6).

86.6% patients (n=26) experienced mild pain with a score of 0-3 on a visual analog scale in the post-operative period which was treated with Diclofenac (75 mg, intramuscular) as and when required. 13.3% (n=4) patients experienced moderate pain with a score of 4-7 on VAS which required opoid analgesics (injectable tramadol 50 mg). Only 2 patients (6.6%) complained of chronic pain, which was mild in nature and required occasional low dose analgesics. There was no requirement of intraoperative blood transfusions. Overall 93.33% cases were satisfied with the long term results. Overall morbidity was 26.7%. There was no recurrence, no bowel injury, no enterocutaneous fistulas, no adhesion obstruction, no DVT or pulmonary embolism and no mortality. Wound related complications like wound infection, seroma formation and mesh infection and overall morbidity was higher in patients with associated risk factors/comorbidities like old age, obesity, diabetes, anaemia, hypoalbuminemia, smoking and patients on steroid (high risk group; n=19) as compared to those patients without comorbidities (low risk group; n=11), as shown in Table 7.

Table 6: Post-operative complications.

		Post-op hospital period		After 1st week		After 2nd week		After 1 month	
		N	%	N	%	N	%	N	%
General health (normal)		30	100	30	100	30	100	30	100
Seroma formation		3	10	1	3.3	2	6.7	0	0
Wound infection		3	10	3	10	1	3.3	0	0
Mesh infection		1	3.3	0	0	0	0	0	0
Recurrence		0	0	0	0	0	0	0	0
Pain	Mild	26	86.7	3	10	2	6.7	0	0
	Moderate	4	13.3	0	0	0	0	0	0
	Absent	0	0	27	90	28	93.3	30	100
DVT/PE		0	0	0	0	0	0	0	0
Bowel injury		0	0	0	0	0	0	0	0
Adhesion obstruction		0	0	0	0	0	0	0	0
Enterocutaneous fistula		0	0	0	0	0	0	0	0
Respiratory complications		1	3.3	0	0	0	0	0	0

Table 7: Wound related complications and overall morbidity with respect to risk involvement.

	High		Low		P value
	N	%	N	%	
Seroma formation	3	15.8	0	0.0	0.172 (NS)
Wound infection	3	15.8	0	0.0	0.172 (NS)
Mesh infection	1	5.3	0	0.0	0.447 (NS)
Overall morbidity (30 days)	8	42.1	0	0.0	0.013 (Sig)

Table 8: Hospital stay (days) and operative time (minutes).

Variable	Values	
Hospital stay (days) (overall)	9.9±2.3 (7, 16)	
With comorbidities (n=16)	10.8±2.4 (7, 16)	P-value = 0.004 (sig)
Without comorbidities (n=14)	8.4±1.1 (7, 10)	
Operative time (min)	107.0±16.6 (90, 150)	

The hospital stay in the study ranged from 7-16 days (mean 9.9±2.3 days). The presence of risk factors like diabetes, obesity, hypoalbuminemia increased the hospital stay. In patients having comorbidities like obesity, diabetes, hypoalbunemia the hospital stay was 10.8±2.4 days. In patients without these comorbidities the hospital stay was 8.4±1.1 days. The difference was statistically significant with a p-value of 0.004. The operative time ranged from 90-150 minutes with a mean of 107±16.6 minutes and the follow up period ranged from 3-15 months with a mean of 9.6±3.6 months.

Table 9: Long term outcome and results.

Long term outcome	N	%
Cosmetic satisfaction	30	100
Overall satisfaction with the results	28	93.3
Overall morbidity (30 days)	8	26.7
Chronic pain	2	6.7
Any long term complaints	2	6.7
Mortality (related to the procedure)	0	0.0
Recurrence	0	0.0
Follow up period (in months)	9.6±3.6 (3, 15)	

Table 8 shows the hospital stay and operative time of the study. Table 9 summarises the long-term outcome and results of the study.

DISCUSSION

In the study, the age ranged from 42-72 years with a peak incidence in 51-60 years age group with a female preponderance (60%). In the study conducted by Rems et al the mean age was 64.4 years.[28] In the study conducted by Wheeler et al 56% patients were females.[29] Bhat et al reported the highest incidence in 5th decade in females and 6th decade in males.[30] In this study all patients presented with history of abdominal swelling of which 10 patients also presented with history of pain. Swelling was reducible in 93.3% cases (n=28) and irreducible in 6.6% cases (n=2). Bhat et al reported in their study that 94.73 patients presented with the complaints of abdominal swelling in the vicinity of the abdominal scar of which 10.52% were irreducible.[30] The study had 20% early onset and 80% late onset incisional hernias. In the study conducted by Bhat et al, they reported that the duration of presentation ranged from 4 months to 30 years with a mean of 7.08±7.53 years.[30]

In this study 16 cases (53.3%) followed gynaecological operations of which 10 were LSCS and 6 cases were following hysterectomy. Bhat et al reported that 68.4% cases followed after gynaecological surgeries.[30] Misra et al in their study reported that gynaecological operations accounted for 50% cases. 9 cases followed emergency surgery for peritonitis of which 6 were for duodenal ulcer perforation and three for ileal perforation.[31] One patient was a case of recurrent hernia and in one patient hernia repair was combined with abdominal hysterectomy for gynaecological indications.

The modified Rives and Stoppa procedure includes placing of the mesh in the retrorectus plane which has many advantages. This plane is highly vascular, hence it prevents infection and moreover any infection occuring in the subcutaneous plane does not affect the mesh, as the mesh is retromuscular in a deeper plane. Preparation of the posterior rectal fascia must be the last surgical step. Placement of two drains is important. In the post-operative period, careful observation is necessary to prevent incipient suppuration. Should this occur, skin sutures must be removed and proper wound care instituted.

In present study wound infection occurred in 10% cases (n=3) which is consistent with the other studies which reported a wound infection rate of 14.2% (Ferranti et al), 9.3% (Ohana et al) and 8% (Berry et al). [25,32,33] Paajamen et al reported a wound infection rate of 5%.[34] In our study mesh infection occurred in 3.3% cases. Similar mesh infection rates are reported in other studies like Corey et al reported a mesh infection rate of 3%, Bauer et al (3.5%) and Wheeler et al (4.4%). In this study seroma formation cccured in 10% cases.[29,35,36] Similar results are reported in other studies like Bauer et al reported seroma formation in 12.3% patients, Paajamen et al (9%), Iqbal et al reported seroma formation in 4% cases. Berry et al and Mehrabi et al reported seroma formation in 2% and 1.7% cases respectively.[26,32-34]

In this study overall morbidity was seen in 26.6% patients. Similar results were reported in other studies like Ferranti et al reported a morbidity rate of 20%, Ohana et al (28%) and Wheeler et al (26%).[25,29,32] Mehrabi et al reported a morbidity of 10.2%.[26] In the study respiratory complication occurred in one patient (3.3%) which is consistent with the study of Mehrabi et al who reported a respiratory complication rate ot 5.7%.[26] There was no DVT or pulmonary embolism in our patients, which is consistent with the findings of Flament et al who in year 2000 reported DVT with pulmonary embolism in 1% cases in their study.[37]

In the study chronic pain occurred in 6.6% cases which in consistent with the findings of Paajamen et al and Mehrabi et al who reported chronic pain in 4% and 6.3% cases respectively.[26,34] In the study hospital stay ranged from 7-16 days (mean 9.9 days) which is consistent with the studies of Mehrabi et al who reported a mean hospital stay of 7.5±1.7 days. Ohana et al reported a mean hospital stay of 5.7 days.[26,32] The hospital stay of patients with comorbidities like COPD, hypoalbuminemia, steroid use, diabetes and obesity was increased in our study. Similar findings were reported by Dunne et al, who reported that COPD and low preoperative serum albumin were independent predictors of wound infection and were the independent factors of increased hospital stay.[38] Post-operative wound infection, obesity, COPD, diabetes, grand multiparity seem to be significant risk factors for the development of incisional hernias. Vivodic et al in their study concluded that the recurrence rate was significantly influenced by the type of repair, obesity, hernia size, wound healing disorders and some chronic comorbidities.[39]

In the study the operative time ranged from 90-150 minutes (mean 106.96 min). Ohana et al reported a mean operative time of 190 minutes. In our study the hernia defect ranged from 25 to 40 cm^2 with a mean of 31.2±4.5.[32] Berry reported an average hernia defect of 31.4 cm^2. Misra et al, in their study reported a mean hernia size of 42.12 cm^2.[31,33] The size of the prosthesis in the study ranged from 15×15 cm to 30×20 cm. Bauer JJ et al in their study used prosthetic meshes ranging from 8×8 cm to 20×28 cm.[36] In a study conducted by Bhat et al, mesh size ranged from 15×7.5 cm to 30×20 cm. Misra et al reported a mean prosthesis size of 152.67 cm^2.[30,31]

The preperitoneal approach allows for even distribution of forces along the surface area of the mesh. This accounts for the strength of the repair and the decreased recurrence associated with it. The repair capitalizes on the physics of Pascal's principle of hydrostatics by using the forces that create the hernia defect to hold the mesh in

place. There was no recurrence in our study which is consistent with other studies like Bhat et al and Bauer et al who also reported no recurrences in their respective studies.[30,36] Ferranti et al, Paajamen et al, Mehrabi et al reported the recurrence rates of 2.8%, 5% and 1.1% respectively.[26,32,34] There was no 30 day post-operative mortality in our group which is consistent with other studies like Mehrabi et al (0% mortality).[26] In present study 93.33% cases were satisfied with the results of the surgery. In the study conducted by Paajamen et al, they reported that all of their patients were satisfied with the results and were having excellent quality of life.[34] With this technique, the retromuscular position of the prosthesis assures that it will not be in direct contact with the abdominal viscera.

Theoretically, this should decrease the risk of complications that can arise from adhesion of the mesh to viscera, such as bowel obstruction and fistula formation. It also minimizes the problems that occur as a result of placement of mesh in subcutaneous plane such as seroma amd wound infection. In addition the Rives Stoppa repair makes use of the intraabdominal pressure to hold the prosthetic material in place against the rectus muscle and it provides a large surface area for incorporation of tissue into the prosthesis. Furthermore, placement of mesh adjacent to highly vascular rectus muscle may also minimize the infection. Care to remain outside the peritoneum and to avoid injury to the bowel is believed to be important in minimizing infection.

The relatively low morbidity, zero mortality and minimal post-operative complications demonstrate that this procedure can be done safely. In addition to zero recurrence over a mean follow up of 9.6±3.6 months and minimal long term complications signifies that this procedure has excellent long term durability. In view of less number of postoperative complications noticed in the present study with no recurrence and excellent long-term results with minimal morbidity and comparing with other types of mesh repair techniques (in literature), the modified retro rectus Rives Stoppa mesh repair is the effective and preferable treatment for midline incisional hernias.

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