

# Assessment of Mesh placement pre- or post-muscular in the management of the midline abdominal incisional hernias

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DOI: 10.29322/IJSRP.12.06.2022.p12638

<http://dx.doi.org/10.29322/IJSRP.12.06.2022.p12638>

Paper Received Date: 1st June 2022

Paper Acceptance Date: 15th June 2022

Paper Publication Date: 20th June 2022

**Abstract- Background:** Incisional hernia is considered as an important complication of abdominal surgery. Procedures for repairing these hernias with surgical meshes have been reported without consensus about which location is the best.

**Objective:** The aim of this study was to compare the difference between pre-muscular and post-muscular location for mesh placement regarding to outcome.

**Patients and Methods:** A prospective comparative study was conducted in 137 patients with a diagnosis of midline abdominal incisional hernia. They are selected from department of General Surgery, Tishreen University Hospital in Lattakia-Syria between January 2018 and January 2021. Meshes were placed either pre-muscular (42 cases) or post-muscular (82 cases).

**Results:** The population of 137 patients was predominantly female (59.9%), with a mean age of 49.9±12.1 years. The most frequent age groups were 51-60 year (30.7%) and 41-50 year (25.5%). Of the predisposing comorbid factors, obesity was present in (45.3%) and hypertension in (24.8%). Other factors included diabetes mellitus (20.4%), smoking (20.4%), and anemia (14.6%). Incisional hernias were more frequent after urgent procedures (46%). Post-muscular meshes were more frequently used in selective operations due to non-oncologic etiologies compared to pre-muscular (45.1% vs 16.7%, p:0.007), whereas pre-muscular meshes were applied more frequently in presence of a previous recurrence on average more than one time (9.5% vs 1.2%, p:0.04). Chronic pain was the more frequent complication in the two groups; 35.7% in group I and 47.6% in group II, p:0.06. The mean duration of passive drain placement was 4.6±0.6 in group I versus 3.9±1.6 in group II, p:0.01. During follow up period, the rate of recurrence was 2 to 3-fold in pre-muscular group compared to post-muscular group.

**Conclusion:** The current study demonstrated favorable results in correction incisional hernias with two techniques, with less rate of recurrence in post-muscular location compared with pre-muscular.

**Index Terms-** Incisional hernia, mesh, outcome

## I. INTRODUCTION

Abdominal wall hernia is defined as a protrusion of an organ or part of it through the wall that is comprised of a complex fusion of overlapping layers of muscles and connective tissues which contain and protect intra-abdominal organs while facilitating movement and breathing [1,2].

Incisional hernia refers to abdominal wall gap with or without a bulge in the site of a previous surgical incision scar. It can be classified by either anatomical or clinical criteria [3]. Anatomical classification include location on abdominal wall (medial or lateral zone) and its size (<4 cm, 4 to 10 cm, and >10 cm). Incisional hernias can be classified to asymptomatic, reducible, incarcerated, or strangulated depending on clinical classification [4]. It occurs in approximately 10-15% of patients with a prior abdominal incision and midline hernias have the highest incidence. They typically develop during the early postoperative period, but the presentation might delay 10 years after surgery [5]. There are multiple risk factors for development of an incisional hernia with contributions from both patient and technical factors. Patient factors that impede normal wound healing include: obesity, old age, smoking, and connective tissue disorders. Factors related to surgery include: wound infection, suboptimal fascial closure, dehiscence of abdominal fascial, and type of abdominal surgery [6]. Management of incisional hernias can be expectant or operative depending on symptoms, size of hernia, and complications. Surgical mesh should be used to repair majority of incisional hernias in which they reduce the rate of recurrence [7]. There are three categories of mesh that used in repairing are synthetic, biologic, and biosynthetic. Most surgical meshes used currently are chemically and physically inert, nontoxic, stable and non-immunogenic, but none of them are biologically inert due to physiology of meshes and its role into the hernia repair process [8]. Owing to the high frequency of the midline incisional hernias, many operative methods have been developed in the last decades to improve the outcome. There are many options for mesh placement during incisional hernia repair, and the ideal anatomic location has been debated. Therefore, the

objective of the study was to compare the outcome of mesh placement either pre-muscular or post-muscular.

## II. PATIENTS AND METHODS

This is a prospective comparative study of a group of patients attending Department of General Surgery at Tishreen University Hospital in Lattakia-Syria during three-year period (January 2018 to January 2021). The inclusion criteria were: adults aged  $\geq 18$  years with midline abdominal incisional hernias. The exclusion criteria were: patients with one of the following; younger than 18 years, with strangulated incisional hernias, or patients who underwent direct closure without using surgical mesh. Complete medical history together with the physical examination were done. Age, sex, body mass index(BMI), comorbidities, type of the surgery, and number of recurrence were recorded. BMI was calculated as weight(kg) divided by height(m) squared(kg/m<sup>2</sup>), and patients were classified according to BMI to: normal weight (18.5-24.9 kg/m<sup>2</sup>), overweight (25-29.9 kg/m<sup>2</sup>) and obesity ( $\geq 30$  kg/m<sup>2</sup>). A polypropylene mesh was used for reconstruction hernia, and placed either anterior or posterior muscle. Patients were divided into two groups according to the location of mesh placement: pre-muscular (42 cases) and post-muscular (82 cases).

Post-operative complications were recorded and compared between the two groups. Seroma is defined as fluid collection in the area of incision or serous leakage through the wound which appears within 3 months after operation. Hematoma is defined as collection of blood and appears in the incision within 7 days after operation. Chronic pain is defined as pain in any degree persisting

at the incisional scar. Wound infection was defined by the discharge of pus from the wound. The scar was examined for recurrence of hernia, which was defined as any fascial defect that was palpable or detected by ultrasound examination.

**Ethical consideration:** All patients were provided a complete and clear informed consent after discussion about the study. This study was performed in accordance with the Declaration of Helsinki.

## III. STATISTICAL ANALYSIS

Statistical analysis was performed by using IBM SPSS version 20. Basic Descriptive statistics included means, standard deviations(SD), Frequency and percentages. To examine the relationships and comparisons between the two group, chi-square test was used. Independent t student test was used to compare 2 independent groups. All the tests were considered significant at a 5% type I error rate( $p < 0.05$ ),  $\beta: 20\%$ , and power of the study:  $80\%$ .

## IV. RESULTS

The study included a group of 137 patients (55 male, 82 female) with a diagnosis of midline incisional hernia. Age ranged from 25 to 68 years, with mean age of  $49.9 \pm 12.1$  years. Patients were divided according to age into five groups: 18-30(5.1%), 31-40(19%), 41-50(25.5%), 51-60(30.7%), and  $>60$ (19.7%). The risk factors of incisional hernia were represented as follows: obesity (45.3%), hypertension (24.8%), diabetes mellitus (20.4%), smoking (20.4%), and anemia (14.6%).

**Table 1 Demographic characteristics of the study population**

Variable	Result
<b>Age (years)</b>	25-68 ( $49.9 \pm 12.1$ )
<b>Age group</b>	
18-30	7(5.1%)
31-40	26(19%)
41-50	35(25.5%)
51-60	42(30.7%)
$>60$	27(19.7%)
<b>Sex</b>	
Male	55(40.1%)
Female	82(59.9%)
<b>Obesity</b>	62(45.3%)
<b>Co-morbidities</b>	
• Hypertension	34(24.8%)
• Diabetes mellitus	28(20.4%)
• Anemia	20(14.6%)
<b>Current smoking</b>	28(20.4%)

Patients were divided into two groups according to the type of surgery: 63 patients (46%) who underwent emergency surgery, and 74 patients (54%) who underwent elective surgery either for oncologic (32.1%) or non-oncologic (21.9%) indications. Incisional hernias were repaired using a variety of techniques

included mesh repair either pre-muscular in 42 cases (30.7%) or post-muscular in 82 cases (59.9%), and direct repair(one of exclusion criteria ) in 13 cases (9.5%)

**Table 2 Distribution of the patients according to the type of surgery and management**

Variable	Result
<b>Type of operation</b>	
• Urgent	63(46%)
• Elective	
<b>Oncology indication</b>	44(32.1%)
<b>Non -oncology indication</b>	30(21.9%)
<b>Management</b>	
<b>Direct incisional repair</b>	13(9.5%)
<b>Mesh placement</b>	
• Pre-muscular	42(30.7%)
• Post -muscular	82(59.9%)

Pre -muscular mesh placement was the most frequent anatomical location in emergency surgery (57.1%), whereas post-muscular location was used frequently in selective surgery for non-oncologic etiologies (45.1%), with a significant difference(p:0.007). Post-muscular was the most frequent location in the absence of recurrence of hernia (93.9% vs 81%), whereas pre-muscular location was used frequently in presence of

recurrence (9.5% vs 1.2%), p:0.04. The mean duration of placement passive drain was 4.6±0.6 in group I versus 3.9±1.6 in group II, p:0.01. Patients were divided into three groups according to the time(days) of passive drain placements; 2-4(57.1%), 5-7(35.7%), and >7(7.1%) in group I versus 2-4(68.3%), 5-7(28%), and >7(3.7%) in group II, p:0.4.

**Table 3 Characteristics of the surgical variables of the study population by comparison of the two groups**

Variable	Location of Mesh placement		P value
	Group I (42) Pre-muscular	Group II (82) Post -muscular	
<b>Type of surgery</b>			<b>0.007</b>
• Urgent	24(57.1%)	31(37.8%)	
• Elective			
<b>Oncology indication</b>	11(26.2%)	14(17.1%)	<b>0.04</b>
<b>Non -oncology indication</b>	7(16.7%)	37(45.1%)	
<b>Recurrence</b>			
Absent	34(81%)	77(93.9%)	<b>0.01</b>
<b>Present</b>			
One -time	4(9.5%)	4(4.9%)	
>1	4(9.5%)	1(1.2%)	<b>0.4</b>
<b>Passive drain duration(day)</b>	<u>4.6±0.6</u>	<u>3.9±1.6</u>	
2-4	24(57.1%)	56(68.3%)	
5-7	15(35.7%)	23(28%)	
>7	3(7.1%)	3(3.7%)	

Table 4 shows the incidence rates of complications according to the location of Mesh placement. In group I, chronic pain was the most frequent complication which was observed in 15 cases (35.7%), followed by seroma (14.2%) and hematoma (11.9%). In group II, chronic pain was also the most frequent

complication (47.6%), followed by seroma (8.5%), and thrombophlebitis (8.5%), with significant differences between two groups. Hematoma was higher in the group I (11.9%) vs (2.4%) in group II, with a significant difference, p: 0.03.

**Table 4 Post -operative complications of the study population by comparison of the two groups**

Variable	Location of Mesh placement		P value
	Group I (42) Pre-muscular	Group II (82) Post -muscular	
<b>Postoperative complications</b>			
Seroma	6(14.2%)	7(8.5%)	<b>0.3</b>
Hematoma	5(11.9%)	2(2.4%)	<b>0.03</b>

Mesh infection	2(4.7%)	5(6.1%)	<b>0.7</b>
Surgical site infection	2(4.7%)	2(2.4%)	<b>0.5</b>
Pulmonary embolus	0(0%)	4(4.9%)	<b>0.1</b>
Thrombophlebitis	1(2.4%)	7(8.5%)	<b>0.1</b>
Intestinal fistula	0(0%)	3(3.6%)	<b>0.2</b>
Chronic pain	15(35.7%)	39(47.6%)	<b>0.06</b>
Cardiopulmonary complication	2(4.7%)	5(6.1%)	<b>0.8</b>

During follow up period, the rate of recurrence was higher in pre-muscular group compared to post-muscular group; at 1 year (12.5% vs 4.6%), at 2 years (6.3% vs 3.7%), and at 3 years (11.1% vs 3.03%)

**Table 5 Recurrence rate during follow-up by comparison of the two groups**

Variable	Number of patients	Location of Mesh placement			
		Group I (42) Pre-muscular	Recurrence	Group II (82) Post -muscular	Recurrence
<b>Follow-up time</b>					
1 year	30	8	1(12.5%)	22	<b>1(4.6%)</b>
2 years	43	16	1(6.3%)	27	<b>1(3.7%)</b>
3 years	51	18	2(11.1%)	33	<b>1(3.03%)</b>

## V. DISCUSSION

The principal clinical concern with subjects underwent abdominal surgery is the potential development of significant incisional hernia and the associated morbidity with a considerable impact on patients' overall quality of life, so it is imperative that research should focus on its prevention as well as its appropriate treatment.

The result of the current study revealed that incisional hernias were more frequent in females than males, who fall in the age groups of 51-60 and 41-50 years. Obesity represented the most frequent risk factor for developing hernias in which was present in approximately half of the patients. Other patient -related factors that predispose for hernias were: hypertension, diabetes mellitus, and smoking. Incisional hernias were more frequent in emergency operations than selective ones. Post-muscular location was associated with low rate of recurrence compared with pre-muscular placement, and chronic pain was the most frequent complication in the two groups, followed by seroma and infection. These findings may be explained by the following: patient and technical-related factors that impair proper wound healing and affect the strength of the new tissue to support the abdominal wall. In addition to that, emergency operations associated with infection and deterioration of the status of patients.

Michael et al (2018) demonstrated in a systematic review of 6227 patients with mean age 53.1 years, and mean BMI 29.1 kg/m<sup>2</sup> who underwent mesh repair of incisional hernias that recurrence rate was 21.6% in pre-muscular mesh placement versus 10.9% in post-muscular placement. Seroma was the most frequent complication in the two groups;17% in pre-muscular and 11% in post-muscular location without significant difference [9].

Jairam et al (2020) found in a randomized clinical trials of 1815 patients who underwent to midline laparotomy that incisional hernia was significantly lower after prophylactic mesh placement compared with sutured closure. Seroma was

significantly more frequently in pre-muscular than post-muscular placement with relative risk 2.2. The rate of recurrence was similar in the two location of surgical meshes [10].

Ahmed et al (2020) demonstrated in a meta-analysis study of 3000 patients who underwent to elective abdominal surgeries that incidence of incisional hernia was reduced significantly after prophylactic mesh placement compared with sutured closure during follow-up periods. Surgical meshes were associated significantly with an increased risk of seroma and chronic wound pain. Onlay position was superior to intraperitoneal in efficacy [11].

In summary, the observed reduction in the rate of recurrence in patients who underwent post-muscular placement prompted us to apply this technique when it is possible, and taking preventive measurements in consideration to reduce the incidence of incisional hernias.

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