

A new modified Mayo technique: should the surgeons need a new open technique for hernia repair in their armamentarium?

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SUMMARY: A new modified Mayo technique: should the surgeons need a new open technique for hernia repair in their armamentarium?

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Introduction. The Mayo technique is one of the most common techniques used to repair incisional, umbilical, and epigastric hernias. A high percentage of recurrences, together with the use of particular expensive types of meshes, are some of the most relevant problems in this surgical field.

Patients and methods. This study is a clinical prospective observational and involves all the patients who underwent procedures using a new modified Mayo technique from 2006 through 2013. The general criteria analyzed were age, sex, obesity, smoke abuse, diabetes, ch-

ronic diseases, type of hernia, operative time, morbidity and mortality. All the patients involved in this study were followed-up from 6 to 120 months.

Results. The types of hernia were 5 epigastric hernia (20,8%), 8 umbilical hernia (33,3%), 11 midline incision hernia (45,9%). Ten patients (41,7%) presented non-complicated hernias; 8 patients (33,3%) presented strangulated hernias and 6 patients (25,0%) presented obstructed hernias. No intestinal resection was necessary in any of the patients. The mean operative time was 55 minutes (range 30-180). The mean hospital stay of the patients' after-post operative procedure was 4.5 days (range, 2 to 8 days). No major complications have been reported. Only one patient present a recurrence.

Conclusion. These preliminary results suggest that this modified Mayo technique could be useful in the armamentarium of surgeon to repair incisional, umbilical, and epigastric hernias. More studies are needed to validate the technique.

KEY WORDS: Ventral hernia - Open hernia repair - Mayo technique - Open surgery.

Introduction

The most frequent hernias of the abdominal wall are umbilical, epigastric, incisional and, less commonly, Spigelian hernias. Umbilical and epigastric hernias constitute about 10% of primary hernias¹ and they are classified into congenital, infantile and adult hernias. Adult hernias are acquired in almost 90% of cases and they are more common in women than in men. Epigastric hernia is an acquired lesion protruding through the linea alba above the level of the umbilicus. Approximately 3-5% of the population has epigastric

hernias, with a higher prevalence in men than in women among those 20-50 years of age (1).

In literature the incisional hernia have an incidence of 20% (2) and it is the most frequent complication after abdominal surgical procedures. For the surgical repair many techniques are reported, but the most common method for the incisional, umbilical and epigastric hernia is a Mayo technique (3). Between 24% and 54% of patients recurred (4) after primary hernia repair and for this reason the mesh are frequently used. However the high recurrence rate and the use of meshes are the cause for the increasing costs for this surgical procedure (4). The primary closure without mesh have a high recurrence rate when compared with open mesh repair, but the primary closure is cheaper, easier and faster (5). Furthermore the primary closure has a lower rate of wound complications including infection. Finally the cost of the meshes cannot be supported by all hospital in the world.

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Laparoscopic ventral and incisional hernia repair requires a longer operative time than does the open approach, with a higher local complication rate and a longer period of localized pain (4). Although this pain is normally self-limiting, in about one quarter of the patients, it persists for more than two weeks (4) and potentially for longer than 8 weeks.

Aim of the present study is to present a clinical experience of a modified Mayo technique based on a previous experimental study (5) in order to consider it as an alternative surgical procedure.

Patients and methods

The clinical study is prospective observational and concerns all the patients submitted to a new modified Mayo technique between 2006 and 2013 at the Department of Surgical Sciences, and Advanced Technologies, "GF Ingrassia" at the University of Catania. All patients were informed before the surgical procedure, and only the patients that signed the informed consent approved by local ethic committee, have been enrolled. All the patients admitted have a hernia with size no more than 10 cm with a single orifice. The general criteria analyzed were age, sex, obesity, smoke abuse, diabetes, chronic diseases, type of hernia, operative time, morbidity and mortality. All the patients involved in this study were followed-up over a variable time period from 6 months to 120 months from the time of the operation. The follow-up was performed by clinical and US examination of the abdomen. In case of recurrence, CT should have been performed only if the diagnosis was uncertain.

Mayo surgical technique

The vertical Mayo technique starts with an excision of the sovrabundant skin over the wall defect and clearing of the rectal fascia. The technique also involves preparation of the hernial sac, allowing examination to evaluate possible fibrous adhesences. After that, the sac is opened, and its contents are exposed and examined. If there are adhesences, they are removed. At this point, mattress sutures are introduced 3 cm from the margin of the overlay fascia, and the overlaying margin is linked to the edge of the underlying margin with a loop. Normally, the free margin of the overlaying fascia is sutured on the surface of the abdominal wall by a non-continuous suture (6). It is important to emphasize that the Mayo technique makes use of an interrupted suture to fix the free mar-

gin of the overlay fascia, while the possibility for using continuous suture was not considered by the author.

Current Mayo modified surgical technique

The patient is prepared and draped in the standard manner. The repair of epigastric or incisional hernias is performed with open technique and under general anesthesia, through an incision over the hernia. The sac is carefully liberated from fibrous adhesences and opened; its contents are then exposed and examined. Once the hernia is freed up by gentle dissection, it is returned through the parietal weakness into its proper position. At this point, the margins of the free fascia are approximated to close the defect with a non-absorbable mattress suture 3 cm from the margin of the overlay fascia. In this way, the fascia is doubled with different sutures that represent a modification of the original technique: the free margin of the overlay fascia is fixed to the surface of the contralateral fascia with non-absorbable and running sutures (Figure 1).

Results

Twenty-four patients underwent the Mayo-modified technique procedure. Table 1 shows the demographic and clinical data of the patients. The mean age was 61,32 (range 35-82 y); 9 patients (37,5%) submitted to the modified Mayo technique presented at least one risk factor: 4 patients (16,7%) were affected by diabetes, 2 (8,4%) had chronic smoke-related cough and 2 (8,4%) were affected by ascites. One (4,2%) of these last two patients had been HBV positive for more than 30 years; the other one (4,2%) was HCV positive. One patient (4,2%) was affected by chronic obstructive lung disease.

The type of hernia is reported in Table 2. One patient (4,2%) was operated upon after a prosthesis infection. This patient had been operated upon with mesh repair 5 months earlier for a midline incisional hernia that developed after cystectomy. Fifteen days after the surgical treatment, she reported the emission of pus from the scar. Therefore the mesh was eliminated, and the patient lived without any hernia repair until the technique described in this work was adopted.

Ten patients presented non-complicated hernias (41,7% of the total); 8 patients (33,3%) presented strangulated hernias and 6 patients (25,0%) presented obstructed hernias. No intestinal resection was necessary in any of the patients. The characteristics of the hernias are reported in Table 3.

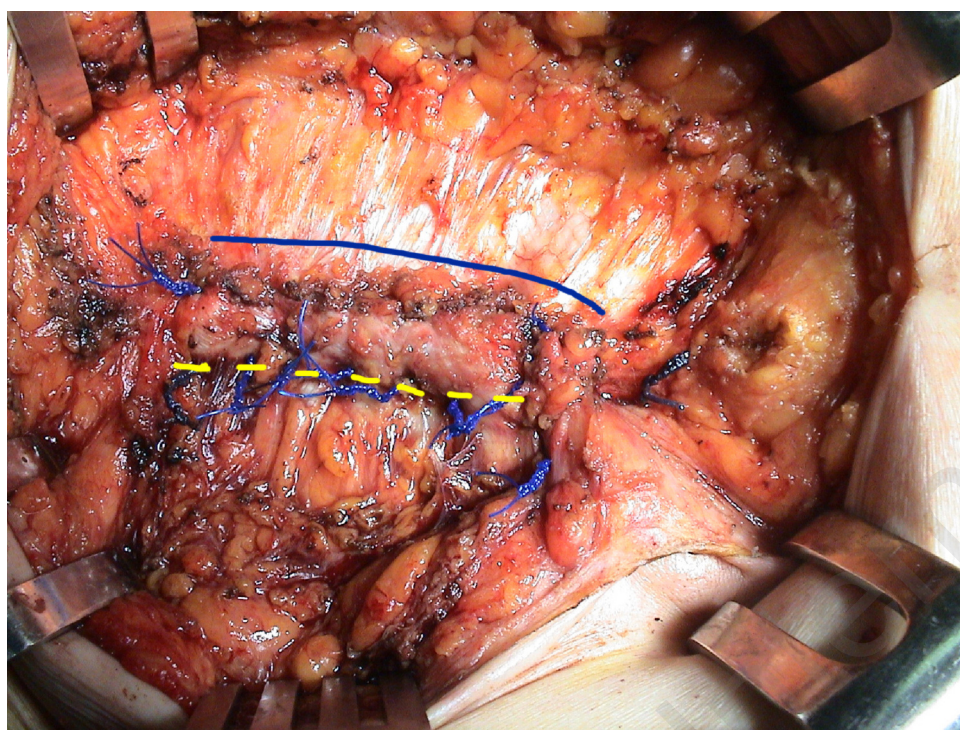


Figure 1 - Abdominal midline hernia repair using the modified Mayo procedure. a) Dotted line: the separate suture performed for the Mayo technique. b) Continuous line: the running suture is the new application.

TABLE 1 - PATIENT DEMOGRAPHICS AND CLINICAL DATA.

Characteristic	No. of patients	%
Sex		
Male	10	41,7
Female	14	58,3
Obesity		
Yes	0	0
No	24	100
Smoker		
Yes	4	16,7
No	20	83,3
Diabetes		
Absent	20	83,3
Present	4	16,7
Chronic diseases		
Absent	21	87,5
Present	3	12,5

The mean operative time was 55 minutes (range 30-180). Suction subcutaneous drainage was used in

12 of the 24 patients (50% of the cases), then retired when no drainage liquid was present.

The mean hospital stay of the patients' after-post operative procedure was 4.5 days (range, 2 to 8 days).

Early complications: No complication was observed. No 30-day mortality was recorded.

Long-term complications: All patients were contacted for follow-up examination every year. One patient (4,2%) was lost to follow-up because died due to cerebral aneurysm after three years; a second moved to South America and he refers by phone no recurrence has been recorded. Twenty-two patients (75%) were submitted to clinical and echographic examinations. The characteristics of this follow-up are presented in Table 4. Only one of these patients presented a late recurrence (4,2%). The patient with recurrence had a chronic obstructive pulmonary disease (COPD) due to a previous tabagism. No patient underwent CT scan.

Discussion

The protrusion of the viscera through the anterior abdominal wall is defined ventral hernia. This type included the umbilical, epigastric and Spigelian hernia.

TABLE 2 - KIND OF HERNIA.

Kind of hernia	N. Patients		Strangulated	Obstructed	Not complicated
Epigastric hernia	5	1	2	2	
- Male	3	1	1		
- Female	2	-	1	1	
Umbilical hernia	8	2	3	3	
- Male	3	1	1		
- Female	5	1	2	2	
Midline incision hernia	11	5	1	5	
- Male	4	1	-	3	
- Female	7	4	1	2	

TABLE 3 - CHARACTERISTICS OF THE HERNIAS.

Type of hernia	Location	Number	M/F	Mean size	Number of orifices
Primary Abdominal Wall Hernia	Midline	Epigastric 5	3/2	3,5	1
	Umbilical	8	3/5	3	1
Incisional Hernia Classification	Midline	Epigastric 6	1/5	6,7	1
		Umbilical 6	3/2	3,3	1

Except for the last type, each has been described in the present study.

Obesity, chronic cough, prostatism, constipation, diabetes mellitus, ascites and use of corticosteroids were considered the risk factors for develop a primary incisional hernia but today these factors are controversial (7).

In our experience, the major cause of recurrence has been cough related to cigarette consumption (8). Luijendijk et al. reported in their study that the 5-year cumulative recurrence rate connected to cough is 51%. Cough represents the fourth most common cause of recurrence after steroid use, constipation and oncology, which respectively have recurrence rates of 78%, 66% and 56% (8). Moreover, in the study by Van Ramshort et al., coughing was related to the risk of abdominal wound dehiscence in 17% of the cases representing one of the major risk factors (9). Our experience, even if limited, suggests the direct correlation between smoking and recurrence after surgical repair. Therefore, smokers could be considered as high-risk subjects and should be probably treated with prostheses. Of course a more appropriate clinical analysis concerning our study is needed.

As reported in the literature, the majority of our patients with umbilical hernia are women (10) and the majority of these patients have a complication, probably due to the small orifice of the hernia, which frequently contributes to incarceration of the intestine or omentum. These phenomena may be related to a history of multiple pregnancies with prolonged labor it occurs easily and poses substantial challenges (1).

In our experience, the majority of the epigastric hernias have a complication due to the fact that the smaller epigastric hernias frequently do not contain intestinal loop but only fat from the greater omentum. For this anatomic reason, they are not strongly symptomatic. Therefore, patients leave these types of hernias in place for a long time, with a more elevated risk of incarceration and strangulation. Larger hernias, in contrast, are frequently symptomatic, and the patient often requests surgery early (1). Midline laparotomic hernias have a recurrence rate estimated to be between 2 and 20% (11, 12).

Causes of incisional hernia after midline incision depend mostly on three fundamental factors. First, it can depend on the contraction of the abdominal wall. In fact, if the patient contracts the abdominal wall,

TABLE 4 - PATIENTS' FOLLOW UP.

Patient	Sex	Age	Recurrence	Months of follow-up after the procedure
1	F	61	no	168
2	M	59	no	144
3	M	37	no	65
4	M	54	no	72
5	M	72	no	120
6	F	76	yes (COPD)	48
*7	F	43	no	Only 36 mo
8	F	53	no	84
9	M	35	no	84
10	M	76	no	84
11	M	73	no	72
12	F	82	no	42
13	F	60	no	72
14	F	78	no	72
15	F	50	no	80
16	F	72	no	72
17	F	50	no	72
18	M	71	no	60
19	F	75	no	60
20	M	37	no	60
21	F	76	no	60
22	F	82	no	60
23	F	53	no	48
24	M	46	no	42

* This patients died for cerebral aneurism after 36 months. Until the death no recurrence have been recorded.

COPD = Chronic obstructive pulmonary disease.

the edges of the wound are retracted from the muscles to the edges of the wound itself. Second, incisional hernia after midline incision can result from anatomic factors. Linea alba fibers are continuous with the aponeurosis of the muscles of the abdominal wall. This means that these fibers cross the midline mostly in transverse or oblique directions; therefore, when the midline incision is executed they are cut perpendicularly, not following their strength lines. The third reason is represented by the avascular nature of the midline incision, which can retard and weaken wound healing (13).

In 1895 for first time Mayo performed the original technique for umbilical, epigastric and incisional hernia repair that since is the most commonly used (3, 8). This technique has rate recurrence between 20% and 28% (14). Here, we describe an innovation of this technique, based on a previous experimental study (5). When the patient with incisional hernia was treated with open access and a mesh was used, the recurrence rates were less evident (12, 15-19), compared with those for patients treated with the Mayo technique. Our experience shows how the rate of recurrence in suture repairs decreases with modification

of the Mayo technique, as reported here, similar to the rate of recurrence for mesh repairs. The limited number of patients examined is a bias of the study, but the small percentage of recurrence have to be taken in consideration. The rate of complications following mesh repair is lesser than that associated with the Mayo procedure (3%-9% (20, 21)), but mesh repairs are more expensive than simple suture due to the cost of the materials used. The costs of the mesh repairs and of suture repairs become similar when recurrences are considered; in fact, suture repairs are usually affected by a higher rate of recurrences. Berger et al. analyzed 392 patients treated for umbilical hernia. These patients were undergoing suture repair and mesh repair. No difference in hernia recurrence rates was reported (22). In our study, the recurrence rate was extremely low, so the costs of suture repairs were lower than the costs for mesh repairs. For these reasons, it is possible to suggest an advantage of the modified Mayo technique involving continuous suture. Burger (13) and Luijendijk (8) in their randomized controlled trial of 181 patients' focuses on the recurrence, complications, pain, cosmetics and satisfaction of two groups of patients. The patients undergoing mesh repair have less percentage of recurrences including the enterocutaneous fistula, which greatly increases the morbidity and cost in these patients. But technically the suture that in this manuscript has been performed is not the same as in Mayo technique and in our study. In fact it is just a single layer, on the opposite the Mayo technique is scheduled with two layers, and in the second layer consist the modification that we have described in our technique and its efficacy has been previously explained with the experimental study (5).

Furthermore, if we analysed the study in relation to the rich countries our study is not of utmost importance. But if we consider that the majority of the hospitals in the world cannot support the cost of a mesh for all the patients, our result can make a difference and can help surgeons and patients. In addition patients with ventral hernia have a compromised quality of life (23). So a prompt elective repair can be the most cost-effective management, compared with wait and repair of hernia in presence of its complication (24).

The modified Mayo technique requires a short operative with a low local complication rate and the limited number of recurrence is encouraging. In studies reported in the literature the laparoscopic approach has a higher local complication rate and the recurrence

rates of laparoscopic-assisted procedures and open procedures were similar in the two groups or, as reported, inferior in the group of open-procedure techniques (25-27).

In literature are reported many studies that analyzed the difference between continuous and interrupted sutures. In particular these studies analyzed the operating time, amount of thread used, post-operative infections and pain, fistula formation, tightness and recurrence. In the present study, except for one recurrence no other complications, such as infections, post-surgical pain, fistula or incisional hernia development, were individuated. Comparing the continuous and interrupted suture it is noted that continuous suture is faster and stronger. This reducing used of the anesthesia and the operating time (5).

The limits of the article are: the number of cases is very small, the study period is very long and statistical analysis is not possible. Furthermore there is no comparison group (Mayo technique group) and this is the most Important lack of study.

Conclusion

This technique can be added to the surgeon's armamentarium and could be suggested as a suitable treatment for abdominal midline hernia repair. More studies are required to better clarify this clinical and experimental hypothesis. Bias of this study is do not be a prospective randomized study, and for the small number of the patients, but the encouraging results can help the surgeons especially in developing countries to make a difference when the mesh is not available, the patients do no request, or it cannot be used in complicated situations. To our knowledge, this is the first study that describes this modification, and the results using this technique in our group of patients could be promising.

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