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**Original Research Article**

# Self-gripping mesh versus polypropylene mesh in ventral hernia repair: an observational study

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## ABSTRACT

**Background:** To compare clinical outcomes following sutureless Parietex ProGrip™ mesh in ventral hernia repair to traditional lightweight polypropylene mesh secured with sutures.
**Methods:** This was a study conducted at the Department of General Surgery in Velammal medical college from August 2019 to February 2020. This prospective observational study involved, 60 patients, 30 each undergoing ventral hernia repair with polypropylene mesh with suture fixation and Parietex ProGrip™ precut mesh (P group) without fixation. The primary outcome measure was postoperative pain using the visual analog scale were assessed prior to surgery and up to 3 months postoperatively (VAS, 0-150 mm); other outcomes (duration of surgery, wound infection and recurrence of hernia) were assessed up to 3 months postoperatively.
**Results:** Compared to baseline (preoperative), pain score below four on the visual analogue scale was higher in the test group at discharge (76.7%) and 24 hours (96.7%), while the pain was more in the study group at discharge (43.3%) and seven days (70%). The difference between groups was significant at both time points. In the test group, patients without fixation suffered less pain compared to those with single-suture fixation (48 hours: 100% versus 86.6%, p=0.038; 3 months: 100% versus 100%, p≤0.001). Surgery duration was significantly shorter in the test group (<60 minutes) (66.7% versus 40%; p<0.038). No recurrence was observed at three months in both groups.
**Conclusions:** A self-gripping mesh for ventral hernia repair may result in less pain in the early postoperative phase. Recurrence rates reduce as well as the patient's quality of life improves.

**Keywords:** Polypropylene mesh, Self-gripping mesh, Ventral hernia, Quality of life

## INTRODUCTION

Ventral hernias are one of the most common challenging problems which the general surgeons confront. The rate of incidence of ventral incisional hernia in the long term after laparotomy has been reported to be as high as 20% to 25%.[1]

Prior to 1993, all ventral and incisional hernias were repaired with open exposure. Primary suture repair remains one of the oldest techniques. Still, it has been shown to have a high recurrence rate with wide variability, ranging from 8% to 63%.[2,3] The invention of prosthetics has revolutionized ventral hernia repair, leading to a significant reduction in the recurrence rates, ranging as low as 1% to 14% in some studies.[4] Later, randomized controlled trials of mesh-based ventral incisional hernia repair, the recurrence rate was found to be 24% with an appropriate follow-up period of 3 years.[3] This gold standard repair widely reinforces or bridges the defect, with mesh placed posterior to the fascia either in retro rectus, preperitoneal, or intraperitoneal anatomic space. This takes advantage of LaPlace's Law, distributing intra-abdominal pressure across the overlapping mesh instead of only at the hernia defect.[5,6]

The downside of the use of these meshes induced by sutures for ventral hernia repair is the increase of

complications like infections, seroma, fistulas and chronic pain.[7-9] Chronic pain, in particular, is thought to be caused by nerve entrapment or nerve irritation induced by sutures fixing the mesh.[10]

Because of the above mentioned mesh-related complications induced by sutures, especially chronic postoperative pain, a self-gripping mesh (Parietex ProGrip™, Medtronic, Trévoux, France) has been developed.[11] This ProGrip™ mesh combines the properties of a well-known lightweight polyester mesh with a surface of absorbable, polylactic acid microhooks for mesh fixation. Clinical (randomized) studies of this mesh in inguinal hernia repair have shown promising results in terms of infection, chronic pain and recurrence rates.[12-15]

This mesh has shown promising results in several different kinds of abdominal wall hernias.[15,16] To date, there are very few studies which have been conducted on the use of this self-gripping mesh in ventral hernia repair cases. Hence, the aim and objectives of this study were to compare clinical outcomes (postoperative pain, duration of surgery, wound infection and recurrence of hernia at the end of 3 months) following sutureless Parietex ProGrip™ mesh in ventral hernia repair to traditional lightweight polypropylene mesh secured with sutures.

## METHODS

### *Patients*

This was a study conducted at the Department of General Surgery in Velammal medical college from August 2019 to February 2020. All research performed in this study was in strict accordance with a common, pre-defined protocol that was approved by a local institutional review board. All patients provided informed consent before any study-related procedures were performed. This prospective observational study consecutively enrolled 60 patients (above the age of 18 years) with an uncomplicated ventral hernia. The main entry criteria were adults with a ventral hernia (width or length ≤5 cm) who required primary elective repair. Exclusion criteria included patients with a recurrent or complicated hernia (obstruction and strangulation), ventral herniae defect more than 5 cm and patients less than 18 years of age.

Patients were divided into two groups, namely; the control group included 30 patients in whom polypropylene mesh was used with suture fixation for ventral hernia repair, and the study group included 30 patients in whom suture less self-gripping (polyester) mesh was used for ventral hernia repair.

### *Procedures*

Patients who met all study entry criteria underwent preoperative history and physical examination. Patients were electively treated by a single surgeon. The hernia sac was dissected. The open primary repair was first performed with as little tension as possible using a double-stranded 0-nylon continuous closure. ProGrip mesh is a large-pore knitted fabric of monofilament polyester that incorporates resorbable microgrips of polylactic acid on one side that facilitate placement and positioning by encouraging immediate tension-free fixation to surrounding tissue. The resorbable microgrips endow the mesh with self-gripping properties during the first several months after implantation and eliminate or reduce the need for fixation by suture, which may penetrate underlying tissue and damage cutaneous nerves. Mesh density is 75 $g/m^2$ at implantation and 40 $g/m^2$ after absorption. The mesh was placed using the onlay technique over the abdominal wall closure in the subcutaneous prefascial space extending 4-5 cm beyond the wound margins. The grips were placed facing down towards the fascia. To standardize mesh fixation and facilitate mesh placement, the mesh was minimally fixated in four quadrants with resorbable sutures, although this step is not required. A Jackson Pratt subcutaneous drain was placed in 15 patients. After recovery, patients were discharged that day or admitted to the hospital for 24 hour observation.

### *Outcomes*

Patients returned for follow-up visits at 24 hours, 48 hours and three months after surgery which included a patient interview and physical examination.

### *Pain score*

In the postoperative period, the pain was measured in both the study groups by using visual analog scale 17 were 0 (no pain) to 10 (worst pain imaginable) scale. Patients with pain score four or more as per the visual analog scale were taken as significant in the study. Other parameters analyzed were duration of surgery (less than or more than 60 minutes), wound infection and hernia recurrence.

Statistical analysis was performed by an independent biostatistician, who received all data for analysis directly from an electronic database. Continuous variables were reported as mean±standard deviation (SD), and categorical variables were presented as n (%). Longitudinal outcomes were analyzed with repeated measures analysis of variance (ANOVA). Statistical significance was set at $p<0.05$. Statistical analyses were performed using predictive analytics software (version 22; IBM, Inc., Armonk, New York, USA).

## RESULTS

A total of 60 patients (Mean age 62±12 years) with uncomplicated ventral hernia (mean defect size: ≤5cm) were treated. Baseline patient characteristics are presented in Table 1.

Among the control group, the majority were 12 (40%) in the 41-50 years age group followed up by 51-60 years

(23.34%) and 61-70 years (16.67%). Among the study group, majority 10 (33.33%) were in 31-40 years age group and the proportion of 51-60 years and 61-70 years age group was 9 (30%) and 6 (20%) respectively (Table 1).

**Table 1: Age distribution in the study between study groups (n=60).**

| Age groups (in years) | Control (n=30) (%) | Study group (n=30) (%) |
|---|---|---|
| **20-30** | 2 (6.67) | 1 (3.34) |
| **31-40** | 2 (6.67) | 10 (33.33) |
| **41-50** | 12 (40) | 2 (6.67) |
| **51-60** | 7 (23.34) | 9 (30) |
| **61-70** | 5 (16.67) | 6 (20) |
| **71-80** | 2 (6.67) | 0 (0) |
| **81-90** | 0 (0) | 2 (6.67) |

Majority 18 (60%) people reported duration of surgery as >60 minutes in the control group, but in the study group, majority 20 (66.7%) reported it as <60 minutes. The difference in duration of surgery between groups as statistically significant (P value=0.038) (Figure 1).

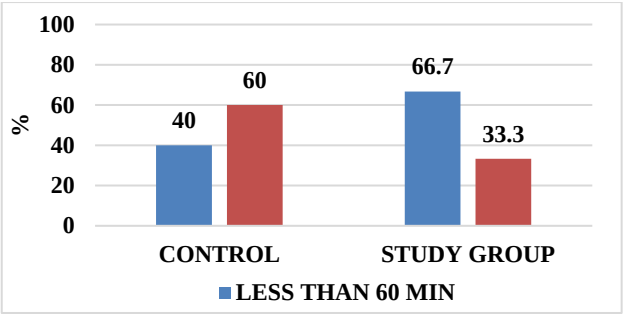


**Figure 1: Distribution of duration of surgery between study groups (n=60).**

In controls pain score was >4 in majority 17 (56.7%) people at baseline, 21 (70%) reported <4 pain score at 24 hours, 26 (86.7%) reported <4 pain score at 48 hours and all 30 (100%) reported at 3rd month. In study group pain score was >4 in majority 23 (76.7%) people at baseline, 29 (96.7%) reported <4 pain score at 24 hours and all 30 (100%) reported at 48 hours and 3rd month (Table 2).

There was no wound infection and recurrence observed in both the groups (Table 3).

**Table 2: Comparison of pain score between the study groups.**

| Pain score | Study group (n=30) | | Chi square | P value |
|---|---|---|---|---|
| | Control group (%) | Study group (%) | | |
| **Baseline** | | | | |
| **Less than 4** | 13 (43.3) | 23 (76.7) | 6.944 | 0.008 |
| **More than 4** | 17 (56.7) | 7 (23.3) | | |
| **At 24 hours** | | | | |
| **Less than 4** | 21 (70.0) | 29 (96.7) | 7.680 | 0.012 |
| **More than 4** | 9 (30.0) | 1 (3.3) | | |
| **At 48 hours** | | | | |
| **Less than 4** | 26 (86.7) | 30 (100) | * | * |
| **More than 4** | 4 (13.3) | 0(0) | | |
| **At 3rd month** | | | | |
| **Less than 4** | 30 (100) | 30 (100) | * | * |
| **More than 4** | 0(0) | 0(0) | | |

*No statistical test was applied-due to 0 subjects in the cell.

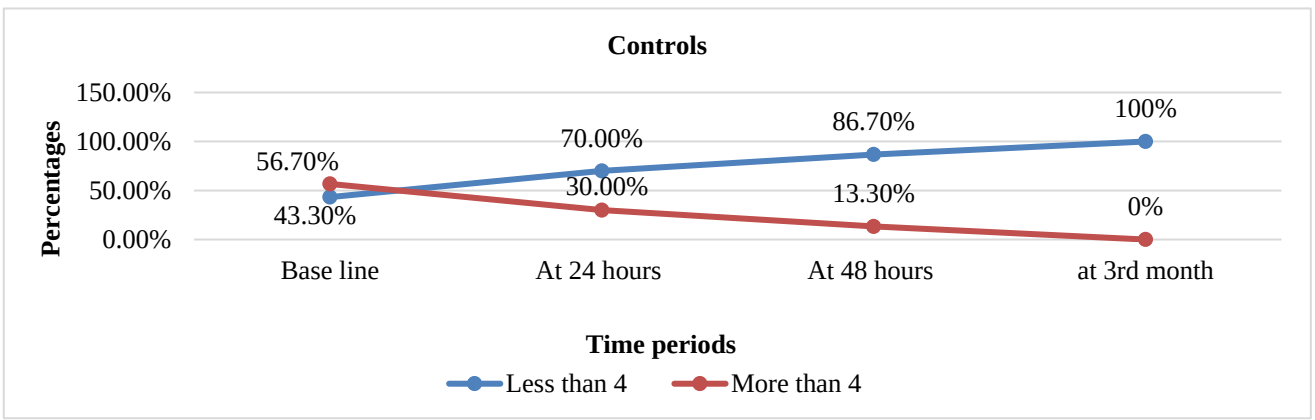


**Figure 2: Pain score distribution in control group (n=30).**

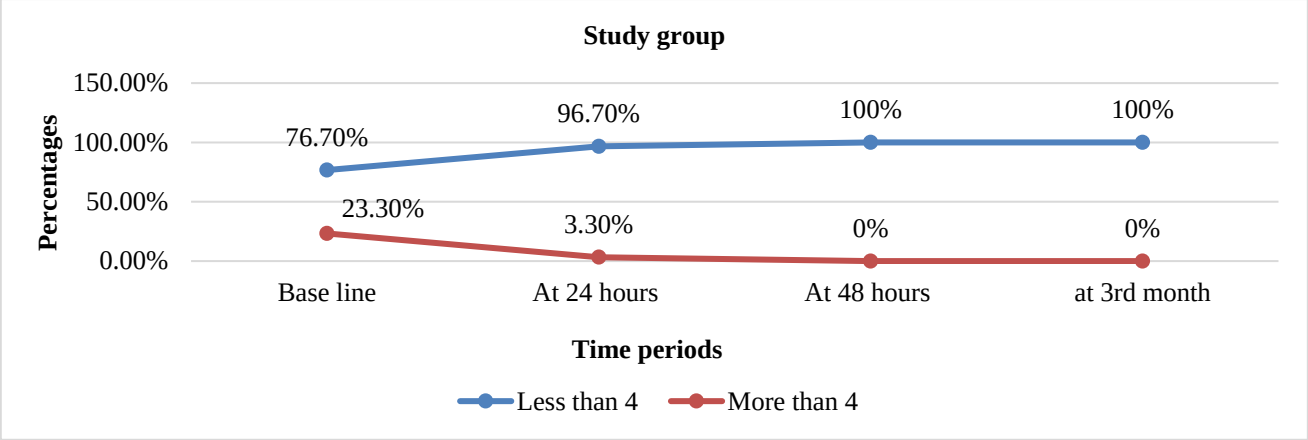


**Figure 3: Pain score distribution in the study group (n=30).**

**Table 3: Comparison of diagnosis between the study groups (n=60).**

| Parameter | Study group (n=30) | |
|---|---|---|
| | Control group (%) | Study group (%) |
| **Wound infection** | | |
| **Present** | 0 (0) | 0 (0) |
| **Absent** | 30 (100) | 30 (100) |
| **Recurrence** | | |
| **Present** | 0 (0) | 0 (0) |
| **Absent** | 30 (100) | 30 (100) |

No statistical test was applied-due to 0 subjects in the cell

## DISCUSSION

The preliminary results of this study are promising and show advantages over the innovative self-gripping mesh. Duration of surgery is significantly shorter. The time necessary to spread out the mesh and fix it is less than 1 minute with the described technique. This short time necessary for mesh fixation reduces the time of mesh exposure and could reduce sepsis complications. This is in accordance with a study done by Wang who said that the mean operation time in for all their hernia repairs using the self-gripping mesh was only 32±8.15 minutes.[17]

The immediate postoperative pain and pain at discharge was reduced in comparison with the control group as described by the patients. This can be attributed to the lack of tension during mesh positioning and closure that can reduce the pain generated by the tension created on surrounding tissues and more particularly, the sutures are avoided. The grip fixation provides the advantage of obtaining fixation on the whole surface of the mesh. At three months from the time of surgery, no patient-reported pain. Chronic pain is perhaps the most serious adverse outcome after ventral hernia repair. With this mesh, we noticed an improved quality of life of the patients by a reduction in the postoperative pain.

In our study, it was noted that on post-operative day (POD) 0, a pain score of less than four was seen in 13 patients in the control group and 23 patients in the study group. A pain score of more than four was seen in 17 patients and seven patients in the control and study group, respectively. These findings are in accordance with observations done by Hopson and Miller.[18]

In our study, it was noted that the pain scores up to 24 hours, a pain score of less than four was seen in 21 patients in the control group and 29 patients in the study group. A pain score of more than four was seen in 9 patients and one patient in the control and study group, respectively. A similar observation was noted in a study done by Hopson and Miller.[18]

In our study, it is observed that the pain scores up to 48 hours, a pain score of less than four was seen in 26 patients in the control group and 30 patients in the study group. A pain score of more than four was seen in 4 patients in control, and none in the study group. Observations were noted in a study done by Hopson and Miller had a similar outcome which is in accordance with our study. In our study, the pain score after three months of surgery, all the patients in the control group and study group had the pain score less than 4. Similar observations are noted in a study done by Hopson and Miller.[18]

In our study, it is noted that there is no incidence of wound infection. This is in contrary to the study done by Hopson and Miller. We observed that there is no incidence of mesh rejection or foreign body sensation in our study. Similar results were noted in studies done by the same group of researchers.[18]

In our study, the duration of surgery was observed to be 12 patients in the control group, and 20 patients in the study group were operated in less than 60 minutes, and 18 patients in the control group and ten patients in the study group were operated for more than 60 minutes. This shows a statistical significance of less operating time in the study

population with a P value of 0.038. Similar observations were noted in studies done by Hopson et al and Peter.[19].

## CONCLUSION

This study shows the promising use of the ProGrip™ mesh for ventral hernias. Because of the self-gripping surface of the mesh, use sutures or tackers can be omitted. This makes the mesh easy and fast to use. Furthermore, it decreases the chance of postoperative pain and discomfort. It improves the quality of life of the patients by decreasing the recurrence of hernias as well. Future long-term studies on a larger sample population can be conducted to validate further and analyze the efficacy of the ProGrip™ mesh.

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