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Reconstruction following full-thickness excision of abdominal wall tumors: A prospective observational study conducted in a tertiary care Government Hospital in Eastern India

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ABSTRACT

Background: Reconstruction of abdominal wall defects following full-thickness excision of large tumors (primary or metastatic) has always been a challenge for the treating surgeon. A number of reconstructive techniques have been described in the literature, including different types of meshes, flaps, and component separation techniques (anterior and amp; posterior), with varying results. We conducted a prospective observational study of our three-layer technique of abdominal wall closure at Medical College Hospital, Kolkata, to assess the long-time success of the procedure, especially in terms of hernia rates. **Aims and Objectives:** Reconstruction of abdominal wall defects following full-thickness excision of large tumors (primary or metastatic) has challenged surgeons for long, with several reconstructive techniques being described, with varying results. We conducted a prospective observational study of our three-layer technique of abdominal wall closure at Medical College Hospital, Kolkata, to assess the long-time success of our procedure, especially in terms of hernia rates. **Materials and Methods:** Thirteen patients with abdominal wall primary and isolated metastatic tumors were included from January 2017 to January 2022 with follow-up period from 8 to 60 months. Tumors were dermatofibrosarcoma protuberans, sarcomas, desmoid tumors, and two abdominal wall metastases. All patients in our study underwent computed tomography scan, core needle biopsy, and immunohistochemistry for better surgical planning. **Results:** Eight patients were male and five were female with mean age of 39 years and mean defect size of 10 cm. Polypropylene mesh was used, size varying from 15 × 15 to 30 × 30 cm with average operative time of 210 min. Post-operative superficial wound infection in 2 (15%), partial flap necrosis in 1 (7.6%), and tumor recurrence in one patient (7.6%) were seen. **Conclusion:** For closure of such large abdominal wall defects, our three-layer reconstructive technique has shown good results in terms of zero hernia rates. We recommend our method of closure, where affordability of biological meshes, availability of expensive meshes, accessibility to plastic and reconstructive surgeons or non-acquaintance with complex closure techniques are present.

Key words: Abdominal wall defect; Flaps; Meshes; Hernia

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INTRODUCTION

Abdominal wall tumors can broadly be divided into primary and metastatic tumors. Primary tumors can arise from any layer of the abdominal wall (skin and subcutaneous tissue, muscle, fascia, and the peritoneum). Common metastatic lesions usually arise from gastrointestinal, hepatobiliary and gynecological malignancies. Pathologically too, these

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tumors can be divided into benign (lipoma, fibroma, and hemangioma), borderline dermatofibrosarcoma protuberans (DFSP) (Figure 1) and Desmoid tumors), and malignant tumors (leiomyosarcoma and fibrosarcoma).[1]

Surgical excision remains the treatment of choice for primary abdominal wall tumors, as also for malignancies which have isolated metastasis to the abdominal wall. Excision depends on the location of the tumor, whether excision will entail a partial or full-thickness abdominal wall reconstruction and the involvement of underlying viscera which may be removed en block. Hence, these patients should get a pre-operative imaging (Computed tomography [CT] scan/MRI scan) done for better planning of skin incision, excision of tumor, and reconstruction. Along with a CT scan of the abdomen, a CT scan of the thorax should also be done to rule out disseminated disease before embarking on a definitive surgical procedure.

A number of defect classification systems have been published to aid the plastic surgeon in reconstruction. Mathes et al., have put forth a system based on location of abdominal wall defect.[2]

- Zone 1A – upper midline defect extending across the midline
- Zone 1B – lower midline defect extending across the midline
- Zone 2 – upper quadrant defect of the abdomen
- Zone 3 – lower quadrant defect of the abdomen.

MD Anderson classification divides the abdominal wall into four surface area types.

- Type 1 – located within the two semilunar lines in the midcentral abdomen
- Type 2 – lateral to the semilunar lines
- Type 3 – cephalad to type 1 to the xiphoid process
- Type 4 – caudal to type 1 from arcuate line to pubic symphysis.

Figure 1: Dermatofibrosarcoma protuberans of anterior abdominal wall

A third classification divides the abdominal wall into three subtypes depending on the depth of involvement of the tumor. Type A involves skin and subcutaneous tissues only, type B involves musculofascial abdominal wall while type C involves the skin, subcutaneous tissue, and any component of the musculofascial abdominal wall.[3]

Keeping in mind the goals of abdominal wall reconstruction, which are to restore fascial integrity, protect the underlying viscera, provide coverage, restore function, and prevent hernia formation, various closure techniques have been described in the past, including component separation techniques (both anterior and posterior), omental flap-mesh repair, and pedicled or free flaps.

Aims and Objectives

Reconstruction of abdominal wall defects following full-thickness excision of large tumors (primary or metastatic) has challenged surgeons for long, with several reconstructive techniques being described, with varying results. We conducted a prospective observational study of our three-layer technique of abdominal wall closure at Medical College Hospital, Kolkata, to assess the long-time success of our procedure, especially in terms of hernia rates.

MATERIALS AND METHODS

Pre-operative examination

A CT scan of abdomen and thorax was performed in every patient preoperatively to assess the size of defect, depth of involvement of abdominal wall, infiltration into underlying viscera, and to rule out disseminated disease (Figures 2 and 3). After having ruled out distant spread and ascertaining the involvement of the abdominal wall, all 13 patients underwent definitive surgical treatment.

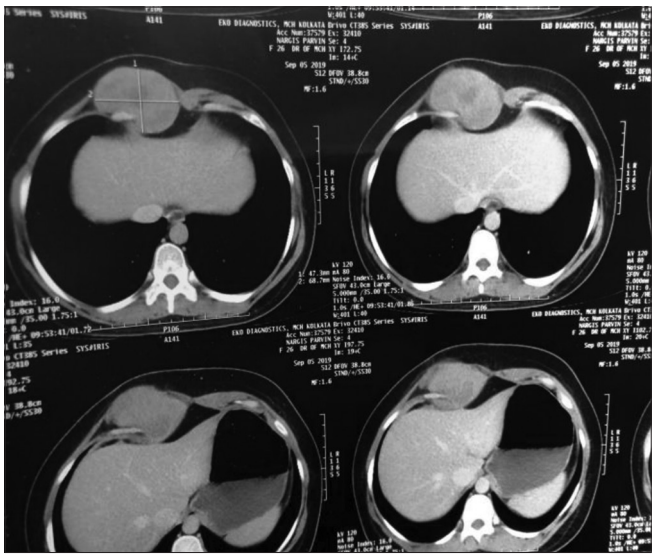


Figure 2: Pre-operative computed tomography images of axial section of the tumor showing full-thickness involvement of abdominal wall

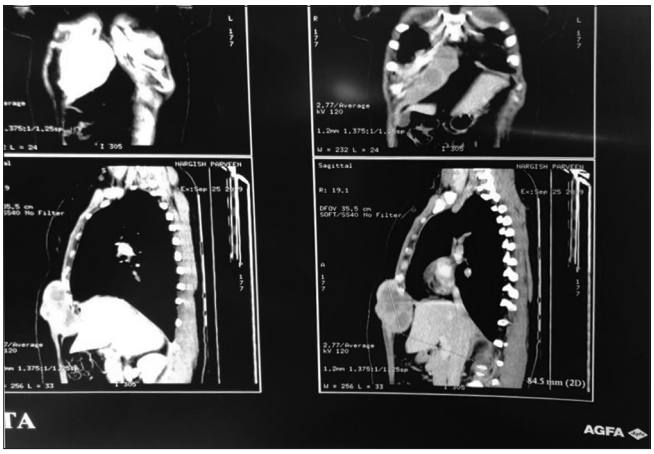


Figure 3: Pre-operative computed tomography images of sagittal section of the tumor showing full-thickness involvement of abdominal wall

Figure 4: Omental layer (First layer)

Figure 5: Mesh placement (Second layer)

Operative details of our technique

We shall describe our three-layer closure technique used to cover the full-thickness defects: Following excision of the tumor, the peritoneum is sutured circumferentially to the omentum, which forms the first layer of closure and separates the underlying viscera from coming in direct contact with the second and third layers (Figures 4-6).

Figure 6: Buttressing the defect with prolene suture (Third layer)

A retrorectus plane is then developed all around the defect and a large polypropylene mesh is then sutured circumferentially with at least a 5 cm overlap using 2–0 prolene suture, which forms the second layer. Interrupted 2–0 prolene sutures are taken at a distance of around 3 mm from the anterior rectus sheath above to the corresponding point below. This provides an additional buttress to the defect and strengthens the abdominal wall. It is this buttress that forms the third layer (Figure 4) of our reconstruction, and differentiates the omental flap-mesh placement ± primary closure or closure using component separation (a technique already mentioned in literature), from our technique of reconstruction.[4,5] The overlying skin and subcutaneous may either be closed primarily or with the help of a rotation flap (Figure 7).

Although many would argue that biological meshes offer better biocompatibility and reduced chances of infection, polypropylene meshes too have stood the test of time in reducing recurrence rates in abdominal wall closures, however, compared to biological meshes, polypropylene meshes have an increased risk of infection and chronic pain in addition to more sinister complications of bowel obstruction and fistula formation.[6-10]

Post-operative follow up

All the patients followed a standard post-operative advice. From the 1st post-operative day, they were made to sit up in bed with steam inhalation twice a day and vigorous chest and lower limb physiotherapy, including incentive spirometry. Intravenous fluids were omitted once bowel sounds returned along with the passage of flatus, which occurred in all patients by day 3.

Figure 7: Rotation flap closure

Figure 8: Patient after 6 months follow-up

All the patients were given strict instructions to refrain from any activity which would produce undue pressure on the abdominal wall. They were encouraged not to get up straight from supine position, not to bend forward or sit on the ground or to strain while coughing, passing stool, or urine for a period of 6 months (Figure 8).

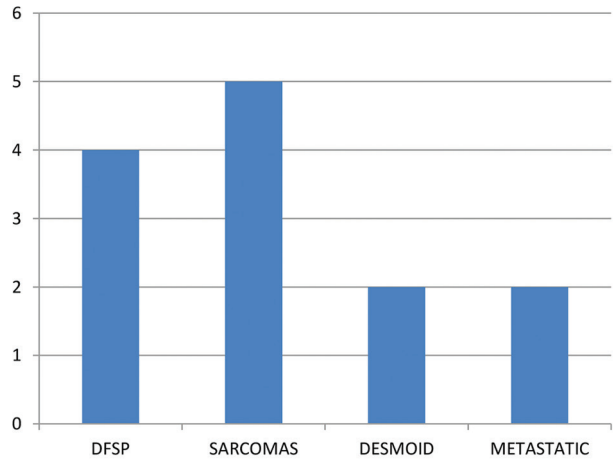
None of the patients presented with any major post-operative gastrointestinal complications following our repair, in terms of vomiting, abdominal distension, and ileus. None of the patients received LMWH too in the post-operative period as lower limb physiotherapy was commenced from the 1st post-operative day. Delayed bowel function was observed in three elderly patients, of whom two were diabetic receiving sliding scale insulin. The third patient needed opioid analgesics for post-operative pain, which possibly could have resulted in delayed return of bowel function. In two patients, a local rotation flap was employed to close the defect with the help of our plastic surgery colleagues, who not only took care to preserve the umbilicus, but also maintain the final position for better esthetic outcome.

Patients were asked to return to the clinic after every 3 months for check-up for first 2 years followed by 6 monthly check-ups for next 3 years, during which time they were thoroughly examined for local tumor recurrence or development of hernia along with CT scans.

RESULTS

In our study, 13 patients underwent radical tumor excision followed by immediate abdominal wall reconstruction. Eight of 13 patients were male and five were female.

Tumor characteristics

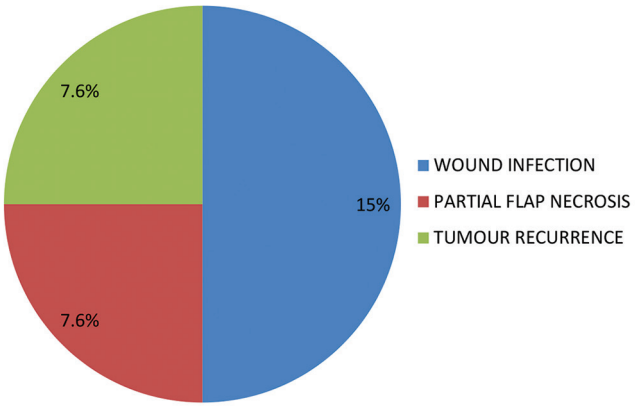


The mean age of our patients was 39 years (24–62 years). The mean defect size of our patients was 10 cm. In all our patients, a polypropylene mesh was used, size varying from 15×15 cm to 30×30 cm. The average operative time taken was around 210 min.

Post-operative superficial wound infection was observed in two patients (15%), which was managed conservatively; partial flap necrosis in one patient (7.6%) which was treated with serial dressings, thus increasing the hospital stay by 10–12 days and tumor recurrence was encountered in one patient (7.6%), which occurred after almost 16 months and was a localized recurrence in one of our DFSP patients, who successfully underwent wide local excision with negative margins and is doing well since. None of the patients during the 5 year follow-up showed radiological features of distant metastasis and there has been no disease specific mortality.

DISCUSSION

Post-operative complications



Limitations of the study

To better evaluate the long term outcome of our study, a larger sample size would be preferable.

CONCLUSION

Since the follow-up period in our study ranges from 8 months to 5 years, and not having observed a single case of hernia following large abdominal wall reconstruction, we are of the opinion that our three-layer closure of the abdominal wall can and should be adopted as one of the techniques, especially in those patients who cannot afford biological meshes, for surgeons working in subdivisional hospitals, where expensive meshes are not readily available, in cases, where plastic and reconstructive surgeons are not easily accessible for closure using complex flaps or when the surgeon is not well acquainted with component separation techniques. This is a technique which can easily be replicated even in the rural hospitals with good results. We have extensively searched the internet and have not found any mention of our technique, which makes it a novel method of closure.

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The authors declare that this is an original prospective observational study conducted jointly by the Departments of Surgical Oncology and Plastic Surgery at Medical College Hospital, Kolkata, India. I wish to thank the faculty of both the Departments at Medical College Hospital, Kolkata, for their valuable contributions. An ethical committee clearance was taken from the Ethics Committee, Medical College, before embarking on our observational study.

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VC- Prepared first draft of manuscript; **SKC-** Interpreted the results; reviewed the literature and manuscript preparation; **MPM-** Concept, coordination, and interpretation, preparation of manuscript and revision of the manuscript; **DM-** Concept and design of the study, statistical analysis, correspondence.

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