

## Original Article

## Hybrid Technique Repair of Ventral and Midline Incisional Hernias — Experience from Rural Hernia Surgical Center

Srikanth Marthandam<sup>1</sup>, Mallikarjun Gunjiganvi<sup>2</sup>, Pavithra Balakrishna<sup>2</sup>, Harshavardhan Vangara<sup>3</sup>

## Abstract

**Background :** Hybrid repair is increasingly becoming common technique in patients with large ventral and incisional hernias. It reduces length of hospital stay, postoperative pain, complications. Main advantages are avoidance of larger scars, effective fascial closure, cosmetic acceptance, and less surgical challenge as intra-corporeal suturing could be avoided. Hence, aim of this study was to assess technical feasibility, patient safety and complications using hybrid technique of hernia repair in patients with ventral and midline incisional hernias.

**Materials and Methods :** Retrospective analysis of data of patients with midline abdominal wall hernias (vertical defect size >4cm and <8cm and width <4cm) visiting rural hospital with facility for hernia repair from 2018 through 2021 were included in the study. Patient demographics, BMI, previous surgeries, co-morbidities, operative time, length of hospital stay, post-operative complications, and recurrence were assessed.

**Results :** Data of 112 patients were analyzed. Mean age was  $47 \pm 12.34$  years, females were 58. The mean hernia defect size was  $22.95 \pm 5.06$  cm<sup>2</sup>. Mean operating time was  $100.54 \pm 15.47$  minutes. Four patients were converted to open repair. The mean length of stay was  $5.61 \pm 2.31$  days. One patient had injury to inferior epigastric vessel intra-operatively; and in the postoperative period, one patient developed spontaneous pneumothorax which was managed conservatively and another patient succumbed to pulmonary embolism. Of 4 patients converted to open technique, two developed seroma, of which one patient had Clavien Dindo class 1 surgical site infection.

**Conclusion :** Hybrid repair for midline ventral and incisional hernias appears to be safe and reproducible. It also overcomes technically difficult to reduce hernias requiring extensive adhesiolysis. It offers all advantages of laparoscopic repair minimizing the risks associated with it.

**Key words :** Hybrid Repair, Ventral Hernia, Incisional Midline Hernia.

European Hernia Society (EHS) and American Hernia Society (AHS) guidelines are recommended for classification and management of abdominal wall incisional or primary midline hernias<sup>1</sup>. Repair of these hernias has undergone paradigm shift from open onlay mesh repair to sublay mesh repair to Intraperitoneal Onlay Mesh Repair (IPOM), laparoscopic retrorectus repair, ventral transabdominal pre-peritoneal repair and many newer techniques including robotic approaches<sup>2,3</sup>.

The advantages of IPOM are lesser steep learning curve compared to other advanced minimally invasive hernia repair techniques including IPOM-plus, and

## Editor's Comment :

- Hybrid technique repair offers a versatile and effective approach for all giant ventral, midline and incisional hernias, leveraging the strengths of both open and laparoscopic methods, providing a balance between durability and minimally invasive benefits to reduce complications and improve patient outcomes.

offers all benefits of laparoscopic hernia surgery – less operative time, less postoperative pain, early mobilization, and shorter hospital stay<sup>4,5</sup>. The main disadvantages of IPOM are postoperative bulging at the ventral/ incisional hernial sites, seroma, pseudo-recurrence, meshoma due to improper placement of tackers or trans-fascial sutures, and the cost of the composite mesh. This bulging can be addressed by IPOM-plus and seromas are less<sup>6,7</sup>.

Although EHS and AHS guidelines recommend closure of fascial defects when feasible to decrease the postoperative Surgical Site Occurrences (SSO)<sup>8</sup>, its technical challenge in laparoscopic IPOM-plus. In few cases reduction of hernial sac contents is technically demanding and difficult adhesiolysis

Department of General Surgery, AIIMS, Mangalagiri, Andhra Pradesh 522503

<sup>1</sup>MS, Faculty and Corresponding Author

<sup>2</sup>MS, Associate Professor

<sup>3</sup>MBBS, Resident, Department of General Medicine, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, Andhra Pradesh 533201

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results in dreaded complications – bowel injuries, and unnecessary enterotomies. To minimize these risks techniques such as laparoscopically assisted approach or limited conversion or hybrid approach have been described<sup>9-11</sup>.

Hybrid technique utilizes both laparoscopic sac reduction, adhesiolysis and visualization of intra-abdomen aided by limited mini laparotomy and followed by laparoscopic mesh placement. These offer safe alternative to formal laparotomy in incarcerated hernias or in patients requiring extensive bowel adhesiolysis<sup>12</sup>. Defect closure using hybrid repair is shown to reduce adverse SSOs in few studies<sup>13-15</sup>. At present the data on outcomes of hybrid technique for ventral/ midline incisional hernias is evolving. In this retrospective analysis we described technique of and intra- and postoperative complications of ventral and midline incisional hernias using novel hybrid approach.

## MATERIALS AND METHODS

This retrospective study analyzed the data of patients with ventral or midline abdominal incisional hernias visiting the facility for hernia repair between April, 2018 to October, 2021 at rural surgical setup of southern India.

### Inclusion Criteria :

Patients with meeting following criteria were included.

- (1) EHS M3 – umbilical hernia (from 3 cm above till 3 cm below the umbilicus),
- (2) EHS M4 – infraumbilical hernia (from 3 cm below the umbilicus till 3 cm above the pubis),
- (3) EHS W1 – width of hernia, <4cm size of hernia defect,
- (4) Additionally, above hernias with vertical defects between 4cm and 8cm were included.

### Exclusion criteria :

Following patients were excluded from the study.

- (1) Patients who underwent previous umbilical or infraumbilical hernia repairs by (a) IPOM technique or (b) IPOM plus technique.
- (2) Unfit for general anesthesia.

All these patients underwent surgery under free government scheme. Data of patient demographics,

occupation, duration of hernia, previous surgeries, co-morbidities, imaging details, operative time, length of hospital stay, postoperative complications and recurrence at 6 months was collected and analyzed.

**Imaging :** Every patient who had hernia had an initial abdominal ultrasound with a thorough evaluation of the abdominal wall defects. In few patients, plain computed tomography was also done when needed to improve the delineation of defects on a case-by-case basis.

**Mesh :** A rectangular shaped composite 3D dual mesh (parietal – polyester, visceral – polyurethane) of size 7.5x15cm pre-fitted with polyester sutures at 4 corners was used in all cases.

**Surgical Technique :** Surgery was performed under general anesthesia with patient placed in supine position with left hand tucked alongside the patient. Prophylactic antibiotic was administered just after intubation. Nasogastric tube was placed and confirmed, Foleys catheter was placed, and surgical site was prepared and draped. Laparoscopic monitor was placed on the patients right-side and procedure performed in following steps.

*Step 1 – Laparoscopic approach:* Standard pressure pneumoperitoneum (14-15mmhg) was created using Veres needle through Palmer's point followed by port placements as shown in Fig 1-a. Diagnostic laparoscopy was performed with reduction of hernia sac contents (Figs 1-b, 1-c) and parietal wall and bowel/omentum adhesions if any were released. Entire anterior abdominal wall was inspected for any occult hernias.

*Step 2 – Combined laparoscopic and transcutaneous approach:* Hernia defect vertical length and width were measured. Multiple transcutaneous 1-0 polypropylene sutures were placed through hernia defect edges through stab incisions using suture passer as described in Fig 2.

After placing all transcutaneous hernia edge sutures, pneumoperitoneum was reduced to 8-10mmhg and all these sutures were tied and buried (Figs 1-d, 1-e).

Alternatively, in cases where contents could not be reduced through totally laparoscopic approach (Fig 1-j), 3-4cm mini-incision (Fig 1-k) was made, sac was dissected, contents were reduced (Fig 1-l), followed by hernial defect closure using 1-0 polypropylene suture (Fig 1-m).

**Step 3 – Laparoscopic approach:** The dual mesh was inserted into the peritoneal cavity through 10mm port (Fig 1-f) and apposed to the anterior abdominal wall centering over the closed hernial defect and four sutures at the corners of the mesh were brought out through stab incisions for trans-fascial fixation and additional trans-fascial sutures were taken along the edges of mesh, (Figs 1-g; 1-m, 1-n). Proper mesh apposition was confirmed and no tackers were used (Fig 1-h), pneumoperitoneum was released, fascial closure of 10mm port was done, followed by skin closure of all ports (Figs 1-i, 1-o).

**Postoperative care :** All patients were mobilized the same day and allowed liquid diet on day-1 and if tolerated regular diet was allowed. Three doses of intravenous antibiotics were administered in the peri-operative period. After discharge, patients were followed up at one week, 1 month, 3 months and at 6 months postoperatively. Postoperative complications and SSO were recorded.

**Pain management :** All patients received intravenous inj. Diclofenac sodium 50mg every 8th hourly on 1st post-operative day and were given tablet diclofenac from 2nd postoperative day on need basis. No patients received any opioid analgesia.

**Data Collection and statistical analysis :** The data was collected in predefined proforma, analyzed using Microsoft excel. Categorical variables were summarized as frequencies and proportions whereas the continuous variables were summarized as mean (SD) or median (IQR) based on the normal distribution of data.

## RESULTS

Data of total of 112 patients were included and analyzed (Table 1). The mean age of the study group was  $47.35 \pm 12.34$  years. There was equal distribution of both sexes (females - 58, males - 54). All patients were either homemakers or farmers. The mean BMI of the patients was  $22.23 \pm 1.98$  kg/m<sup>2</sup>. Presenting symptom was only swelling in 64 patients and in the remaining 48 patients there was associated mild discomfort or vague pain along with swelling. The median duration of the hernia was 10 (6-12) months. 74 patients had history of undergoing previous open surgery. None of these patients could recollect any Surgical Site Infection (SSI) during these surgeries. There were 81 patients who were either hypertensive or diabetic. Forty-one males were smokers. A total of 40 patients had EHS type M3 and 72 patients had



Fig 1 — Technical details are described in the text: a) EHS M3 defect, b) laparoscopic view of sac with contents, c) hernia sac after content reduction, d) transcutaneous sutures through hernia defect edges placed with laparoscopic assisted e) hernia site after defect closure f) dual mesh in peritoneum g) trans-fascial sutures of mesh edges and additional trans-fascial sutures before tying h) mesh apposition to parietal wall centred over hernia defect, i) post procedure completion. Figs j-o: incarcerated hernia steps – mini-laparotomy incision (k), sac dissection (l), defect closure (m), trans-fascial sutures (n) and post procedure appearance (o). [(Figs a, d, e, f, g, h, and i are from same patient and Figs b, c another patient), (Figs j, k, l, and o are from same patient, m and n another patient)].

Table 1 — Demographics and baseline details.

| Parameter                                    | N=112             |
|----------------------------------------------|-------------------|
| Age (mean $\pm$ SD) years                    | 47.35 $\pm$ 12.34 |
| Sex :                                        |                   |
| Female                                       | 58                |
| Male                                         | 54                |
| Occupation :                                 |                   |
| Farmer                                       | 88                |
| Homemaker                                    | 24                |
| BMI kg/m <sup>2</sup> (mean $\pm$ SD)        | 22.23 $\pm$ 1.98  |
| Presenting                                   |                   |
| Swelling only                                | 64                |
| symptoms Swelling with associated vague pain | 48                |
| H/o Previous Surgery                         | 74                |
| Co-morbidities                               | 81                |
| EHS type :                                   |                   |
| M3                                           | 40                |
| M4                                           | 72                |
| Duration of Hernia (median, (IQR)) months    | 10 (6-12)         |
| Hernia                                       |                   |
| Vertical length (v) (mean $\pm$ sd) cm       | 6.10 $\pm$ 0.96   |
| Defect size                                  |                   |
| Width (w) (mean $\pm$ SD) cm                 | 3.74 $\pm$ 0.44   |
| Defect size (v x w) cm <sup>2</sup>          | 22.95 $\pm$ 5.06  |

SD : Standard Deviation, BMI: body mass index, EHS: European Hernia society, M3: umbilical hernia, M4: infraumbilical hernia, IQR: Inter Quartile Range, v: vertical length of hernia defect, w: width of hernia defect, cm: centimeters

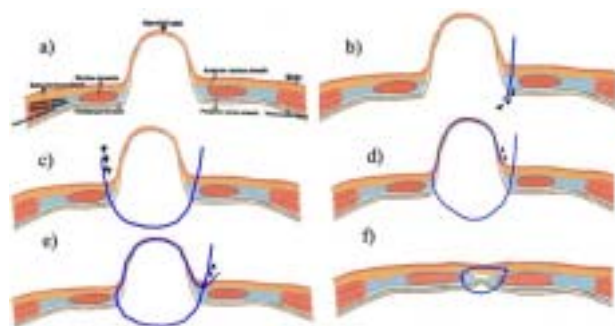


Fig 2 — Transcutaneous hernia defect closure: Suture is passed from outside through one edge of defect (b) and brought out through other edge of defect (c), then suture is advanced through skin and hernia sac as in (d) followed by suture ligation and burying in subcutaneous plane as in (e) and (f).

EHS type M4 hernias. The average size of vertical length hernial defect size was  $6.10 \pm 0.96$  cm, width was  $3.74 \pm 0.44$  cm, defect size was  $22.95 \pm 5.06$  cm<sup>2</sup>.

**Outcomes :** Outcomes are described in Table 2.

**Mean operating time** – The mean operation time in the study population was  $100.54 \pm 15.47$  minutes.

**Mini laparotomy** – Only 31 patients required targeted mini laparotomy to reduce hernia contents. In remaining patients' defect was approximated using only transcutaneous approach. **Conversion to open technique:** All patients could effectively be managed by hybrid approach except in 4 cases who required conversion to open only mesh repair because of technical difficulty. **Length of hospital stay:** The median length of hospital stay was 5 (4-6) days. The patient who developed spontaneous pneumothorax stayed for 10 days, patient with seroma stayed for 10 days and patient with superficial SSI stay for 6 days.

**Complications :** There was injury to inferior epigastric artery in 1 patient while taking trans-fascial suture and bleeding was controlled with bipolar electrocautery device. Only 2 cases of open mesh repair developed seroma. Both cases were managed expectantly. One of these seroma patients developed superficial surgical site infection (grade I Clavien Dindo) which was managed with regular dressing. One patient developed right sided spontaneous pneumothorax (could be ruptured small pulmonary bulla) which was noticed on 2nd postoperative day as patient experienced chest pain and cough; managed conservatively with discharge on 10th post-operative day. Another patient developed pulmonary embolism on 3rd post-operative day and subsequently succumbed during the hospital courses.

Table 2 — Outcome measures

| Measure                           | N                  |
|-----------------------------------|--------------------|
| Mean operating time (minutes)     | $100.54 \pm 15.47$ |
| Average operating time/patient    |                    |
| <90 min                           | 46 patients        |
| 91-100 min                        | 47 patients        |
| 101-120 min                       | 16 patients        |
| >120 min                          | 3 patients         |
| Conversion to open                | 4 patients         |
| Intra-op complications            |                    |
| Inferior epigastric artery injury | 1 patient          |
| Non-surgical complications        |                    |
| Spontaneous Pneumothorax          | 1 patient          |
| Pulmonary embolism                | 1 patient          |
| Mean length of hospital stay      |                    |
| Mean $\pm$ SD (days)              | $5.61 \pm 2.31$    |
| Median (IQR) (days)               | 5 (4-6)            |
| Average length of stay/patient    |                    |
| 3 days                            | 1                  |
| 4-6 days                          | 99                 |
| 7-9 days                          | 7                  |
| 10-12 days                        | 5                  |
| Mortality                         | 1                  |
| Surgical site occurrences         |                    |
| Seroma                            | 2                  |
| SSI infection                     | 1                  |
| Recurrence                        | 1                  |

SD: Standard Deviation, IQR: Inter Quartile Range, SSI: Surgical Site Infection

**Recurrence :** Only one patient had recurrence at 6 months of follow up period. This patient was 31 years old female with BMI of 27 kg/m<sup>2</sup> with vertical hernial defect size of 6 cm and later was managed with open onlay repair.

## DISCUSSION

The midline abdominal incisional or ventral hernias management is witnessing paradigm shift with newer techniques and approaches. The evolving evidence on safety and advantages of hybrid repairs in technically difficult IPOM-plus approach effectively avoids open repair technique. In this novel hybrid technique safety, perioperative complications and short-term outcomes were studied.

The hybrid repair combines both laparoscopic and open approaches and has advantages of both approaches. The first description of hybrid technique of repair for recurrent incisional hernias and procedural safety was published in 2009. In this series, total of 6 patients were included, with an average defect size of 116 to 187 cm<sup>2</sup> and a 24-36 cm double-layer Polytetrafluoroethylene (PTFE) mesh was used<sup>11</sup>. In our study mean vertical hernia defect size was  $6.10 \pm 0.96$  cm, width was  $3.74 \pm 0.44$  cm, defect size was  $22.95 \pm 5.06$  cm<sup>2</sup>. This procedure



was relatively easy with mean operating time  $100.54 \pm 15.47$  min and 4 patients were converted to complete open onlay repair. Also, procedure was safe with no inadvertent visceral injuries and inadvertent injury to inferior epigastric artery in one patient. Two patients in converted to open repair developed SSOs (seroma) of which one had superficial SSI (grade I Clavien Dindo) and one patient had recurrence at 6 months. The findings of our study are similar to the published literature, in term of operative time and complications<sup>16</sup>.

Our technique adhered to the recommended guidelines of fascia closure<sup>8</sup>. This novel technique as described in Fig 2 effectively approximated hernia defects using transcutaneously placed sutures overcoming the challenge of intracorporeal suturing and followed by IPOM mesh placement. The hernia defect edges approximation could be reproduced in all cases with ease. Though surgical guidelines recommend the closure of fascia to prevent, reduce the hernia recurrences, a randomized study with long term follow up with median follow-up period of 87 months, with 125 patients completing follow up, found no differences between hybrid repair with fascia closure versus laparoscopic IPOM repair<sup>13</sup>.

The laparoscopic step in this hybrid repair offers all the benefits of the minimally invasive hernia surgery – visualizes intra-abdominal pathologies, identifies multiple abdominal wall defects, less tissue trauma, less tissue dissection hence less post-operative pain, and shorter hospital stay<sup>14,15</sup>. The length of hospital stay was  $5.64 \pm 2.31$  days. Though we did not use the visual analogue score for pain calculation, most of the patients did not require analgesics for long time.

A systematic review of hybrid repair for incisional hernias of the abdominal wall analyzed data of 232 patients post complications and recurrence rates. The reported incidences of complications were seroma formation (5.47%), wound infections (6.53%) and chronic pain (4.49%); and recurrence was seen in 3.29% of patients<sup>17</sup>. Another systematic review and meta-analysis of hybrid repair for incisional hernia for intra- and post-operative complications studied data of 1681 patients from 11 published studies. The incidence of pooled intra-operative complication rate was 1.8% in hybrid repairs compared to laparoscopic repairs of 2.8%. The postoperative prevalence of surgical site occurrences (hybrid 23% versus laparoscopic 26%,  $p = 0.02$ ) and surgical site occurrences requiring interventions (hybrid 1.5%

versus laparoscopic 4.1%,  $p < 0.01$ ) were significantly less in hybrid repair compared to laparoscopic repair. Though majority of studies included in the analysis were retrospective, data favored the safety and efficacy of hybrid repair in abdominal wall incisional hernias<sup>15</sup>.

Hence, hybrid approach is technically easier – easily reproducible as proper approximation of hernia defects could be achieved with novel transcutaneous sutures or through mini-laparotomy overcoming the challenge of intracorporeal suturing of abdominal wall, and help in appropriate mesh placement; safer – can completely visualize the whole abdomen, potentially minimizes risks of enterotomies, or other injuries and further the targeted mini-laparotomy can be used in incarcerated hernias or difficult to reduce hernias or for difficult adhesiolysis; and better short-term outcomes as it decreases length of stay, post-operative pain, and postoperative SSOs.

#### Limitations :

Our study had few limitations. This was retrospective analysis and hence potential for selection bias. Only available data of patients was included hence small sample size. The patient included were all operated under government free scheme hence had to stay longer for administrative reasons including procedural approvals. In this study standard pain calculation was not done as no such protocol was existed for analgesics. We only included vertical defect sizes  $< 8$  cm and width of  $< 4$  cm as only the above mentioned IPOM mesh size was available in our hospital under government scheme. Nonetheless, this technique could be extended with caution to larger defects provided primary fascial closure is achieved and larger and longer follow up studies are required to assess benefits in long-term SSOs.

#### CONCLUSION

In conclusion, the results of study demonstrated this novel hybrid repair technique was safe and offers all the benefits of minimally invasive surgeries in difficult to reduce hernias and difficult adhesiolysis with acceptable postoperative complications and could be reproducible with relative ease by novice hernia surgeons and in rural hernia set up with basic laparoscopic training. Technique is safer with less length of hospital stay and favourable postoperative recovery.

**Data availability :** The data sets analysed during the current study are available from the corresponding author.

**Conflicts of Interest :** The authors declare that no competing interests exist.

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