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CLINICAL RESEARCH

Incisional Hernia Prophylaxis in Morbidly Obese Patients Undergoing Biliopancreatic Diversion

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Abstract
Background The development of incisional hernia after open bariatric surgery is a major cause of morbidity and hospital readmission. The use of prosthetic material in clean-contaminated procedures remains controversial and correlated to high rate of local complications. A prospective observational clinical study on two different surgical techniques used to close the abdominal wall has been performed to better assess the safety (primary end point) and the efficacy (secondary end point) of polypropylene mesh placement to prevent incisional hernia in morbidly obese patients undergoing biliopancreatic diversion (BPD).
Methods Between January 2007 and February 2009, two consecutive series of 25 obese patients, each undergoing BPD, have been analyzed to compare prophylactic retrorectal muscle prosthetic mesh placement with conventional suture repair of the abdominal wall. The first 25 consecutive patients selected to BPD underwent abdominal closure without mesh (group A), and the next 25 consecutive ones have been treated with prophylactic retrorectal muscle prosthetic mesh placement (group B).
Results No mesh infection occurred in patients in group B. The incidence of minor local complications (seroma or hematoma) was similar in both groups. The incidence of incisional hernia was significantly higher (p=0.009) in no-mesh group (group A) than in the mesh group (group B) at 1-year follow-up (range, 12 to 24 months). The incidence of incisional hernia was 4% (one case reported) in the group treated with mesh versus an incidence of 32% (eight cases reported) in the group conventionally closed.
Conclusions The mesh placement in clean-contaminated bariatric surgery seems to be safe (primary end point) and effective (secondary end point) at 1-year follow-up.

Keywords Incisional hernia · Bariatric surgery · Clinical trial

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Introduction

Morbid obesity is the major patient-related risk factor for the development of incisional hernias, with an incidence ranging from 25% to 50% in large reviews [1, 2]. Biliopancreatic diversion (BPD) is one of the most effective procedures in the treatment of morbid obesity [3]. Laparoscopic bariatric surgery has significantly reduced the risk of incisional hernias. However, the long learning curve and a similar, if not increased, incidence of complications such as bowel obstruction, gastrointestinal hemorrhage, and stomal stenosis associated with laparoscopy make the open approach the preferred technique for many surgeons [4–6]. The development of incisional hernia after open abdominal surgery is a major cause of postoperative morbidity and hospital readmission. Neither new suture materials nor the use of retention sutures has significantly reduced the incidence of incisional hernia [7, 8]. The use of polypropylene mesh has become the gold standard in the treatment of postoperative hernia in clean procedures. Several recent reviews have shown that in selected cases the use of mesh can be safe in the setting of minimal contamination [9, 10]. Moreover, the prophylactic placement of mesh has been shown to decrease substantially the risk of incisional hernia in one small series of obese patients

Table 1 Demographics and clinical features of the two groups analyzed

	Group A Conventional abdominal closure	Group B Abdominal closure with polypropylene MESH	*p*
Number of patients	25	25	NS
Length of abdominal incision	15±5	15±5	NS
Operative time (min; mean)	120 (range 110–135)	130 (range 120–150)	NS
Leakage/seroma	3	5	NS
Bleeding/hematoma	1	0	NS
Surgical site infection	1	1	NS
Mesh infection	–	0	
Length of stay (days; mean)	7.5 (range 6–11)	6.5 (range 6–7)	NS
Incisional hernia (*n*)	8 (32%)	1 (4%)	0.009

undergoing gastric bypass [11]. Nevertheless, the use of prosthetic material in clean-contaminated procedures, such as BPD, remains controversial and correlated to high rate of local complications [12].

A prospective observational clinical study on two different surgical techniques used to close the abdominal wall has been performed to better assess the safety (primary end point) and the efficacy (secondary end point) of polypropylene mesh placement to prevent incisional hernia in morbidly obese patients undergoing BPD.

Patients and Methods

Between January 2007 and February 2009, 50 morbidly obese patients undergoing open BPD were assigned to either wound closure using a prophylactic retrorectal muscle polypropylene mesh placement (group A) or conventional suture repair of the abdominal wall (group B). The first 25 consecutive patients underwent conventional suture repair of the abdominal wall (group A), while the next 25 consecutive ones have been treated with a prophylactic retrorectal muscle polypropylene mesh placement (group B). The senior author GN operated on all the patients. The outcome of each of the two consecutive series of 25 obese patients, differently closed after BPD, has been analyzed to compare prophylactic retrorectal muscle prosthetic mesh placement with conventional suture repair.

The distribution of gender, age, body mass index (BMI), and comorbidities was similar in both groups (Table 1). The two groups were compared by analyzing the outcome at 1-year follow-up (Table 2). After the operation, the patients were followed up for surgery-related complications: leakage/seroma, bleeding/hematoma, surgical site infection or abscess, hernia development, or recurrence. Clinical examinations were performed after 2 weeks and then monthly up to 1 year. An abdominal wall ultrasonography was performed at the 15th day, sixth month, and first year after surgery in both groups to detect local complications or hernia recurrence.

Surgical Procedure

Informed written consent was obtained from all the patients before surgery. Prophylactic short-term antibiotic and antithrombotic therapy were administered preoperatively. All procedures were performed with the patient under general endotracheal anesthesia. A nasogastric tube was

Table 2 Comparison of the two groups differently treated (1-year follow-up)

	Group A Conventional abdominal closure	Group B Abdominal closure with polypropylene MESH	*p*
Number of patients	25	25	NS
Age (years; mean)	39 (range 23–66)	38 (range 27–64)	NS
Male/female (ratio)	4/21	3/22	NS
BMI (mean)	46 (range 40–65)	45 (range 40–60)	NS
Comorbidities			
Diabetes mellitus (*n*)	6	4	NS
Hypertension	10	5	NS
Hypercholesterolemia	4	1	NS
Hypertriglyceridemia	3	0	NS

inserted before surgery started. The patient was placed in supine position with the surgeon standing on the right side of the patient.

In summary, in all patients, the skin was incised from just below the xiphoid process to 10–15 cm above the umbilicus. The abdominal wall is then opened in the midline by incising the linea alba. A Rochard self-retaining retractor is then used to maintain exposure. A biliopancreatic diversion is then performed according to RESA technique except for the open approach [13]. Simultaneous cholecystectomy was performed in all the patients.

At the end of the procedure, in patients of group A, the abdominal wall was closed in two layers. The peritoneum is closed using a running suture with 0 Vicryl. Linea alba is then closed using interrupted 1 Vicryl suture. In patients of group B, the peritoneum and the posterior rectal sheath are closed with a continuous 2/0 polydioxanone suture. A polypropylene mesh, 10 cm wider and 8 cm longer than the fascia defect, was inserted between the rectus muscle and its posterior sheath and fixated to the posterior sheath with 10–12 interrupted 0 polypropylene sutures. A suction drain was inserted between the mesh and the rectus muscle. The anterior rectal sheath was then closed with a continuous one polypropylene suture. The skin was closed using interrupted 2/0 polypropylene suture in both groups.

Statistical Analysis

Differences between the groups were analyzed with Student's t test. Differences in the distribution of nominal parameters were assessed with the χ^2 test.

Results

All procedures were performed as planned. The mean operation time was 120 min in group A (range 110–13 min) and 130 min in group B (range 120–150 min). Intraoperative blood loss was less minimal in all cases without intraoperative or postoperative blood transfusion. The incidence of minor local complications (seroma or hematoma) was similar in both groups; in particular, no mesh infection was recorded in group B. The length of hospital stay was similar in both groups. The incidence of incisional hernia was significantly higher in group A (eight cases reported with an incidence of 32%) than in group B (one case reported with an incidence of 4%) ($p=0.009$) at 1-year follow-up. The average time of presentation of the postoperative hernia from BPD was 180±60 days. One patient in group B presented with a symptomatic umbilical hernia that was confirmed intraoperatively as such during a laparoscopic hernia repair. The incidence of incisional hernias and surgical local complications was shown to be statistically correlated to obesity but not to its severity (higher BMIs) or its associated comorbidities (diabetes mellitus and hypercholesterolemia) in both groups ($p>0.05$ in all variables considered) (Table 1). Only the surgical procedure utilized to close the abdominal wall (no mesh versus mesh) was shown to be significantly and statistically correlated to the development of postoperative hernia ($p=0.009$). The eight patients who developed postoperative hernia after conventional closure needed further admission to hospital for prosthetic repair of the abdominal hernia. All the eight procedures have been performed laparoscopically without any complication.

Discussion

Incisional hernia is defined as an abdominal wall defect that appears after surgical operation along the incision line during the first 3 months after surgery, considered the critical period for the healing process to develop. Several factors have a negative impact on wound healing and among them the presence of metabolic disorders (diabetes, obesity, and cirrhosis), surgical site infection, and poor surgical technique. Morbid obesity is itself one of the most common patient-related factors negatively affecting wound healing, and the incidence of incisional hernias after bariatric surgery can be as high as 45–50%.

BPD is one of the most effective procedures in bariatric surgery achieving long-term weight reduction and significant improvement of comorbidity (diabetes, hypertension, and hypercholesterolemia). In the last decade, laparoscopy has been widely utilized in bariatric surgery especially because it reduces the incidence of incisional hernia [13]. However, laparoscopic BPD is characterized by a similar incidence of postoperative complication such as bowel obstruction, gastrointestinal hemorrhage, anastomotic leakage, and stomal stenosis [4–6]. Consequently, the open approach is still the preferred technique for many surgeons around the world [4–6]. Unfortunately, as stated before, the incidence of incisional hernia in open bariatric surgery has been reported to be high as 25%, reaching 50% in superobese patients [1, 2]. Several attempts have been made to reduce postoperative hernia incidence in open surgery. Neither new generations of sutures nor the use of different surgical techniques in wall closure (multilayer versus monolayer, interrupted versus continuous sutures, etc.) has demonstrated any significant impact in reducing the occurrence of this complication. Polypropylene mesh has become the "gold" standard in the treatment of incisional hernia. However, some concerns still exist on the prophylactic use of prosthetic materials in clean-contaminated procedures such as BPD which includes two intestinal anastomoses and a cholecystectomy. There are

few published reports using prophylactic mesh placement for the primary closure of laparotomies in high-risk patients. Gutierrez de la Pena et al. reported a higher incidence of incisional hernia after conventional suture repair of the abdominal wall than in the group closed with mesh implantation [14]. Similarly, El-Khadrawy OH et al. compared 20 high-risk patients for hernia development in which the abdominal wall was closed conventionally with 20 high-risk patients in which a mesh was utilized [15]. The incidence of incisional hernia was 15% in the first group versus 5% in the group where a mesh was placed.

Only two reports exist on the safety and effectiveness of prophylactic retrorectal muscle prosthetic mesh placement in morbidly obese patients, and they reach opposite results and conclusions. Strzelczyk JM et al. performed a randomized trial to assess the effects of prophylactic polypropylene mesh in morbidly obese patients undergoing gastric bypass surgery [11]. In their experience, the use of mesh prevented incisional hernia development in all cases without serious intra-abdominal or local complications. Conversely, among the 38 obese patients, whose abdominal wall was closed without using mesh, 21% of them developed an incisional hernia.

Herbert GS et al. performed an observational study on prophylactic mesh placement in 16 obese patients undergoing gastric bypass [12]. Six out of 16 patients experienced failure of mesh placement. Five patients developed fluid collections surrounding the mesh and subsequently underwent mesh explantation and in three cases an infection of the prosthesis was confirmed by cultures. One patient developed a symptomatic ventral hernia despite the placement of prophylactic mesh.

The lack of consistent data in favor or against the prophylactic use mesh in the closure of the abdominal wall after bariatric BPD was the reason to design and to run a randomized clinical study to better assess the safety (primary end point) and the efficacy (secondary end point) of prophylactic retrorectal muscle polypropylene mesh placement to prevent incisional hernia in morbidly obese patients undergoing open BPD.

Our data confirm Strzelczyk findings. Our data show no statistically significant difference comparing postoperative complications among patients of groups A and B. In particular, there were no cases of surgical site infection or mesh infection. This zero incidence of mesh infection could be, in our opinion, explained with the meticulous, standardized, and virtually bloodless surgical technique utilized. In particular, two technical details are important. The use of linear cutters to transect the stomach and the small bowel and to perform the gastrointestinal and the entero–entero anastomosis resulted in a virtually zero contamination and consequently in a virtual clean surgery. We always put a closed suction drain between the mesh and rectus muscles to avoid fluid collection potentially leading to infection around the prosthesis as reported by Strzelczyk but not by Herbert.

The incidence of incisional hernia was 4% (only one case reported) in the group treated with mesh versus an incidence of 32% (eight cases reported) in patients of group A. One patient in group B developed an umbilical hernia in the postoperative period that underwent subsequently a laparoscopic repair. Laparoscopy confirmed that was a trough umbilical hernia. However, we do not know if the hernia was present and not detected at the first operation or if it developed postoperatively. In the latter case, we do not know if the mesh placement influenced in any way its development or if it can be associated with the sudden weight loss induced by BPD.

In light of our results, we strongly disagree with the conclusion drawn by Herbert GS et al. "… prophylactic mesh placement ... led to unacceptably high rate of adverse events related to mesh" and we think that at least part of these unsatisfactory results can be related to the absence of a drain between the mesh and rectus muscles to avoid fluid collection potentially leading to infection around the prosthesis. In our opinion, this is one of the reasons the results of Herbert GS et al. differed so dramatically from our and Strzelczyk's results.

In summary, our results at 1-year follow-up show that prophylactic retrorectal muscle polypropylene mesh placement is safe and effective in reducing the incidence of incisional hernia after open BPD. Longer follow-up and prospective randomized trials with a large number of patients are needed to confirm these promising results.

Conflict of Interest The authors declare that they have no conflict of interest.

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