

A PROSPECTIVE RANDOMIZED STUDY OF SUBFASCIAL VERSUS PREFASCIAL POLYPROPYLENE MESH REINFORCEMENT OF MIDLINE WOUND CLOSURE AFTER VERTICAL BANDED GASTROPLASTY IN MORBID OBESE PATIENTS.

By

Gamal I. Moussa, M. D.; Sherif A. Mostafa, M.D. ; Mahmoud M. AbdulRazek, M.D.

Department of General Surgery, Faculty of Medicine, Tanta University.

Background :Incisional hernia is a common problem following a midline vertical incision in all patients undergoing open bariatric procedures.

Patients and methods: The present study was conducted on 30 morbid obese patients who underwent vertical banded gastroplasty (VBG) operation through upper midline incision. The patients were randomly divided into three groups. Group I: Patients for whom the midline abdominal incisions were reinforced by subfascial preperitoneal polypropylene mesh before closure of the linea alba. Group II: The midline abdominal incisions were reinforced by prefascial subcutaneous polypropylene mesh after closure of the linea alba. Group III: The linea alba was closed en-mass with continuous polypropylene No 1 sutures (standard closure).

Results: The mean age was 30.4 years. Twenty-four patients were females (80%) and six were males (20%). The mean body mass index was 45.4kg/m². The commonest associated medical conditions were, osteoarthritis detected in 18 patients (60 %), hypertension in 17 patients (56.7%), type II diabetes mellitus in 15 patients (50%). Most of the patients presented with more than one associated medical condition as, osteoarthritis & hypertension. The mean time of incision closure was 36 minutes in group I, 31 minutes in group II and 15.4minutes in group III. Early postoperative wound complications were, superficial wound infection in one patient of group I(10%), in 3 patients of group II(30%) and in one patient of group III(10%) . Partial wound disruption in 2 patients of group II(20 %) and in one patient of group III(10%). Subcutaneous seroma in one patient of group I(10%), 3 patients of group II(30%) and one patient of group III (10%). During the period of follow up (mean of 22 months), chronic pain at the scar site was reported in 2 patients of group I(20%), 3 patients of group II(30%) and one patient of group III(10%). Incisional hernia reported in 3 patients of group III(30%).

Conclusion: The subfascial placement of the mesh has many advantages over prefascial position, as, the possibility of bowel obstruction or fistula formation is not present, likewise, the risks of seroma and wound infection were minimized. The subfascial technique also does not initiate adhesions between the subcutaneous tissue and rectus sheath with subsequent difficult dissection during late dermolipectomy if needed. Subfascial placement of the mesh is a very simple technique and is recommended as an ideal method for closure of the midline abdominal incisions in morbid obese patients.

Key words: Prefascial, subfascial, mesh, mid-line.

INTRODUCTION

Obesity is becoming an epidemic in the United States and its prevalence continues to rise in many industrialized and developed countries. It is estimated that there are more than 500 million overweight and 250 million obese adults

in the world⁽¹⁾ . The most widely used abdominal incision for bariatric surgery is vertical midline incision, as most surgeons preferred it where it provides wide and rapid access as well as it is easy for opening and closure. Vertical banded gastroplasty represent 20% of the operations

performed for surgical treatment of morbid obesity^(2,3).

The incidence of incisional hernia in obese patients ranged between 18% to 45%. In spite of the presence of other factors which increase the incidence of incisional hernia in obese patients as, increased intra-abdominal pressure, diabetes mellitus, wound infection, anemia, postoperative chest infection and postoperative vomiting, the only factor that significantly influences the incidence of incisional hernia in morbidly obese patients is body mass index^(4,5). The incidence of incisional hernia increases from 13% in patient with a body mass index less than 35 kg/ m² to 39% in those with body mass index more than 35 kg/ m² ⁽⁶⁾. Morbid obesity is associated with a three- fold increase in the incidence of postoperative herniation ⁽⁷⁾.

There are many factors involved in postoperative development of incisional hernia in obese patients as, cutting through large masses of fat, increased retraction needed during the operation, rise the infection rate in these patients and the tissue infiltrated with fat which is not able to hold the sutures ⁽⁸⁾.

Experimental studies demonstrated that increased intra-abdominal pressure (IAP) leading to increases in pleural pressure, cardiac filling pressures, femoral venous pressure, renal venous pressure, systemic blood pressure, vascular resistance, rennin and aldosterone levels and intracranial pressure. Thus, the co-morbidities presumed secondary to increased IAP in obese patients include congestive heart failure, hypoventilation, venous stasis ulcers, gastroesophageal reflux, urinary stress incontinence, incisional hernia, pseudo-tumor cerebri, proteinuria and systemic hypertension⁽⁹⁾.

PATIENTS AND METHODS

The present study was conducted on 30 morbid obese patients underwent vertical banded gastroplasty operation through upper midline incision, admitted to Gastrointestinal and Laparoscopic Surgery Unit, General Surgery Department, Tanta University Hospital.

The patients were randomly divided into three groups. Group I (10 patients): Patients for whom the midline abdominal incisions were reinforced by subfascial preperitoneal polypropylene mesh before closure of the linea alba. Group II (10 patients): Patients for whom the midline abdominal incisions were reinforced by prefascial subcutaneous polypropylene mesh after closure of the linea alba. Group III (10 patients): Patients for whom the linea alba was closed en-mass by continuous polypropylene No. 1 sutures (standard closure).

All patients were subjected preoperatively to, full history taking, thorough clinical examination,

psychological evaluation, body mass index measurement, routine laboratory investigations (including liver, renal functions and blood sugar) abdominal ultrasonography, plain chest X-ray and respiratory function tests.

The operative technique:

Each incision was performed in a standard fashion midline incision through skin, subcutaneous tissue and linea alba from the xiphoid process to near the umbilicus in all groups.

Group I (preperitoneal subfascial mesh reinforcement):

-Before opening the peritoneal layer, dissection of the peritoneum from the posterior rectus sheath for about 3cm on both sides was done (Fig.1).

-The peritoneum was divided slightly to the left side of the midline to avoid the falciform ligament injury.

-After completeness of Vertical banded gastroplasty (VBG) operation as described by Mason⁽¹⁰⁾ and shown in (Figs 2&3), closure of the peritoneum by continuous polyglactin 0 sutures was done (Fig.4).

-A sheet of polypropylene mesh with its length 4cm more than the length of the wound and 6 cm wide (sufficient to cover 3cm from each side of the wound) was put over the closed peritoneum deep to the posterior rectus sheath. The mesh was fixed by 4 interrupted sutures on the four corners with polypropylene No. 2/0 to the overlying rectus sheath (Fig.5).

-Then the linea alba was closed en-mass by continuous polypropylene No. 1 sutures which were placed 1cm from the cut edge and 1cm apart (Fig.6).

-After closure of the sheath the tie-over sutures are tied over the sheath as interrupted sutures.

-The subcutaneous tissue was closed by polyglactin 2/0 interrupted sutures. The skin was closed by subcuticular running stitch using 2/0 polypropylene without using a subcutaneous drain.

Group II (Subcutaneous prefascial mesh reinforcement):

- Before opening the linea alba, dissection of the subcutaneous fatty layer from the anterior rectus sheath for about 3cm of both sides was done. A sheet of polypropylene mesh with its length 4-cm more than the length of the wound and 6 cm wide was put over the closed linea alba and the anterior rectus sheath(Fig.7). The mesh fixed to the underlying rectus sheath by four interrupted sutures with polypropylene 2\0 on the four corners.

Group III (Standard closure):

- The midline incision was closed by standard wound closure method (as in group I but without mesh reinforcement).

Post-operative care and follow up:

- Each patient received 3 gm of a third generation cephalosporins, one with induction of anesthesia, one during & one after the operation.

-For each patient the following data were obtained: operative details, wound closure time, intra-operative complications, type and amount of postoperative analgesics used, time to ambulate, hospital stay, time to return to unrestricted physical activities and early postoperative complications.

-Elastic stocking applied during the operation and for 24 hours.

-Heparin 5000 units was given subcutaneously every 8 hours started the night prior to the operation and continue until the patient fully ambulated.

-Postoperative chest physiotherapy.

-The patients were followed up in the outpatient clinic at 1,3,6, 12,18 and 24 months for detection of incisional hernias and scar complications, besides observation of the sequelae of vertical banded gastroplasty.

Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS® software statistical computer package version 10. For quantitative data, the mean and standard deviation were calculated. The difference between two means was statistically analyzed using the student-t test. For qualitative data, statistical analysis was done using Fisher exact test. For qualitative data with multiple parameters, Chi square was used. The 5% level of significance was adopted for interpretation of results of tests of significance.

RESULTS

The present study was conducted on 30 morbid obese patients who underwent VBG through midline upper abdominal incision. 24 (80%) patients were females and 6(20%) were males. The age of the patients ranged between 19 and 56 years with a mean age of 30.4 years. These patients had been randomized into three groups according to the method of incision closure.

Body mass index: It ranged between 35 and 54kg/m² (a mean of 45.4kg/m²). Between 35 and 40 kg/m² in 6(20%)

patients, above 40 to 50kg/m² in 18(60%) patients and above 50kg/m² (super obese) in 6(20%) patients.

Associated medical conditions(Table1): Osteoarthritis reported in 18 (60 %) patients, hypertension in 17 (56.7%) patients, type II diabetes mellitus in 15 (50%) patients (6 of them under insulin therapy, 5 under oral hypoglycemic drug and 4 discovered accidentally during routine preoperative investigations), sleep apnea in 9(30%) patients, urinary stress incontinence in 6(20%) females, gastroesophageal reflux in 3(10%) patients, chronic calcular cholecystitis in 3 (10%) patients, bronchial asthma in one (3.3%) patient and paraumbilical hernia in one (3.3 %) patient. Most of the patients presented with more than one associated medical condition as, osteoarthritis and hypertension in 6 patients, osteoarthritis and sleep apnea in 5 patients, DM and hypertension in 4 patients, sleep apnea and hypertension in 4 patients. Hypertension, osteoarthritis and urinary stress incontinence in 3 patients and 3 patients presented by diabetes, urinary stress incontinence and chronic calcular cholecystitis.

Wound closure time: The time was measured from the start of peritoneal closure to the end of skin closure. It ranged from 30 to 40 minutes (mean of 36 minutes & SD±5.7) for patients of group I, from 25 to 35 minutes(mean of 31 minutes & SD±5.8) for patients of group II and from 10 to 20 minutes (mean of 15.4minutes & SD±3.2) for patients of group III . There was no significant difference in the incision closure time between groups I&II, but there was a significant difference between group I&III and between groups II&III.

Early postoperative wound related complications: Superficial wound infection in 5 patients, one (10%) in group I, 3 (30%) in group II and one (10%) patient in group III. Partial wound disruption in 2 (20 %) patients of group II and one (10%) in group III, the disruption down to the mesh in patients of group II was localized to the lower half of the wound in one patient and localized to the upper third in the other). Subcutaneous seroma in one (10%) patient of group I, 3 (30%) patients of group II and one(10%) of group III. Subcutaneous hematoma in one (10%) patient of group II. These complications were managed conservatively.

There was no statistical significant difference (P< 0.05) between all groups as regards, the age of the patients, type of work, body mass index ,type and amount of postoperative analgesics used, time to ambulate, hospital stay, time to return to routine daily activities and VBG related complications.

Follow up study: Chronic pain in the scar was reported in 2 (20%) patients of group I, 3 (30%) patients of group II and in one (10%) patient of group III. Incisional hernia

reported in 3 patients (30%) all in group III. The 1st patient developed hernia 6 months postoperatively, affecting the whole length of the scar. The 2nd patient developed incisional hernia 13 months postoperatively, at the lower part of the scar (buttonhole incisional hernia) and the last patient developed incisional hernia 15 months postoperatively, affecting the lower 2/3 of the scar. Hernia

repair was delayed until the patients achieved maximal weight reduction, the repair was combined with a panniculectomy (dermolipectomy) using prefascial polypropylene mesh technique.

There was no statistical significant difference ($P < 0.05$) regarding follow up findings in the 3 groups.

Table 1 : The associated medical conditions in both groups

Associated medical conditions	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
-Osteoarthritis	7	70	5	50	6	60
-Hypertension	5	50	6	60	6	60
-Type II diabetes mellitus	6	60	5	50	4	40
-Sleep apnea	2	20	4	40	3	30
-Urinary stress incontinence	2	20	1	10	3	30
-Gastroesophageal reflux	1	10	-	-	2	20
-Chronic calcular cholecystitis	2	20	1	10	-	-
-Bronchial asthma	1	10	-	-	-	-
-Paraumbilical hernia	-	-	1	10	-	-
-More than one associated medical condition	10	100	10	100	9	90

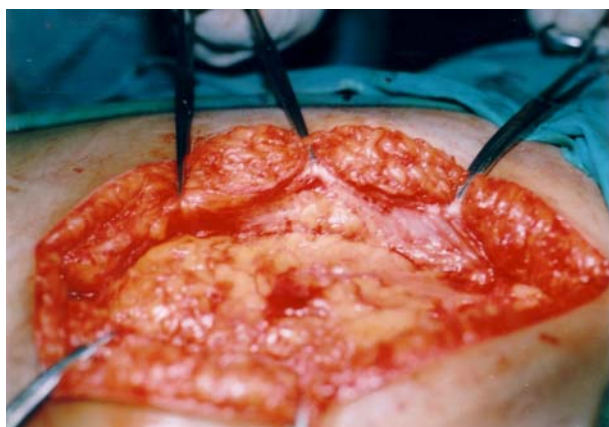


Figure 1: Dissection of the peritoneum from the posterior rectus sheath in group I.

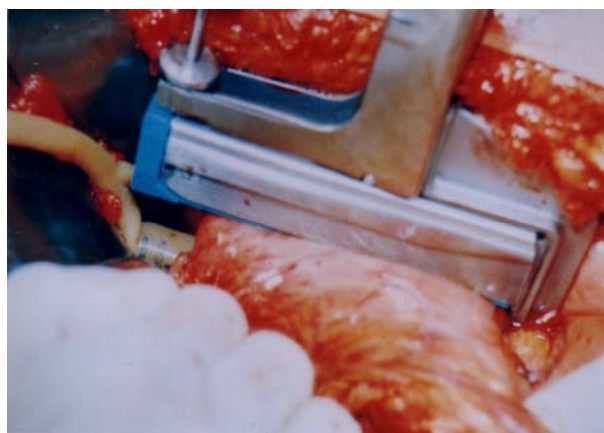


Figure 2: The reusable non-notched stapler pass through a circular opening in the stomach created by circular stapler.

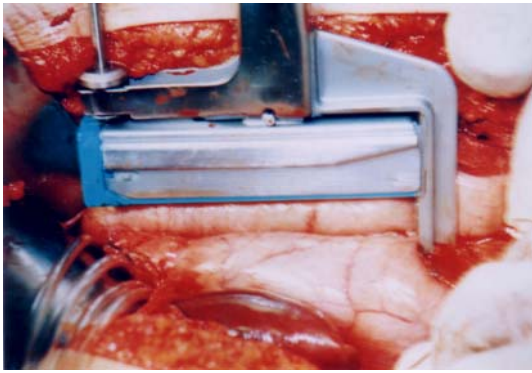


Figure 3: *The stomach stapled vertically by 4 row staples to form a long narrow tube.*

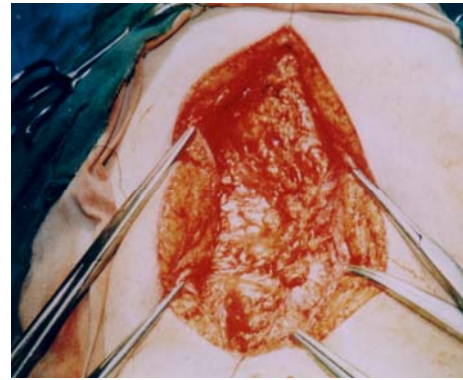


Figure 4: *Closure of the peritoneum by continuous polyglactin 0 (vicryl) suture.*

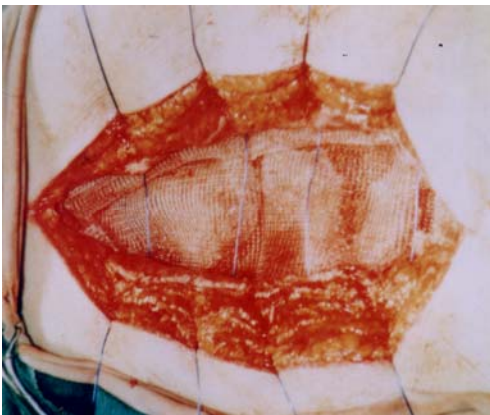


Figure 5: *Fixation of the mesh to overlying rectus sheath in group I*

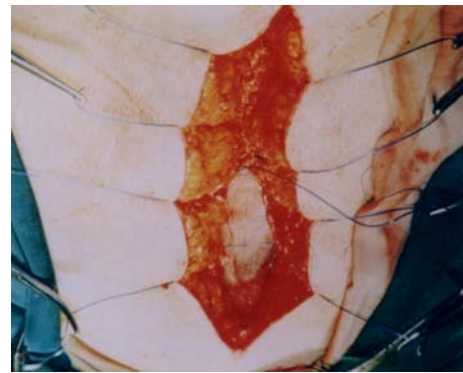


Figure 6: *The linea alba closed en-mass by continuous prolene sutures in group I.*



Figure 7: *Prefascial polypropylene mesh in group II*

DISCUSSION

The problem of obesity is largely mechanical. When vertical incisions are necessary in obese patients, the lateral distracting force is great. As has been noted, it requires a measure of physical strength to approximate the wound and extra-strength on the part of the suture material to maintain that approximation. On the other hand, obesity per se interferes with the biological process of healing, because the thick layer of adipose tissue makes closure of the dead space and approximation of the wound edges somewhat more difficult. So, we must use both non-absorbable and tension sutures in wound closure⁽¹¹⁾.

In our study, the most common associated medical conditions were osteoarthritis reported in 60 %, hypertension in 56.7%, type II diabetes mellitus in 50% and sleep apnea in 30 %. Voitek and his associates found hypertension in 57%, osteoarthritis in 56%, sleep apnea in 55% and type II diabetes mellitus in 40.8%⁽¹²⁾.

In the present study the mean time for incision closure was 36 minutes in group I, 31 minutes in group II and 15.4 minutes in group III. There was no significant difference in the incision closure time between group I&II, but a significant difference was present between group I and III and between group II and III. Strzelezyk and his coworkers reported that, the mean wound closure time was 14.6 minutes for the standard midline closure and 28 minutes for the patients who underwent prefascial polypropylene mesh repair⁽¹³⁾. Brolin reported that, the mean wound closure time in the standard midline closure was 13.3 minutes⁽⁴⁾.

In this study, early postoperative wound-related complications were, superficial wound infection in one (10%) patient of group I, 3 (30%) of group II and one (10%) of group III. Partial wound disruption in 2 (20 %) patients of group II and one (10%) of group III. Subcutaneous seroma in one (10%) patient of group I, 3 (30%) patients of group II and one (10%) of group III. Subcutaneous hematoma reported in one (10%) patient of group II. Sugerman and his colleague reported that, complications occurred in 35% of patients after prefascial polypropylene mesh reinforcement in midline closure following vertical banded gastroplasty. These complications were minor wound infection in 20%, major wound infection in 5%, seroma in 15% and hematoma in 5%⁽¹⁴⁾. Israelsson and Jonsson reported wound infection in 20% of the patients underwent midline laparotomy incision closure with a continuous en-mass technique in morbid obese⁽¹⁵⁾. McLanahan and his coworkers reported wound infection in 8%, subcutaneous seroma in 5% and subcutaneous hematoma in 3.5% after retrorectus prosthetic mesh repair of midline hernia⁽¹⁶⁾.

The low incidence of wound-related complications in group I of our study may be due to subfascial mesh

insertion. This explanation also reported by McLanahan and his coworkers, as, in subfascial technique the mesh was isolated from the abdominal contents by closure of the peritoneum. Likewise, the mesh does not contact the subcutaneous space, minimizing the risk of seroma and wound infection. Also, they mentioned that prosthetic mesh placed superficially and covered only by skin, may erode through the skin and become exposed through the resultant ulcer⁽¹⁶⁾. Another study reported that, serum accumulation and wound infection was the most frequent complication after prefascial mesh reinforcement in midline closure. These complications minimized by subfascial placement of the mesh⁽¹⁷⁾.

In our study, chronic pain, at the scar site, was reported in 2 (20%) patients of group I, 3 (30%) patients of group II and in one (10%) patient of group III. In a study of 191 patients, postoperative wound pain and tenderness was 25% higher in patients with mesh repair than in patients with suture repair⁽¹⁸⁾. The high incidence of abdominal wall pain above 20%, can be explained by the high tension of the non-absorbable sutures that fix the prosthesis especially if both rectus muscles were sutured to the linea alba. Reduction of scar site pain can be achieved by using absorbable sutures⁽¹⁹⁾. The abdominal wall pain especially at the mesh edges was frequently observed after the use of polypropylene mesh because of the more rigid texture⁽³⁾. However, the pain gradually diminishes nearly in every case⁽²⁰⁾.

In the present study, during a mean period of follow up 22 months, incisional hernia was reported in 3 (30%) patients from group III. Strzelezyk & his coworkers found that, incisional hernia reported in 20% of the patients after standard wound closure and none of the patients with inserted prefascial mesh, during one year of follow up. The length of hospital stay in the mesh group was similar to that of the non-mesh group⁽¹³⁾. Sugerman and his colleague reported incisional hernia in 25% of patients in whom fascia were closed with running No. 2 polyglycolic acid suture and none of the patients underwent prefascial polypropylene mesh repair developed hernia, during follow-up period of 20 months⁽¹⁴⁾. Arribas and his coworkers reported that, the incidence of incisional hernia was 24% in obese and 51% in superobese patients subjected to vertical banded gastroplasty by midline abdominal incision and the abdominal wound closed by mass continuous polyglactin 901 sutures. The mean follow up period was 30 months⁽²¹⁾. Voitek and his associates reported 5 out of 25 (20%) patients complicated by incisional hernias 2 years after vertical banded gastroplasties in morbid obese⁽¹²⁾.

CONCLUSION

Prophylactic use of the prosthetic mesh reinforcement of midline abdominal incision in morbid obese is a highly

effective in prevention of postoperative incisional hernia. The subfascial placement of the mesh has many advantages over prefascial position, as, it utilizes the force of intra-abdominal pressure to push the peritoneum against the mesh and the mesh against the posterior rectus sheath and rectus muscle to achieve a solid face to face overlap, the mesh is isolated from the abdominal contents, so, the possibility of bowel obstruction or fistula formation is not present, likewise, the mesh is not in contact with the subcutaneous space, so, the risks of seroma and wound infection were minimized. The subfascial technique also does not initiate severe adhesions between the subcutaneous tissue and rectus sheath with subsequent difficult dissection during late dermolipectomy if needed. In our opinion the subfascial placement of the mesh is a very simple technique and recommended as an ideal method for closure of the midline abdominal incisions in morbid obese patients.

REFERENCES

- Samuel K. Medical management of morbid obesity. *The Surg Clin Of North Amer.* 2001; 5(81): 1025-1038.
- Alvarez CR, Aragon V E. Incisions for Obesity Surgery, A brief report. *Obes Surg.* 1991; 1(4):409-411.
- Korenkov M, Paul A, Neugebauer E, etal. Classification and surgical treatment of incisional hernia, *New Surgical Horizon.* 2000; 19(3): 251-261.
- Brolin RE. Prospective randomized evaluation of midline fascial closure in gastric bariatric operations. *Am J Surg.* 1996; 172(4): 328-31.
- Sauerland S, Korenkov M, Kleinen T, etal. Obesity is a risk factor for recurrence after incisional hernia repair. *Hernia.* 2004; 8(1):42-6.
- Kendal SW, Brennan TG, Guillou PJ. Suture length to wound length ratio and the integrity of midline and paramedian incisions. *Br J Surg.* 1991; 78: 705 -709.
- Buchnall TE. The effect of local infection upon wound healing, An experimental study. *Br J Surg.* 1982; 67:851-855.
- Storozhenko OB. Surgical strategies in the treatment of postoperative abdominal wall hernia complicated by other abdominal diseases in patients with morbid obesity. *Klin Khir.* 2002; 8 (4): 30-33.
- Sugerman HJ. Effects of increased intra-abdominal pressure in severe obesity . *The Surg Clin of North Amer.* 2001; 81(5):1063-75.
- Mason EE. Vertical banded gastroplasty for morbid obesity. *Arch Surg.* 1982; 9117:701-706.
- Ponka JL. Incisional hernias. In: *Hernias of the abdominal wall.* by Ponka J.L. 1st ed. 1980, Chap 3, 135-176. Saunders W B Co Philadelphia, Toronto.
- Voitk A, Tepp J, Joffe J. Impartial long-term review of vertical banded gastroplasty in a low volume community hospital practice. *Obes Surg.* 2001; 11(5):550-1.
- Strezelezyk J, Czupryniak L, Loba J, etal. The use of polypropylene mesh in midline incision closure following gastric by-pass surgery reduces the risk of postoperative hernia. *Arch Surg.* 2002; 387(7-8):294-7.
- Sugerman HJ, Kellum JM, Reines HD, etal. Greater risk of incisional hernia with morbid obese and lower recurrence with prefascial polypropylene mesh. *Am J Surg.* 1996; 171(1):80-84.
- Israelsson LA, Jonsson T. Morbid obesity and healing of midline incisions, The importance of suture technique. *Eur J Surg.* 1997; 163(3):175-80.
- Mc-Lanahan D, King LT, Weems C, etal. Retrorectus prosthetic mesh repair of midline abdominal hernia. *Am J Surg.* 1997; 173: 445-449.
- Larson GM, Harrower HW. Plastic mesh repair of incisional hernias. *Am J Surg.* 1978; 135: 559-563.
- Luijendij KW, Wim C, De-long A. Comparison of suture repair with mesh repair for incisional hernia. *New England Journal of Medicine.* 2000; 6 (343): 392-398.
- Martin-Deuce A, Naguerals F, Villeta R, etal. Modification to rives technique for midline incisional hernia repair. *Hernia.* 2001; 5:70-72.
- Haddad V, Marcon WJ. Abdominal wound dehiscence, Contributing factors and improved mortality. *Am J Surg.* 1990; 46(5): 508-512.
- Arribas D, Elia M, Artigas C, etal. Incidence of incisional hernia following vertical banded gastroplasty. *Hernia.* 2004; 8(1): 42-6.