

# Open Component Separation Technique for Management of Ventral Hernia with Emphasis on Undesirable Outcomes: An Observational Cross-Sectional Analytical Study

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## Abstract

**Aim and Objective:** The aim of the study was to study the surgical details of component separation technique (CST). This includes clinical indication for component separation size of defect, types of component separation, size of mesh used, and time taken for surgery and to compare the association between pre-operative factors and complications of CST.

**Introduction:** Sir Astely Paston Cooper's words: "No disease of the human body belonging to the province of the surgeon requires in its treatment a better combination of accurate anatomical knowledge with surgical skill than Hernia in all its varieties." A hernia is defined as an area of weakness or disruption of the fibromuscular tissues of the body wall. Often hernia is also defined as an actual anatomical weakness or defect. About 75–85% of abdominal wall hernias are groin hernias. About 15% of males and 5% of female will develop groin hernia. The CST was first described by Ramirez *et al.* in 1990. It is very effective for reconstructing large or complex midline abdominal wall defects and it has the advantage of restoring the innervated dynamic abdominal wall integrity without producing undue tension on the repair. It can be performed to reconstruct a large abdominal wall defect without the need for mesh. Recurrence rates after the use of CST ranged from 0% to 30%. Endoscopic-assisted CST was performed to save the perforators of the epigastric arteries and the results were comparable to the open technique.

**Discussion:** Repair of large ventral hernia is a challenge for even experienced surgeons, as there are large defects with large contents, often with loss of domain. The large defects were bridged by various plastic surgical procedures such as myofascial flaps or free flaps with high recurrences and complications. More often, the bridging was done with artificial prosthesis, leaving the defects open. This was accomplished by either open surgery (onlay, inlay, sublay, or underlay) or laparoscopic intraperitoneal onlay meshes. However, non-closure of the midline had adverse effects on postural maintenance, respiration, micturition, defecation, and biomechanical properties, which have a profound impact on the patients' overall physical capacity and quality of life. CST is a novel answer to the closure of midline with live, active tissues with or without the use of additional prosthesis. Although this technique was originally described in 1990, it has undergone lots of modifications such as perforator preserving CST, endoscopic technique, and posterior component separation.

**Conclusion:** CST is a novel answer to closure of midline with live, active tissues with or without the use of additional prosthesis. This technique was originally described in 1990 by Ramirez. Lower hernia recurrence rates, restoration of dynamic abdominal wall function, and improvement in back and postural abnormalities have been cited in the Western literature. Major issue with this technique is wound-related com.

**Key words:** Component separation technique, Hernia, Mesh

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## INTRODUCTION

A hernia is a defect in the fascia of the abdominal wall and thus resulting into formation of a hernial sac of peritoneum that contains visceral organ or abdominal contents or other bulges that may appear similar, but are not true hernias. Other abnormalities that present

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as hernia but are not true hernias are diastasis recti and eventration.

Exploratory laparotomy is opening of abdominal cavity for surgical purposes, for the pathologies of abdomen that cannot be dealt with minimally invasive techniques. Abdominal wall comprises musculo-aponeuroses that give the strength to abdominal wall along with skin and fascia. This also functions to keep the abdominal viscera within the cavity. Any incision over the abdominal wall for exploration may result into the weakening of this protective barrier and predisposes for the protrusion of the abdominal wall viscera through the musculo-aponeurotic layers and it presents as a swelling over the wall just beneath the incision scar. This swelling is known as incisional hernia that contributes to significant proportion of post-operative complication in patients who underwent laparotomy.

The incidence of incisional hernia develops after abdominal wall closure range widely from 10 to 23%<sup>[1,2]</sup> and up to 69% in long-term high-risk patients. Various methods of suture closure (material and technique) and mesh reinforcement (position and shape) have been used to restore abdominal wall integrity and prophylactic treatment of incisional hernia. Primary repair of incisional hernia can be done when the defect is small. Despite advances in early repair, recurrence rates remain unacceptable (12–54%). Larger defect (>2–3 cm) shows higher recurrence rate around 10–15% if closed by primary repair. Recurrence is susceptible to a vicious cycle of morbidity, because early subsequent repair presents greater technical challenges and an increased risk for recurrence and morbidity.<sup>[3,4]</sup>

Failure of effective and sufficient closure of the abdominal wall after operations leaves the patient at risk for developing hernia. The introduction of prosthesis has become game changer in repair of ventral hernia. To date, few studies have focused on prophylactic management of incisional hernias in index patients which in short decreases the iatrogenic complications secondary to surgical incisional hernia repair.

Ideal mesh positioning is also a topic of study. Till date wound dehiscence and incisional hernia is potentially serious complication following: Abdominal surgery, especially if it is performed through a midline incision. Although, prophylactic reinforcement with mesh has been shown to reduce this risk. Reinforcement of the suture line with a mesh may be an effective way of preventing wound dehiscence. By placing a polypropylene mesh under the aponeurosis along with drain after closure of the midline, the risk for incisional hernia has been shown to be reduced by at least two-thirds.

Enough evidence is now available to advise prophylactic mesh placement (PMP) for routine midline laparotomy in these high-risk cases. However, literature for the use of PMP in emergency midline laparotomy is rather scarce. We conducted this prospective study to examine the safety and efficacy of PMP in Elective Midline Laparotomy.<sup>[5,6]</sup>

### **Aims and Objectives**

#### **Primary objective**

The primary objective of the study was to study the outcome of prophylactic use of mesh in patients undergoing elective exploratory laparotomy.

#### **Secondary objective**

The secondary objective of the study was to study the efficacy of PMP in reducing the incidence of incisional hernia in such patients.

## **MATERIALS AND METHODS**

### **Title**

“A prospective study of outcome of prophylactic use of mesh in patients undergoing elective laparotomy in department of general surgery at M.Y. Hospital, Indore.”

### **Study Design**

This was a prospective observational study.

### **Sample Size**

The sample size was 50.

### **Inclusion Criteria**

The following criteria were included in the study:

1. Patients >18 years and <70 years
2. Patients who give written informed consent and to follow-up
3. Patient with comorbidities (obesity (body mass index [BMI] <35), chronic obstructive pulmonary disease Smoking (Ceased 1 month before procedure), Diabetes (HbA1C <7).

### **Exclusion Criteria**

The following criteria were excluded from the study:

- Patients not willing to give written consent
- Patients with irregular follow-up
- Age <18 years
- Recurrent hernia (ventral) cases
- Morbidly obese (BMI>35)
- Unable for smoking cessation
- Diabetes (HbA1C>7)
- Immunocompromised cases
- Pregnancy.

### Source of Data

All elective cases operated routine Operation Theatre in Department of Surgery, M.G.M Medical College and M.Y Hospital, Indore. The study will include prospective cases for 1 year from date of approval from ethics committee.

### Study Period

- One year from date of approval.

### Place of Study

The study was conducted at the Department of surgery, M.G.M Medical College and M.Y Hospital, Indore.

### Sample Size

The sample size was 50 cases.

### Procedure Planned

1. Our study is based on the patients attending the surgical outpatient department of M.Y. Hospital, Indore
2. All patients are to be examined and planned for exploratory laparotomy. An informed consent will be taken from each patient after which the patient will be taken for an elective surgery PMP
3. The patients who developed complications after surgery will be examined clinically and managed as required
4. This study will be conducted after approval from thesis and ethical committee
5. Data will be collected and appropriate statistical analysis will be done. Present study includes 50 cases of laparotomy.

### Follow-up

Patient will be discharged and advised to follow-up at

- 1 month
- 3 months
- 6 months
- 1 year.

### Routine Investigations

1. Hemogram
2. Renal function tests
3. Liver function tests
4. Serum electrolytes
5. Coagulation study
6. Ultrasonography whole abdomen
7. X-ray chest + electrocardiogram
8. Serology.

## RESULTS AND DISCUSSION

We conducted an observational study to see the prophylactic effect of prosthetic mesh in development of incisional

hernia after elective laparotomy. The study was conducted in the department of general surgery MGM Medical College Indore from a period of July 2018 to October 2020.

The study is a type of comparative study in which the outcomes after mesh placements were used for comparison with patients developing incisional hernia acting as cases and those not developing act as controls. Furthermore, it compares the variation in the outcomes with the location of mesh, namely, sublay and onlay.

The study comprised 50 elective laparotomy cases done irrespective of the actual pathology involved. The age and gender were not taken as selection criteria. There was no other specific inclusion criteria. Patients who did not give consent were excluded from the study. All emergency laparotomy cases were also excluded from the study.

We had 8 (16.0%) patients in the age group of 18–20 years, 27 (54.0%) patients in the age group of 21–40 years, 12 (24.0%) patients were in the age group of 41–60 years, and 3 (6.0%) patients were in the age group of >60 years. Majority of the patients were in the age group of 21–40 years, followed by 41–60 years.

Patient in 21–40 years age group, 2 in 40–60 years and 1 in >60 years group developed incisional hernia. The association of age with the development of incisional hernia post-laparotomy was found not to be statically significant. We, in our study, were able to establish that age did not have a role as a risk factor in development of incisional hernia in contrast to as described by various surgical literatures based on the fact that human tissue tend to weaken off with ageing.

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Two out of 26 females (7.7%) and two out of 24 males (8.3%) in our study developed incisional hernia. This gender-wise incidence was not statically significant and gender as a risk factor for development of incisional hernia cannot be established in our study.

All four patients developed hernia belonged to obese category as per the WHO criteria for BMI classification. Four out of 24 (16.7%) patient who were obese were associated with this complication. This was, however, not found to be clinically significant but we could not clearly rule out obesity as a risk factor for development of incisional hernia. To clearly establish the relation, we

need to conduct study for greater sample size or in a same cohort.

We placed mesh in all patients in our study. However, the location of mesh placement in different patients was not randomized and was fully on surgeon's discretion. We did sublay mesh placement by retro-rectus dissection in 45 patients and onlay placement in five patients. About 60% (3 out of 5) patient had onlay mesh placement developed incisional hernia. Furthermore, the rate of local wound

complications in this group was higher. All five patients developed surgical site infection (SSI) and three progressed to develop seroma and four developing wound dehiscence and burst abdomen.

The hospital stay in patients with sublay mesh placement was highly variable with six patients getting discharged before 7 days and 24 staying till 14 days. Eleven patients had stayed for more than 15 days up to 21 days and four patient stayed for more than 21 days. One patient who developed hernia in sublay group had prolonged hospital stay due to development of complications (wound dehiscence). This proves that the sublay mesh placement as such is not associated with increased risk but the wound infection associated with the mesh leads to the hernia formation. Overall sublay mesh placement had lower rate of wound complications with 18% patients developing SSI, 20% developing seroma, and 5% developing wound dehiscence. This, in turn, correlates with lower rate of incisional hernia with sublay mesh placement as compared to that in onlay mesh placement.

In onlay mesh placed cases all five patients had either of the wound complications, that is, SSI, seroma, or wound dehiscence. These complications were related to the prolonged hospital stay in all patients with onlay mesh. One out of five patients had stayed in ward up to 21 days and other four patients had stayed for more than 21 days. Three out of four patients who developed incisional hernia belonged to the onlay mesh placed group. The high rate of hernia in this group hence can be attributed to higher rate of wound complication in these patients.

As compared to previous studies our study showed similar results. In study by Borab *et al.* comparing the suture closure and onlay mesh placement, they found lower rate of incisional hernia with mesh but seroma formation and other wound complications were present. This was consistent with our study. We additionally tried to compare the rate of hernia with onlay and sublay mesh placement but due to lower number in onlay group, we could not establish the clear-cut relationship even though the cases were more after onlay mesh placement. Furthermore, the post-operative pain and development of hematoma are more with the sublay mesh placement than compared with the onlay. This was done in no other previous study of PMP.

In our study, we did not have any patient with intraperitoneal placement as was compared in other studies like that done by Andres Kohler *et al.* and Burns *et al.* Furthermore, the study is limited by the fact that many of the factors directly involved in wound healing such as diabetic status, hemoglobin status of patient, protein status, and technical aspect of closure. Furthermore, our study

**Table 1: Distribution of Patients According to Post-operative Complications**

Post-operative complications	Number	Percentage
Post-operative pain	15	30.0
Hematoma	1	2.0
Seroma	12	24.0
Surgical site infection	13	26.0
Wound dehiscence	6	12.0

**Table 2: Distribution of patients according to duration of hospital stay**

Duration of hospital stay	Number	Percentage
1–7 days	6	12.0
7–14 days	23	46.0
14–21 days	13	26.0
>21 days	8	16.0
Total	50	100.0

**Table 3: Association between age and final outcome**

Age	Final outcome (%)			Total (%)
	Hernia	no hernia	Unknown	
18–20 years	0	7	1	8
	0.0	87.5	12.5	100.0
21–40 years	1	24	2	27
	3.7	88.9	7.4	100.0
41–60 years	2	9	1	12
	16.7	75.0	8.3	100.0
>60 years	1	2	0	3
	33.3	66.7	0.0	100.0
Total	4	42	8	50
	8.0	84.0	8.0	100.0

**Table 4: Association between location of mesh and final outcome**

Location of mesh	Final outcome (%)			Total (%)
	Hernia	No Hernia	Unknown	
Onlay	3	2	0	5
	60.0	40.0	0.0	100.0
Sublay	1	40	4	45
	2.2	88.9	8.9	100.0
Total	4	42	8	50
	8.0	84.0	8.0	100.0

did not comment on the deviations with normal suture closure of the abdominal cavity and the type of mesh used [Tables 1-4].

## CONCLUSION

From this prospective study following conclusions can be drawn

1. Incisional hernia is an important delayed post-operative complication of abdominal wall surgery
2. Several factors are implicated in occurrence of hernia after abdominal wall closure that includes patient factor and technical factors
3. Wound infections SSI leading to wound dehiscence are a major cause of development of incisional hernia
4. Technique of abdominal wall closure, namely, suture closure and mesh placement respectively have variable impact on the prevention of outcome that is incisional hernia
5. Length of hospital stay depends on the development of wound infection and hence increases the chances of incisional hernia
6. The mesh placement after elective laparotomy while abdominal closure is associated with low occurrence of incisional hernia as compared with the primary suture closure
7. Onlay mesh placement technique has more chances of complications such as seroma and flap infections than sublay due to the fact of more dissection in fatty plane for mesh placement. Furthermore, more superficial

location of mesh is easily accessible for bacterial invasion

8. The concept of mesh placement can be successfully applied to selected patients to halt the development a morbid condition of incisional hernia.

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