

# A Comparative Study of Repair of Complex Ventral Hernias with Double Mesh Repair (Sandwich Technique) and Single Mesh Repair in Adult Patients Admitted in General Surgical Wards

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## 1. Introduction

**Ventral hernia** is the herniation of a viscus or a part viscus through a defect in the anterior abdominal wall. It is a common condition encountered by surgeons in elective as well as emergency situations. **Complex ventral hernias (CVH)** include hernias with large defects (>10cm), multiple orifices and recurrent anterior abdominal wall hernia, mainly along the midline incision. The surgical treatment of large midline ventral hernias remains a challenge. Considering different causes of ventral hernias, wide differences in defect sizes, locations and associated medical comorbidities of every patient, it is less likely that a single approach to various ventral hernia repairs will ever be identified.

The use of prosthetic mesh for the treatment of hernia repair has established a strong position not only in the repair of large or recurrent hernias but also in the small primary repairs. Moreover, all hernia repairs at a minimum require prevention of incarceration of herniated bowel contents, which has to be accomplished with less morbidity and a minimal recurrence rate.

The standard treatment of complex ventral hernia is single (prosthetic) mesh repair, but even with the routine use of mesh, repairing an incisional hernia is a challenge, as it carries unsatisfactory rates of recurrence (8-27%) and high rates of morbidity (12-42%).<sup>1,2,3,4</sup> This is particularly evident in obese patients, multiparity and patients with poor general conditions. Multiple mesh materials (e.g. absorbable, non-absorbable, prosthetic and biologic) and multiple methods of mesh insertion have been tried (e.g. onlay, inlay and sublay mesh repairs). But none of these methods are satisfactory or have become the standard for treatment.

The aim of this study is to present the prospective evaluation and results of a novel technique for complex ventral hernia repair that involves repair of the hernia defect in between two layers of prosthetic mesh (sandwich technique). In the double mesh repair method, the anterior abdominal wall is reinforced by placing the first mesh in between the posterior rectus sheath and rectus abdominis muscle. The recti muscles are then approximated together to cover the first mesh. Afterward, the second mesh is laid in between the rectus muscle and anterior rectus sheath.

This is a prospective study conducted in the department of general surgery at RIMS Ranchi to compare the outcome of

single mesh repair and double mesh repair in the treatment of complex ventral hernias.

## Aims & Objectives

The aim of this study was to:

- 1) To analyze the various methods available to treat a complex ventral hernia.
- 2) To compare postoperative outcome of double mesh repair (sandwich technique) with single mesh repair of complex ventral hernia in adult patients.
- 3) Determine and recommend the ideal methods to reduce the morbidity and optimize the functional capability of the individual.

## 2. Materials and Methods

**Study Site:** Department of General Surgery, Rajendra Institute of Medical Sciences (RIMS), Ranchi.

**Study Duration:** The study was done from September 2019 to September 2021.

**Design of Study:** Hospital-based prospective, observational analytical study.

**Study Population:** All adult patients admitted in the surgery department for the treatment of ventral hernia, irrespective of sex and weight.

**Sample Size:** 40 Patients

### Inclusion Criteria

- All adult patients undergoing treatment of ventral hernia
- Both sex group

### Exclusion Criteria:

- a) All patients who did not voluntarily give consent
- b) Those patients who could not be followed up
- c) Patients with very severe co-morbid conditions like:
  - Uncontrolled diabetes
  - Severe respiratory, cardiovascular, neurological, renal diseases
  - Haemodynamically unstable patients
  - Bleeding diabetes
  - Pregnancy

2.1 Methods

- A complete history of all patients with the complex ventral hernia was taken, followed by a complete physical examination.
- They were subjected to standard blood examinations, including complete blood count, serology, BT/CT, PT/INR.
- The patients were followed up post-surgery at 1 month and 6 months.

Data was analyzed and outcome with the different modality of management was calculated.

3. Observation and Results

Table 1: Age-Wise Incidence Of Complex Ventral Hernia

Age group (years)	No. of patients	Percentage
< 18	Nil	0.0
18-30	5	12.5
31-40	13	32.5
41-50	10	25.0
51-60	6	15.0
> 60	6	15.0
Total	40	100

Table-1 shows incidence of complex ventral hernia with respect to age group. 40 patients were studied. 23 patients were in age group 31-50 years (57.5%). 12 patients were in age group >50 years (30%). No case was observed in age group less than 18 years. Mean age was 45.47 years.

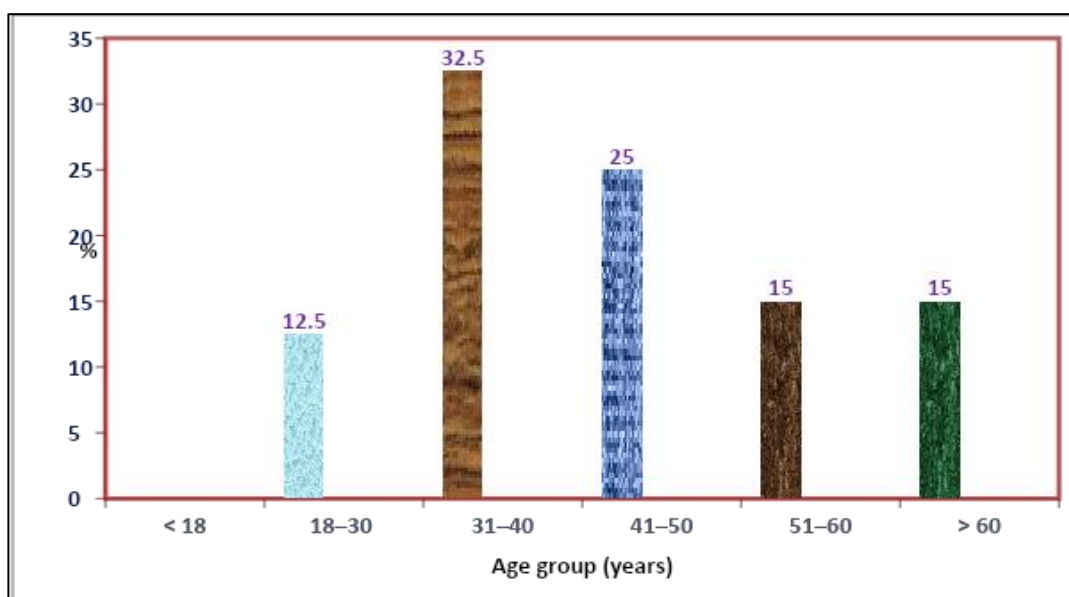


Table 2: Gender Wise Incidence of Complex Ventral Hernia

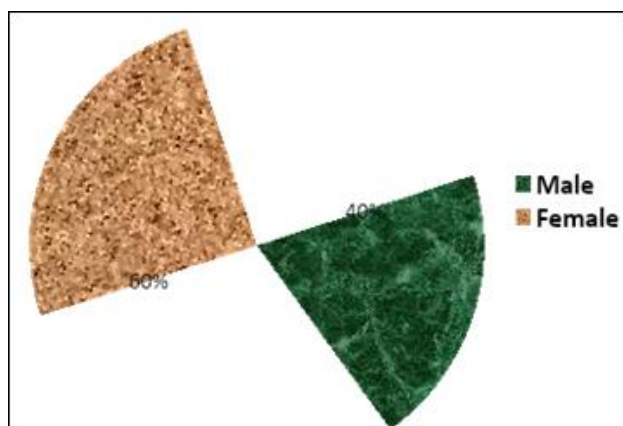
Gender	No. of patients	Percentage
Male	16	40
Female	24	60
Total	40	100

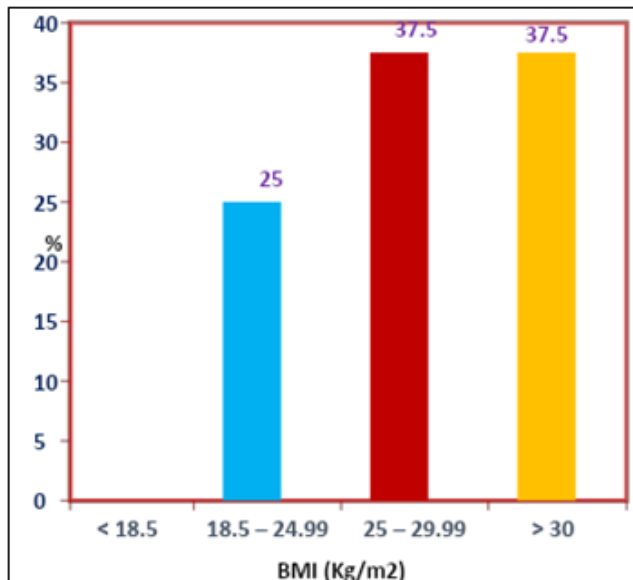
Table-2 shows the Incidence of complex ventral hernia with respect to gender. There were 24 female patients (60%) and 16 male patients (40%) out of 40 patients.

Table 3: Incidence of complex ventral hernia on the basis of BMI

BMI (Kg/m <sup>2</sup> )	No. of patients	Percentage
< 18.5 (Underweight)	00	0.0
18.5 – 24.99 (Normal)	10	25.0
25 – 29.99 (Pre-obese)	15	37.5
> 30 (Obese)	15	37.5
Total	40	100

Table-3 shows incidence of complex ventral hernia with respect to Body Mass Index (BMI). Majority of patients (75%) belong to pre-obese and obese category i.e. 30 patients out of 40. 10 patients belong to the normal category (25%). There was no patient belonging to underweight category. Average BMI was 28.95 Kg/m<sup>2</sup>.

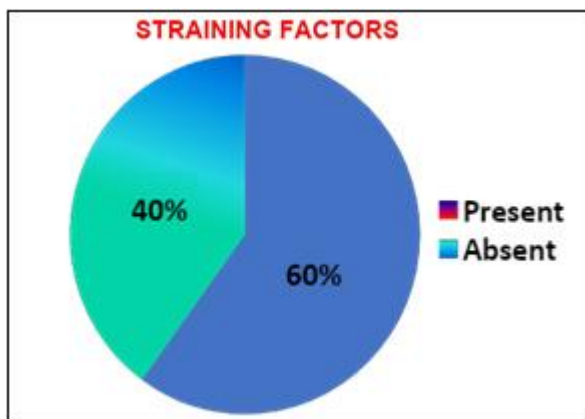




**Table 4:** Incidence of complex ventral hernia on the basis of straining factors

Straining factors	No. of patients	Percentage
Present	24	60
Absent	14	40
Total	40	100

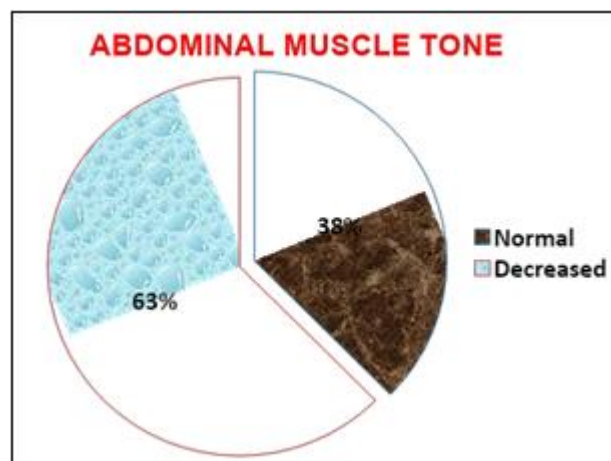
Table-4 shows the incidence of complex ventral hernia based on straining factors. Straining factor was present in 24 patients of complex ventral hernia (60%) out of 40 patients.



**Table 5:** Incidence of complex ventral hernia on the basis of abdominal muscle tone

Abdominal muscle tone	No. of patients	Percentage
Normal	15	37.5
Decreased	25	62.5
Total	40	100.0

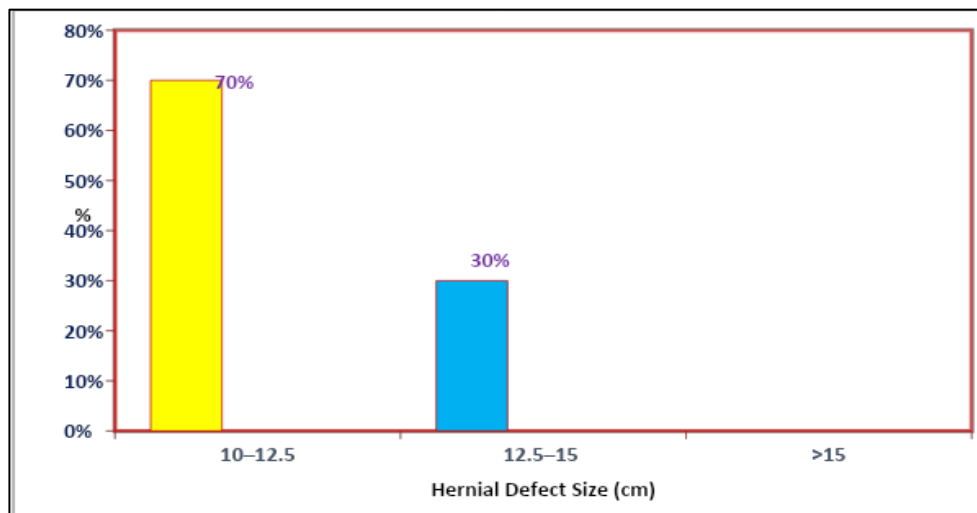
Table-5 shows the incidence of complex ventral hernia based on abdominal muscle tone. We observed that 25 patients had decreased abdominal muscle tone out of 40 patients (62.5%). Rest 15 patients had normal abdominal muscle tone (37.5%).



**Table 6:** Incidence of complex ventral hernia on the basis of hernial defect size

Hernial defect size (cm)	No. of patients	Percentage
10-12.5	28	70
12.5-15	12	30
>15	0	0.0
Total	40	100.0

Table-6 shows the incidence of complex ventral hernia based on transverse hernial defect size. Table-6 shows that the majority of patients with CVH had transverse hernial defect size in the range 10 cm-12.5 cm (70%) i.e. 28 patients out of 40 patients. The rest of the patients had a defect in the range 12.5cm-15 cm (30%), i.e. 12 out of 40 patients.



**Table 7:** Comparison of Complications Occurred in Double Mesh Repair Versus Single Mesh Repair

Complications	Double mesh repair (n=16)		Single mesh repair (n=24)	
	No. of patients	Percentage	No. of patients	Percentage
Seroma	6	37.5	4	16.66
SSI	2	12.5	2	8.33
Flap necrosis	1	6.25	1	4.16
Respiratory distress	1	6.25	2	8.33
Intrabdominal complications	0	0.0	0	0.0
Recurrence	0	0	2	8.33
Total	10		11	

p = 0.616, Not significant

Table-7 shows comparison between double mesh repair technique and single mesh repair technique in terms of postoperative complications.

Seroma was the most common postoperative complication in single mesh repair group (16.66%) i.e. 4 patients out of 24

patients. 6 patients in double mesh repair group had seroma, out of 16 patients (37.5%).

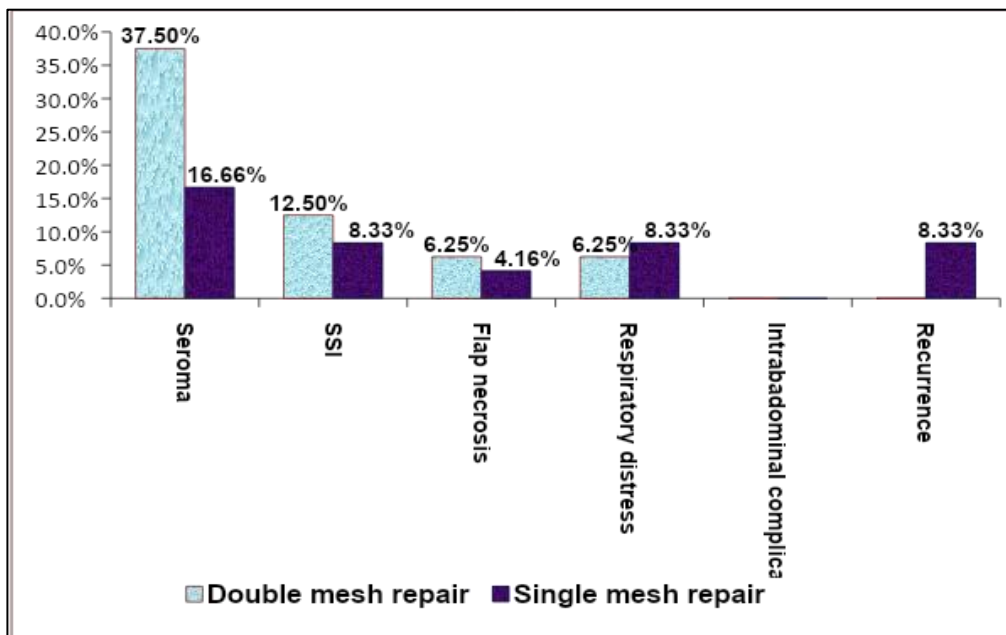
Surgical site infection was the second most common post operative complication in single mesh repair group (8.33%) i.e. 2 patients out of 24 patients. 2 patients had SSI in double mesh repair group, out of 16 patients (12.5%).

Post operative respiratory distress was seen in 1 patient (6.25%) in double mesh repair group and in 1 (4.33%) patient in single mesh repair group.

Flap necrosis was observed in 1 patient in single mesh repair group out of 24 patients (8.33%) as compared to 1 patient in double mesh repair group out of 16 patients (6.35%).

Recurrence occurred in 2 patients (8.33%) in single mesh repair group on 6 month follow up; however, there was no recurrence seen in double mesh repair group.

Overall complication was more and statistically significant in single mesh repair group as compared to double mesh repair group (p = 0.616).



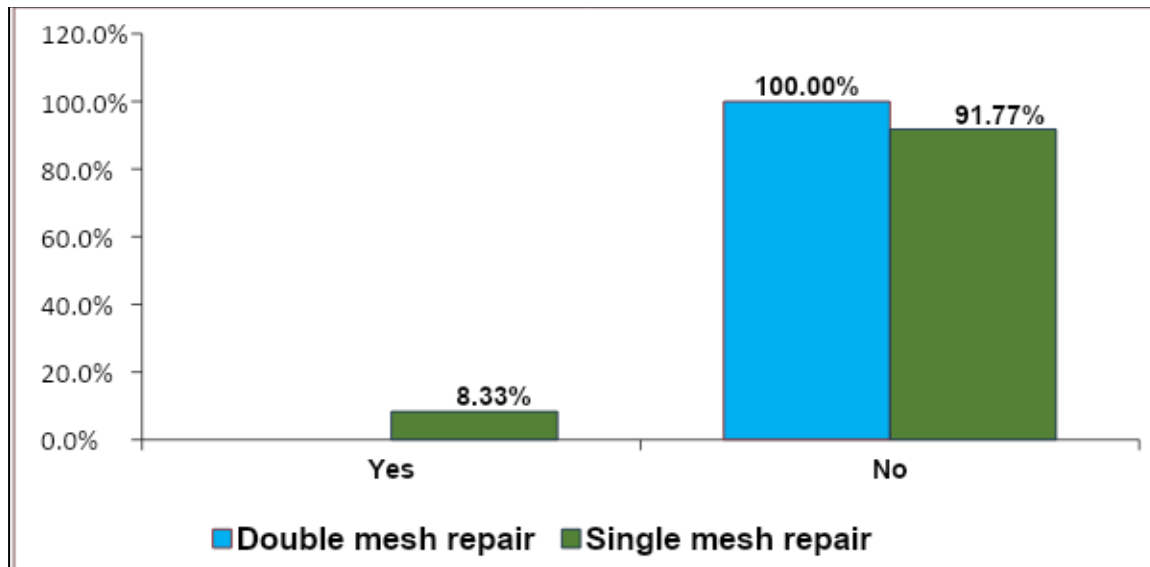
**Table 8:** Comparison of Recurrence in Double Mesh Repair Versus Single Mesh Repair

Recurrence	Double mesh repair (n=16)		Single mesh repair (n=24)	
	No. of patients	Percentage	No. of patients	Percentage
Yes	0	0	2	8.33
No	16	100	22	91.77

p = 0.417, Not significant

Table-8 shows a comparison between double mesh repair technique and single mesh repair technique in terms of recurrence on 6-month follow-up.

There was no recurrence seen in double mesh repair group on 6 months follow up however, there were 2 recurrences in single mesh repair group on 6 months follow-up i.e. 2 patients out of 25 patients (8.33%). It was statistically not significant (p = 0.417).



#### 4. Discussion

In the present study, 40 cases of complex ventral hernia were evaluated with respect to usual age of presentation, incidence on the basis of gender, Body Mass Index (BMI), straining factors, abdominal muscle tone, and size of defect.

A comparative study was done between single mesh repair technique and double mesh repair technique on the basis of post operative complications, recurrences and overall outcome of the procedures on 6 month follow-up.

##### Table 1 (Age incidence)

In this present study, **Table 1** shows the incidence of complex ventral hernia (CVH) in different age groups. We observe that majority of the patients (22 out of 40) were in the age group 41-60 years (55%). No cases were observed in age less than 18 years.

Nikita Kadakia et al.<sup>46</sup> (2020) studied 420 patients observed that majority of patients with complex ventral hernia were in age group 35-55 years.

Mikael Lindmark<sup>42</sup> (2018) conducted a study on 408 patients and observed that majority of patients with complex ventral hernia were in age group 51-65 years. No cases were seen in age less than 18 years.

Konstantin M. Gaidukov<sup>37</sup> et al. (2013) studied 30 patients and observed that most of the patients with complex ventral hernia were in age group 53-69 years and no cases were seen in age less than 18 years.

Ryan Howard<sup>43</sup> et al. (2019) did a cross-sectional analysis of 22664 adult patients of ventral hernia and observed that 50% of the patients were in age group 44-64 years.

The result of our study is consistent with that of the above-mentioned studies.

##### Table 2 (Gender incidence)

**Table 2** shows the incidence of complex ventral hernia on the basis of gender. We observed that the majority of patients were females (24 out of 40) i.e. 60%.

Abdulmajeed Ahmed Alenazietal<sup>40</sup> (2017) did a cross sectional study on 1567 adult patients with ventral hernia and found that ventral hernia was more prevalent in females (63.4%).

Hongwong Wand & Jie Zhou (2018)<sup>41</sup> conducted a study on 1294 patients with complex ventral hernia and observed that the majority of patients were females (67%).

The result of our study is consistent with that of the above mentioned studies.

##### Table 3 (Incidence on basis of BMI)

In this present study, **Table 3** shows incidence of complex ventral hernia on the basis of BMI. We observed that the majority of the patients belong to pre-obese and obese group (75%) i.e. BMI more than 24.99 kg/m<sup>2</sup>. Mean BMI was 29.7 kg/m<sup>2</sup> in our study.

Mikael Lindmark<sup>42</sup> et al. (2018) studied 40 patients with CVH and observed that mean BMI of the patients was 28.7 kg/m<sup>2</sup>.

Ryan Howard<sup>43</sup> et al. (2019) did a cross sectional analysis of 22664 adult patients of ventral hernia and observed that the mean BMI of the patients with CVH was 32.02 kg/m<sup>2</sup>.

K. Strigard<sup>39</sup> et al. (2016) conducted a study on 46 patients of CVH and found that the mean BMI was 31.1 kg/m<sup>2</sup>.

The results of our study were consistent with that of Mikael Lindmark<sup>42</sup> et al., Ryan Howard<sup>43</sup> et al. and K. Strigard<sup>39</sup> et al. From the above mentioned studied, we can draw an inference that incidence of CVH is more in patients who are pre-obese or obese.

**Table 4 (Incidence on basis of straining factors)**

**Table 4** shows the incidence of CVH on the basis of straining factors. We observed that the majority of the patients i.e. 24 patients out of 40 patients (60%) had some straining factor.

R. D. Jayker et al.<sup>48</sup> (2017) studied 50 patients and observed that 31 patients out of 50 had some straining factor (62%).

The result of our study was consistent with that of the above mentioned study.

**Table 5 (incidence on basis of abdominal muscle tone)**

In the present study, **Table 5** shows the incidence of CVH on the basis of abdominal muscle tone. We observed that majority of patients with CVH had decreased abdominal muscle tone (62.5%) i.e. 25 patients out of 40 patients.

K. Strigard<sup>34</sup> et al. (2011) conducted a study on 52 patients in which they observed a statistically significant relationship between decreased abdominal muscle tone and development of CVH (p=0.015).

The above mentioned study showed comparable results with our study.

**Table 6 (incidence on basis of hernial defect size)**

**Table 6** shows that the majority of patients with CVH had transverse hernial defect size in the range 10cm-12.5 cm (70%) i.e 28 patients out of 40 patients. Rest of the patients had a defect in the range 12.5cm-15 cm, however, we observed that the 2 patients who had recurrence after surgery had a defect larger than 12.5 cm. So, we can say that larger hernial defect size is associated with more complications.

KE Poruk<sup>49</sup> et al. (2016) did a study on 228 patients with CVH and observed that patients with larger defects presented with recurrent hernia in future and the result was statistically significant (p=0.007).

So, we can say that larger hernial defect size is associated with more complications and the result of our study is consistent with the above study by KE Poruk<sup>49</sup> et al.

**Table 7 (Comparison of complications)**

**Table 7** shows a comparison between double mesh repair technique and single mesh repair technique in terms of post operative complications.

Our study shows that **surgical site infection** was the second most common post operative complication in single mesh repair group (8.55%) i.e. 12 patients out of 24 patients. 2 patients had SSI in double mesh repair group, out of 16 patients (8.33%). (p=0.6171)

Raafat Y Afifi<sup>30</sup> (2005) did a prospective study between two different techniques for the repair of complex ventral hernia. 41 patients were randomized in 2 groups. Superficial wound infection occurred in two patients (4.8%), one in each group.

Broker<sup>32</sup> et al. (2011) **studied** nine patients (3 women, 6 men). The overall occurrence of wound infections was 44% i.e 4 patients out of 9.

Bantu Rajsiddharth<sup>44</sup> et al. (2019) did a study on 60 patients and found surgical site infection in 6 cases (10%).

The results of our study were consistent with that of Broker<sup>32</sup> et al., however it was different from the studies of Raafat Y Afifi<sup>30</sup> and Bantu Rajsiddharth<sup>44</sup> et al.

This might have been due to:

- A) Different sample size,
- B) Difference in level of asepsis in the operation theatre,
- C) Patient factors such as age, BMI and co-morbidities.

In our study **seroma** was the most common postoperative complication in single mesh repair group(16.66%) i.e. 4 patients out of 24 patients. 6 patients in double mesh repair group had seroma, out of 16 patients (37.5%) (p=0.2808).

M.H. Sodergren<sup>33</sup> (2010) conducted a study in which 8 patients out of 55 patients (14.5%) developed seromas post-operatively.

Raafat Y Afifi<sup>30</sup> (2005) did a prospective study between two different techniques for the repair of complex ventral hernia and observed that seroma formation or hernia recurrence was not found in group B in comparison to 7 cases (17.07%) in group A (p ≤ 0.000).

The results of our study were consistent with that of M. H. Sodergren<sup>33</sup> and Raafat Y Afifi.<sup>30</sup>

In our study **flap necrosis** was observed in 1 patient in single mesh repair group out of 24 patients (4.16%) as compared to 1 patient in double mesh repair group out of 16 patients (6.25%). (p=0.4795).

Novitsky<sup>35</sup> (2012) reported 1 of the 42(0.02%) original patients developed skin flap necrosis.

Harth<sup>36</sup> et al. (2011) presented similar findings when studying the flaps raised during hernia repair.

In our study we found **overall post op complications** to be more in single mesh repair group 14 patients (67.5%) as compared to double mesh repair group i.e. 11patients (15%). (P=0.6106).

In 2011 Broker<sup>32</sup> et al. **studied** nine patients [3 women, 6 men; median age = 62 years (range = 26-77)]. Postoperative complications occurred in 66%.

In 2010 Peter Nau<sup>29</sup> et al. conducted a study on Modified Rives-Stoppa repair or double mesh repair for abdominal incisional hernias. 83 patients were studied. 16 patients (25%) had a complication as a result of double mesh hernia repair.

In all the above studies post operative complications were more in single mesh repair group as compared to double mesh repair group.

In our study, none of the patients in either of the groups suffered any **intra abdominal complications** (0%).

In 2005 Raafat Y Afifi<sup>30</sup> did a prospective study between two different techniques for the repair of a large recurrent ventral hernia: a double mesh intraperitoneal repair versus onlay mesh repair. 41 patients were randomized in 2 groups. There was no intra abdominal complication in the cases subjected to double mesh intraperitoneal repair (0%).

The result of our study is consistent with that of Raafat Y Afifi.<sup>30</sup>

### Table 8 (Comparison of recurrence)

**Table 8** shows a comparison between double mesh repair technique and single mesh repair technique in terms of recurrence. In our study, recurrence occurred in 2 patients (8.33%) in single mesh repair group on 6 month follow up; however, there was no recurrence seen in double mesh repair group. (p=0.417).

Rives et al.<sup>19</sup> (1973) published extensively on the outcome of double mesh repair on this repair and Flament<sup>50</sup> (2002) from this group reported a recurrence rate of 6.7% in over a 10-year follow-up of 693 cases.

Ger<sup>13</sup> (1982) did a study in which 1 recurrence was seen out of 13 patients (7.6%).

In a study conducted by Wantz<sup>28</sup> (1989) out of 340 patients 16 recurrences (4.7%) were seen in single mesh repair method.

Raafat Y Afifi<sup>30</sup> (2005) did a prospective study in which hernia recurrence was not found in group B (0%) i.e. double mesh repair group in comparison to 6 (14.6%) cases in group A i.e. single mesh repair group (p ≤ 0.000).

We observed that recurrence rate is minimal in case of double mesh repair technique in the treatment of CVH. Our results were consistent with that of Rives<sup>19</sup> et al., Flament<sup>50</sup>, Ger<sup>13</sup>, Wantz<sup>28</sup> and Raafat Y Afifi.<sup>30</sup>

## 5. Conclusion

This study was conducted in the department of general surgery at Rajendra institute of medical sciences (RIMS) Ranchi.

The problem of ventral hernia occupies a significant percentage of general surgical problems from ancient time.

Various methods of repair have been done like suture repair, prosthetic mesh repair etc.

Even in mesh repair techniques, variations have been performed. Multiple mesh materials and multiple methods of mesh insertion have been tried but no single method is satisfactory nor become the standard for treatment.

This might be due to unsatisfactory recurrence rates, complications and high rates of morbidity.

In conclusion, this study tried to overcome some of the problems that the surgeon face while repairing a complex large ventral midline hernia.

We used the hernia sac (peritoneum) to bridge the defect and prevent adhesion formation between the intestine and inner mesh layer without any additional cost. On the other hand, we performed a double layer (sandwich) technique with the two meshes separated by the approximated recti muscles. This is supposed to give more strength to the repair.

This technique shows favourable outcome in terms of post operative complications(p=0.616). The recurrence rate was minimal when this technique was employed for the treatment of complex ventral hernia. Hence it appears to be promising with good results regarding deep wound infection and hernia recurrence and might be preferred over single mesh repair technique for the correction of complex ventral hernias.

More detailed significant difference between the above two methods can be obtained by choosing a larger sample size and a longer follow up.

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