Original Research Article

Polypropylene Mesh for Recurrent Incisional Hernia: Different Operative Techniques

ABSTRACT

Aims : To locate the plane of mesh insertion whether it is onlay ,inlay,sublay,or underlay

Design :Prospective study

Place and duration :Done at Benisweif and Al hayat hospitals between May 2011 till May 2012 with follow till May 2014.

Methodology :Twenty two patients, six were males sixteen were females with recurrent incisional hernias were included in the study with a mean age ± SD of 44 years ±11.87, there were 14 patients presented after the first recurrence(group1,2), 7 patients after the second recurrence(group3,4) and only one for the third recurrence. There were no significant difference between patients presented by 1st and 2nd recurrence concerning the age, sex and level of hernia. To all patients a polypropylene mesh was applied, 12 onlay, 2 inlay, 5 sublay and 3 underlay.

Results :There were two serosal lesions and only one perforation. There were 4(18%) patients with seroma, 1 (4.5%) with haematoma, 4 (18%) with infection, 3 (13.6%) with DVT, 1 (4.5%) with non falal PE, and 1 (4.5%) respiratory failure. The highest incidence of complications were in the onlay repair, the lowest in the underlay repair. The patients were followed for two year, there were 6 recurrence (27.2%), most of them were in the onlay repair with the highest incidence in the inlay repair. The incidence of recurrence in the onlay to inlay was statistically non significant (P<0.5), the onlay to the sublay was significant (P<0.05) and the onlay to the underlay was highly significant (P<0.02).

Conclusion: It is to be concluded that when a patient with recurrent incisional hernia is in need for repair, it is better to avoid inlay technique ,not to do the underlay and the onlay techniques , and recommended to do the sublay approach .

Key words: Incisional hernia – recurrent repair.

INTRODUCTION

Recurrent incisional hernia remain a major problem for the general surgeon. The high incidence of recurrence rate of incisional hernias after primary closure by tissue approximation led to the development of free procedures using prosthetic materials (1). Incisional hernias develop in 2-19 percent of patients after abdominal surgery (2). After primary repair, until recently the methodol choice, recurrence occurs in up to 48 percent (3).

Recurrence rates after hernia repair much higher and have been reported as 30-50 percent using only primary closure. This could be due to reincision and reapproximation of a vascular scar tissue (4). Almost half of the defects appear more than 12 months. Buttonholing of the rectus sheath by a sawing motion on the continuous nonabsorbable suture maybe responsible for this later herniation. The recurrence rate after primary repair was 25% (5) and after a second repair was 42% (5). For repair of incisional hernias in which sutures are used, the edges of the defect are brought together, which may lead to excessive tension and subsequent wound dehiscence or incisional herniation as a result of tissue ischemia and the cutting of sutures through the tissue. With posthetic mesh, defects of any size can be repaired without tension. In addition polypropelene mesh by inducing an inflammatory response, sets up a scarfolding that, in turn, induces the synthesis of collagen (6). The mesh can be, onlay after primary closure, onlay mesh placement only, inlay mesh placement, retrorectus mesh placement. Combination such as onlay and either retrorectus or peritoneal. It can be applied as a cuff on each side of the defect. With the advent of prosthetic meshes being used for incisional hernias the recurrence rate has dropped to approximately 10%. More recently with the development mesh that is now safe to place intraperitoneally, the recurrence rate has dropped to under 5% (7). Annually approximately 100.000 patients undergo a laparotomy in the Netherlands. About 15,000 of these patients will develop an incisional hernia. Both open and laparoscopic surgical repair have been proven to be safe. However, the most effective treatment of incisional hernias remains unclear. This study, the 'INCH-trial', comparing cost-effectiveness of open and laparoscopic incisional hernia repair, is therefore needed.(8)

PATIENTS

22 patients were included in the study, 6 were males and 16 were females at Banisweif and Alhayat hospitals between May 2011 till May 2014 . Their ages ranged from 21 to 62 years with a mean age ± standard deviation of 44 years ± 11.87. Included in the study 14 patients with the first recurrence, 7 patients with the second recurrence and only one patient recurrent for the third time. The patients were classified into five groups (table 1). The first group, recurrence after primary repair, two were males, four females. Their ages ranged from 21 years to 62 years with a mean ± SD of 45.8 years ± 13.92. the second group included eight patients with the first recurrence after mesh repair three were males, five were females. their ages ranged from 24 years to 58 years with a mean ± 3D of 42.6 years ± 9.61. The third group included five patients with the second recurrence, the first repair was primary repair the

second was mesh. Their ages ranged from 28 years to 52 years with a mean ± SD of 47.4 years ± 10.57. the fourth group included two female patients with the second recurrence after two mesh repairs with the fifth group included only one female patient, her age was 44 years with a third recurrence after primary repair, mesh, then mesh repair. Regarding to site of the hernia each group was classified into two sub groups 1st above the umbilicus the 2nd below the umbilicus (table 1). The first group two above and four below the umbilicus. Group two, three above and five below the umbilicus. Group three, two above and three below the umbilicus. Group four, one above and the other below the umbilicus like the patient in group five.

METHODS

All patients received anti-thrombotic propylaxis in the form of compression stockings, subcutaneous LMWH. All patients were performed under general anesthesia (9). At induction of anesthesia all patients received antibiotic prophylaxis. Using standard sterile surgical procedures the skin was prepared with providone-iodine solution. The cutaneous scar was excised and the hernia sac dissected to expose the circumference of the abdominal wall defect, this entailed removal of the old repair materials as we could, most of the mesh and sutures. The fascial margins of the incisional hernia were identified and the peritoneal cavity was explored to dissect any loops of intestine adherent to the parietal peritoneum near the fascial margins to avoid injury to the bowel during reconstruction (4). At this point tension on the wound was assessed and if a tension free repair could be could be performed the wound was closed primarily with prolene sutures with an onlay polypropylene mesh reinforcement sutured to the anterior rectus sheath after the fascial defect has been closed primarily (primary repair + onlay technique). If there was tension in closing the abdomen, we applied the polypropylene mesh on the defect direct without primarily closing the fascial defect (onlay technique only), this after adjusting the sac and closing it in order not to place the mesh direct to the bowel. (7) When good fascial or muscular edge was identified all around the hernia defect, the polypropylene mesh was circumferentially sewn to the fascial edge with interrupted or continuous prolene sutures (inlay mesh repair) (6). When we were confronted with too much scaring weakening the anterior abdominal wall without good edge, the new mesh was applied posterior to the rectus muscle, (sublay) (7). With marked scaring associated with marked weakness and loss of the anterior abdominal wall a bilayer prosthesis was applied interperitoneally(underlay) (10).

STATISTICAL ANALYSIS

The data obtained were statistically analyzed using chi-square test to compare the distribution of a categorical variable in a sample with the distribution of the same categorical variable in other sample. T-test used to find the standard error of the difference between two means and testing the

size of the difference by this standard error to find out the degree of probability .Chi – square used to compare the distribution of a categorical variable and from the standardized table the degree of probability is obtained (11).

RESULTS

Twenty two patients, six were males sixteen were females with recurrent incisional hernias were included in the study with a mean age ± SD of 44 years ±11.87, there were 14 patients presented after the first recurrence(group1,2), 7 patients after the second recurrence(group3,4) and only one for the third recurrence. Among 22 patients enrolled in the study, 6 had first recurrence after primary repair, 8 had first recurrence after mesh repair, 5 had second recurrence after primary then mesh repair, two had second recurrence after mesh, then mesh repair and only one had third recurrence after primary repair then mesh twice. Comparison between group one and two showed non significant age difference ($P>0.5$), while comparing the sex, it was highly significant ($P<0.001$), also on comparing the level of the hernia recurrence whether it was above or below the umbilicus, it was highly significant ($P<0.001$).

There was a statistically non significant difference in age between group two and group three , also there was a non significant difference in the sex, while there was statistically highly significant difference ($P<0.001$) when comparing the difference in the level of hernia recurrence group two and three.

. There was no statistically significant difference in the age distribution, also there was no statistically significant difference in the sex in both the first and second recurrence, we got the same on comparing the level of the hernia.

During adhenolysis there were two cases with serosal tears (9%), only one case with perforation (4.5%) which was in need to close the perforation only and we did not encounter any post operative complications regarding any form of entero cutaneous fistulization or any form of intestinal leak.

The six patients of the 1st group were 1st recurrence after primary repair, repaired through primary closure then application of the mesh anterior to the repair with at least 10cm of mesh lateral to the primary closure. There were 8 patients in the second group with previous mesh repair for the 1st recurrence, four of them repaired with primary repair then onlay mesh reinforcement, two of them with onlay mesh alone as the defect could not be closed primary and the remaining two with inlay mesh incorporated well with the edge of the defect. The five patients in the third group with the second recurrence after primary then mesh repair were treated by sublay mesh, two applied on the posterior rectus sheath above the umbilicus, the other three were applied in the pre-peritoneal space below the umbilicus, then in all the five patients the defect were closed in front of the mesh. The three patients in the fourth and fifth groups were treated by application of a bilayer mesh with the non adhesive surface of the mesh facing against the abdominal contents

and the tissue in growth side of the mesh against the fascial side of the abdominal wall.

Regarding the post operative complications there were 4 patients (18%) represented with seroma all were on the onlay mesh group, three of them responded well to the repeated aspiration, only one was in need for insertion of a vacuum for three weeks. One patient presented with haematoma and was treated by aspiration, and no more was needed, it was on the onlay group. Four patient presented by wound infections, three in the onlay and the other on the inlay group.

There were three cases with DVT, one in the underlay group and two were in the sublay group. Non fatal pulmonary embolous reported in the sublay group. Only one patients presented with respiratory failure in the inlay group and was on need for ventilation for two days. There was no reported any from of enterocutaneous fistula, also there was no mortality reported in the study.

Follow up was done for 24 months, , six cases of recurrence were reported in the study. Three cases were in the onlay group, one was reported to have a haematoma the other two in the infection group. The other three cases of recurrence one in the sublay and one in the inlay group the last in the sublay group .

Table 1 Classification according to recurrence and old repair

GP	REC.	OLD REPAIR	AGE	NO.	♂	♀	ABOVE	BELOW	OPERATIVE TECHNIQUES
1st	1st	Primary	45.8±13.29	6	2	4	2	4	6 primary plus onlay
2nd	1st	Mesh	42.6±9.61	8	3	5	3	5	4 primary plus onlay 2 onlay only 2 inlay
3rd	2nd	Primary-Mesh	47.4 ±10.51	5	1	4	2	3	5 sublay
4th	2nd	Mesh-Mesh	60 ± 2	2	0	2	1	1	2 bilayer-underlay
5th	3rd	Pri-Mesh-Mesh	4.4	1	0	1	0	1	1 bilayer-underlay

Table 2 Comparison between group 1, 2

VARIABLE	1ST GROUP	2ND GROUP	STATISTICS
Age	45.8 ± 13.92	42.6 ± 9.61	+=0.5113 P>0.5 N.S
Sex	2♂ 4♀	3♂ 5♀	x^2=12.725 S P<0.001 H.S
Level	2↑ 4↓	3↑ 5↓	x^2=12.725 P<0.001 H.S

Table 3 Comparison between group 2,3

VARIABLE	2nd GROUP	3rd GROUP	STATISTICS
Age	42.6 ± 9.61	47.4 ± 10.57	+=0.3802 P>0.5 NS
Sex	3♂ 5♀	1♂ 4♀	x^2=0.859 P<0.5 NS
Level	3↑ 5↓	2↑ 3↓	x^2=13.773 P<0.001 HS

Table 4 Grouping according to recurrence

RECURRENCE	NO.	MEAN AGE	SD	♂	♀	↑	↓
1st recurrence (group 1,2)	14	44	11.76	5	9	5	9
2nd recurrence (group 3,4)	7	51	10.65	1	6	3	4

Table 5 Comparison between 1st and 2nd recurrence

VARIABLE	1ST RECURRENCE	2ND RECURRENCE	STATISTICS
Age	44 ± 11.76	51 ± 10.65	+=1.3240 P<0.5 NS
Sex	5♂ 9♀	1♂ 6♀	x^2=1.05 P<0.5 NS
Level	↑5 ↓9	↑3 ↓4	x^2=0.0814 P>0.5 NS

Table 6 Operative techniques

REPAIR	NO.	%
Primary + onlay	10	45.4%
Onlay	2	9%
Inlay	2	9%
Sublay	5	22.7%
Underlay	3	13.6%

Table 7 Pre andpost-operative complications

COMPLICATION	NUMBER

Serosal lesion	**2(9%)**
Perforation	**1(4.5%)**
Seroma	4 (18%)
Haematoma	1 (4.5%)
Infection	4 (18%)
DVT	3 (13.6%)
Non-fatal pulmonary embolus	1 (4.5%)
Respiratory failure	1 (4.5%)
Entero-cutaneous fistula	0 (0%)

224
225
226 **Table 8 Complication in each techniques**

TECHNIQUE	NO.	SEROMA	HAEMATOMA	INFECTION	DVT	P.E.	RF
Onlay	12	4	1	3	-	-	-
Inlay	2	-	-	1	-	-	1
Sublay	5	-	-	-	2	1	-
Underlay	3	-	-	-	1	-	-

227
228 **Table 9 Recurrence rate**

TECHNIQUE	NO.	RECURRENCE
Onlay	12	3 (25%)
Inlay	2	1 (50%)
Sublay	5	1 (20%)
Underlay	3	1 (33%)
Total	**22**	**6 (27.2%)**

229
230
231
232
233

DISCUSSION

Incisional hernia is the most frequent surgical complication after laparotomy. Up to 30% of all patients undergoing laparotomy develop an incisional hernia.(12)Recurrent incisional hernias are common, encountered by surgeons, many predisposing factors are patient-related, some factors such as type of primary closure and materials used may reduce the overall incidence of recurrence. With the advent of prosthetic meshes the recurrence rate has dropped. More recently, with the development of prosthetic mesh that is now safe to place intraperitoneally, the recurrence rate has dropped to under 5%. The current controversies for incisional hernia repair are, which approach to use and what type of fixation is necessary to stabilize the position of the mesh while tissue in growth occurs. During the next decade the answers to these controversies should be available in the surgical literature. There was non significant difference in the mean age between first, second and third group of patients, also there was non significant difference in the age between the first recurrence and the second recurrence. The mean age was 44 years $\pm$ 11.87, it was 49 years $\pm$ 11 in the work of Heartsill et al.,(13) while it was higher in the study of Machairas et al.,(1) as it was 68.2 years. Regarding the sex there were no significant difference between all groups except between group one and two ($P<0.001$).

The level of hernia recurrence deserve attention, as we know that the strength of the abdominal wall is not the same above and below the umbilicus, in the current study there were more recorded cases of recurrence below the umbilicus. There were highly significant difference ($P<0.001$) between group one and two, also the same between two and three.

On the other hand the same significance was not encountered between 1st and 2nd recurrence.

Among the patients included in the current study, there were sixteen patients treated before through mesh repair, this is in contrast for the work of Read et al.,(5) who had 41(out of 51) recurrence after primary repair and 10 recurrence after previous mesh repair, while in the work of Clark(14) there were four recurrence after primary repair and three after mesh repair in

his series for mesh repair for recurrent incisional hernia, also in the work of Machairas(1) there were 21 after primary repair and 3 after mesh repair. We can see that in our area the use of mesh repair is more common than the use of primary repair this is due to the fear of more recurrences.

Adhenolysis done in most of the cases easily, only in two cases (9%) there were serosal lesions and in one (4.5%) there was perforation which necessitates closure, these goes hand in hand with that of Vrijland et al(15) who reported 5% serosal lesions and 2% bowel perforation. In the study 12 onlay mesh were applied, 10 after primary repair and 2 onlay direct,2 inlay, 5 sublay, and 3 were intraperitoneal (underlay) and these were applied according to the circumstances at the time of the operation, this was in accordance with De Varies et al (16) who inserted 13 as onlay, 23 as inlay and 17 as underlay.

Regarding the post operative complication there were 4 (8%) seroma, all were in the onlay group and this is attributed to extensive dissection laterally to insert the mesh anterior to the sheath, it was only 2% in the work of Molloy et al (17), 6% by Lewis (19) but no seroma was reported by Matapurkar et al (19) because their mesh was incorporated into a peritoneal sandwich while Machairas (1) reported 14% incidence of seroma.

There were 4 cases (18%) of infection ranging from superficial wound infection to deep infection, responded to drainage, dressing and parentral antibiotics, in non of them we were in need to disturb the mesh by any mean, also the same was reported by Morris et al., (20) and Liakakos et al.,(4). There was one case of haematoms (4.5%), it was in the onlay group and responded to repeated aspirations, it was less than 1% in the work done by Vrigland et al (15).

In the study there were three cases of DVT (13.6%) non of them were in the onlay group, there were two in the sublay, one complicated by non fatal PE and one in the underlay group, the same was reported by Khaira et al (21). There was one case of respiratory failure who was in need to assisted ventilation mostly due to tight repair restricting respiratory muscles, the same was reported by Liakakos et al (4).

Attempts was made to determine the reasons for recurrence in all patients who underwent mesh repair before, regardless of treatment assignment. Possible explanations were that the mesh was attached with 2cm or less overlap, interrupted sutures were placed 2cm apart, and that the repair was inadequate .

In the current study there were 6 recurrences (27.2%), Liakakos et al (4) reported an incidence of 8% recurrence after mesh for recurrent incisional hernia, while clark (14) reported five of thirteen (38%) of mesh repairs for recurrent incisional hernia.

Out of the three cases of recurrence in the onlay group, two patients had wound infection, the patient who presented by recurrence in the inlay group also had wound infection, the same reported by Heartsill et al (13) who had 60% recurrence in patients with infection.

Patients with PE had a significant recurrence rate as the patient in the sublay group who had PE had the only recurrence in that group, this was also reported by Heartsill et al (13) who had 50% recurrence in patients with PE.

Concerning the time of recurrence, the six recurrences were detected by the end of the first year, this is goes hand in hand with that of Read and Yoder(5) who stated that a little more than half of incisional hernial defects can be identified within 12 months and recurrent incisional herniation appeared sooner than primary. In the current study, the suture material used was prolene and it was suggested that this non absorbable sutures (22) cause a sawing motion leading to button holes, however Ellis et al.(23) reported delayed herniation after procedures with both kinds of sutures. The onlay technique was associated with the highest rate of complications and a high rate of recurrence,while the inlay group got the highest rate of recurrence, sublay group had the least recurrence and least com plications also. . During operations, there was less blood loss and less need for a wound drain in the laparoscopic repair. However, operative time was longer during laparoscopy. Perioperative complications were significantly higher in the laparoscopic group. Visual analog scores for pain and nausea did not differ between groups. The incidence of a recurrence was similar in both groups. The size of the defect was found to be an independent factor for recurrence of an incisional hernia. (12) Elective incisional hernia repair were beset with high rates of readmission and reoperation for recurrence. Readmission and reoperation for recurrence were most pronounced after open repair and repair for hernia defects up to 20 cm. Additionally, sublay mesh position reduced the risk of reoperation for recurrence after open repairs(24) It is to be concluded that when a patient with recurrent incisional hernia is in need for repair, it is better to avoid inlay technique ,not to do the underlay and the onlay techniques , and recommended to do the sublay approach .

REFERENCES

1. Machaires A, Misiakos EP, Liakakos T and Karatzas G.: Incisional hernioplasty with extraperitoneal onlay. Am Surg, 70 (8): 726-729, 2004.
2. Israelsson LA and Jonsson T.: Suture length to wound length ratio. Br J Surg, 80: 1284-1288, 1993.
3. Hesselink VJ, Luijendijk RW, de Wilt JH and Jeekel J.: An evaluation of risk factor in incisional hernia recurrence. Surg Gy ob, 178: 278-234, 1993.
4. Liakakos T, Karanikas I, Panagiotidis H and Dendrinos S.: Use of Markex mesh in the repair of recurrent incisional hernia. Br J Surg, 81:248-249, 1994.
5. Read RC and Yoder G.: Recent trends in the management of incisional herniation. Arch Surg, 124:485-488, 1989.
6. Luigendijk RW, Hop WC, Van den tol P et al.: A comparison of suture repair with mesh repair for incisional hernia. N Engl J Med, 8:343-392, 2000.
7. Millikan KW.: Incisional hernia repair. Surg Clin N Am, 83:1223-1234, 2003.
8. Poelman M[1], Apers J, van den Brand H, Cense H, Consten E, Deelder J, Dwars B, van Geloven N, de Lange E, Lange J, Simmermacher R, Simons M,Sonneveld E, Schreurs H, Bonjer J. **The INCH-Trial: a multicentre randomized controlled trial comparing the efficacy of conventional open surgery and laparoscopic surgery for incisional hernia repair**BMC Surg. 2013 Jun 7;13:18. doi: 10.1186/1471-2482-13-18.
9. Anthony T, Bergen PC, Kiln LT et al.: Factors affecting recurrence following incisional herniorrhapy. World J surg, 24:95-101, 2000.
10. Chrysos E, Athanasakis E, Saridakiz et al.: Surgical repair of incisional ventral hernia. Am surg, 66:679-682, 2000.
11. Swinscow TDV and Campell MJ.: Statistics at square one. BMJ Publishing group, Plymouth, Latimer Trenda Company Ltd. Pp-1-138 thed, 1996.
12Eker HH[1], Hansson BM, Buunen M, Janssen IM, Pierik RE, Hop WC, Bonjer HJ, Jeekel J, Lange JF. **Laparoscopic vs. open incisional hernia repair: a randomized clinical trial.** 2013 Mar;148(3):259-63. doi 10.1001/jamasurg.2013.1466.
13.Heartsill L, Richards ML, Arfain et al.: Open rivers – stoppa ventral hernia repair. Hernia. 2005
[Epub ahead of print].
14. Clark JL.: Ventral incisional hernia recurrence. J Surg Res, 99 (1): 33-39, 2001.
15. Vrijland J, Jeekel E, Styerberg W et al.: Mesh repair of incisional hernia. Br J Surg, 87: 348-352, 2000.
16. De Vries Reilingh TS, Van Geldere, Langenhorst B et al.: Repair of large midline incisional hernias with polypro-pylene mesh. Hernia 8 (1): 56-59, 2004.
17. Molloy RG, Moran KT, Waldron R et al.: Massive incisional hernias, Br J surg 78: 242-244, 1991.
18. Lewis RT.: Knitted polypropylene (marlex) mesh in the repair of incisional hernias. Can J surg, 27:155-157, 1984.
19. Matapurkar BG, Gupta AK and Agarwal AK.: A new technique of “Marlex-Peritoneal Sandwich” in the repair of large incisional hernias. World J Surg, 15:768-770, 1991.
201. Morris GJ and Hughes LE.: The outcome of non absorbable mesh placed within the abdominal cavity. J Am Coll surg, 186:352-357, 1998.
21. Khaira HS, Lall P, Hunter 13 and Brown JH.: Repair of incisional hernias. JR Coll Surg Ed, 46:39-43, 2001.
22. Krukowski ZH and Matheson NA.: Button hole incisional hernia: when do they occur. Br J surg, 70:290-291, 1988.
23. Ellis H, Gagragh and George CD.: Incisional hernia: When do they occur. Br J Surg, 70:290-291, 1988
24 . H Frederik ,R Jacob KHenrik , J Lars and B Thue .: Nationwide Prospective Study of Outcomes after Elective Incisional Hernia Repair Presented at a poster session at the 5th Annual European Hernia Society/American Hernia Society Joint Hernia Congress, 2012 World Hernia Congress, New York, March 2012.Received: June 26, 2012; Received in revised form: October 25, 2012; Accepted: October 25, 2012; Published Online: December 10, 2012DOI: http://dx.doi.org/10.1016/j.jamcollsurg.2012.10.013