



Case Report

A challenge in soft tissue reconstruction: The use of pedicled anterolateral thigh fasciocutaneous flap and gluteal fasciocutaneous rotational flap in reconstructing a huge full thickness lateral trunk defect

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ABSTRACT

Introduction and importance: Lateral abdominal wall (LAW) defect presents as a rare and unique challenge to the reconstructive surgeons.

Case presentation: We report a huge recurrent right lateral abdominal DFSP with local invasion in a 35-year-old lady. After wide local excision, the reconstruction was done by using pedicled anterolateral thigh fasciocutaneous flap and gluteal fasciocutaneous rotational flap.

Clinical discussion: The goal of reconstruction of the lateral abdominal wall is similar to that of the anterior abdominal wall, namely to provide a static repair that will not attenuate and form a bulge or hernia over time. Anchoring a mesh to stable fixation points is expected to ensure structural integrity in the LAW defect. However, we selected fascial inset from our flaps which did not lead to hernia formation or a bulge following a 7-month postoperative review. In terms of soft tissue coverage, the pedicled anterolateral thigh fasciocutaneous flap and gluteal fasciocutaneous rotational flap were used. The standard free flap will require more complexity of works, especially if the recipient vessels for microsurgical reconstruction are remotely situated or sometimes not even available.

Conclusion: Huge full-thickness LAW defect following an oncological resection can be reconstructed with combination of simpler locoregional flaps which yield good functional and aesthetic outcome.

1. Introduction

Reconstruction of a massive lateral abdominal wall defect following oncological resection without complex microsurgical procedures often presents as a challenging problem. In cases where the local fasciocutaneous flaps are inadequate for soft tissue coverage, regional pedicled or free flaps are recruited. Among the regional flaps, pedicled anterolateral thigh (ALT) flap offers the greatest advantage for covering this type of defect.

In this paper, we present a successful reconstruction of a huge full-thickness defect of the lateral abdominal wall as a result of a wide local excision of dermatofibrosarcoma protuberans.

2. Case report

A 35-year-old lady presented with a right lateral abdominal mass. 5 years ago, the patient presented with a similar mass at the same location, subsequently locally excised with no surgical complications and histopathologically proven to be dermatofibrosarcoma protuberans (DFSP). Besides morbid obesity (BMI 41kg/m²), she had no history of trauma, no other known medical illness and her family, psychosocial and drug history were unremarkable. After the previous surgery, she defaulted follow-up and received no radiotherapy. She had been well until a year ago when she noted local recurrence and rapid increment in size of the mass.

On examination, a huge mass was seen over the right lateral abdomen, extending anteriorly from the right lumbar region to

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posteriorly the right paravertebral region. The mass was seen directly under the scar from previous excision (Fig. 1a–c). Radiological imaging was performed to delineate the depth of invasion and presence of metastasis. CT thorax, abdomen and pelvis with contrast revealed a large heterogeneously enhancing mass measuring 26.6cm × 19.8cm × 21.5cm (APxWxCC) at the subcutaneous region over the previous surgical site, from T10 to S1 vertebral levels, suggesting recurrence (Fig. 1d). It also demonstrated that there was local invasion into right 10th and 11th intercostal muscles, right latissimus dorsi, right quadratus lumborum and almost all of the right sided abdominal muscles with no distant metastasis.

Wide local excision (WLE) was performed by Orthopaedic team. Intraoperatively, the patient was positioned in the left lateral decubitus position with the right hip and knee slightly flexed. The anterior aspect of the tumour was in contact with external oblique, internal oblique and transversus abdominis. The excision was done up to peritoneal. Posteriorly the excision reached the latissimus dorsi muscle. The 9th and 10th rib resection was done as there was tumour contact. The breached peritoneum was repaired. Parietal pleural was also breached, and subsequently repaired and chest tube was inserted (Fig. 2a). Caudally the tumour was in contact with the ileum thus the periosteum was resected. The defect was subsequently downsized by Plastic team and the right gluteal fasciocutaneous rotational flap was raised at deep fascia plane and rotated anticlockwise to fit into the defect posteriorly (Fig. 2c). The right pedicled anterolateral thigh (ALT) fasciocutaneous flap was raised to inset into the defect anteriorly (Fig. 2b). The proximal aspect of the donor site was closed primarily in layers whereas the distal part was closed by using a split-thickness skin graft (Fig. 2c). The operation took

around 13 hours in total to complete.

The histopathology revealed an FNCLCC (French Federation of Cancer Centers Sarcoma Group) Grade 2 myxoid DFSP, pTNM staging pT4. Subcutaneous spindle cell proliferation with plump nuclei and abundant cytoplasm arranging in fascicular pattern with myxoid background was seen, which is consistent with DFSP (Fig. 3a). All margins were clear from tumour cells. It stained positive with immunohistochemistry CD34 (Fig. 3b).

Postoperatively, patient was positioned in the left lateral decubitus position for a week in order to avoid pressure on the pedicled ALT flap. The patient spent approximately 6 weeks in hospital as the postoperative course was complicated by a superficial surgical site infection which required wound debridement, courses of negative pressure wound therapy and subsequently secondary suturing. The patient was discharged home with no further wound complications (Fig. 4). Subsequently the patient completed a course of radiotherapy after 7 months from the reconstruction. There was no hernia or bulge formation over the operation site and no local recurrence noted as well. The patient was satisfied with the functional and aesthetic outcome of the operation.

3. Discussion

The focus of abdominal wall reconstruction (AWR) has been on the anterior abdomen, there are limited literatures concerning the reconstruction of lateral abdominal wall (LAW) defect. The LAW has been described horizontally as the region from the linea semilunaris to the posterior paraspinal muscles, and vertically from the costal margin to the iliac crest [1]. The myofascial anatomy of the LAW encompasses the

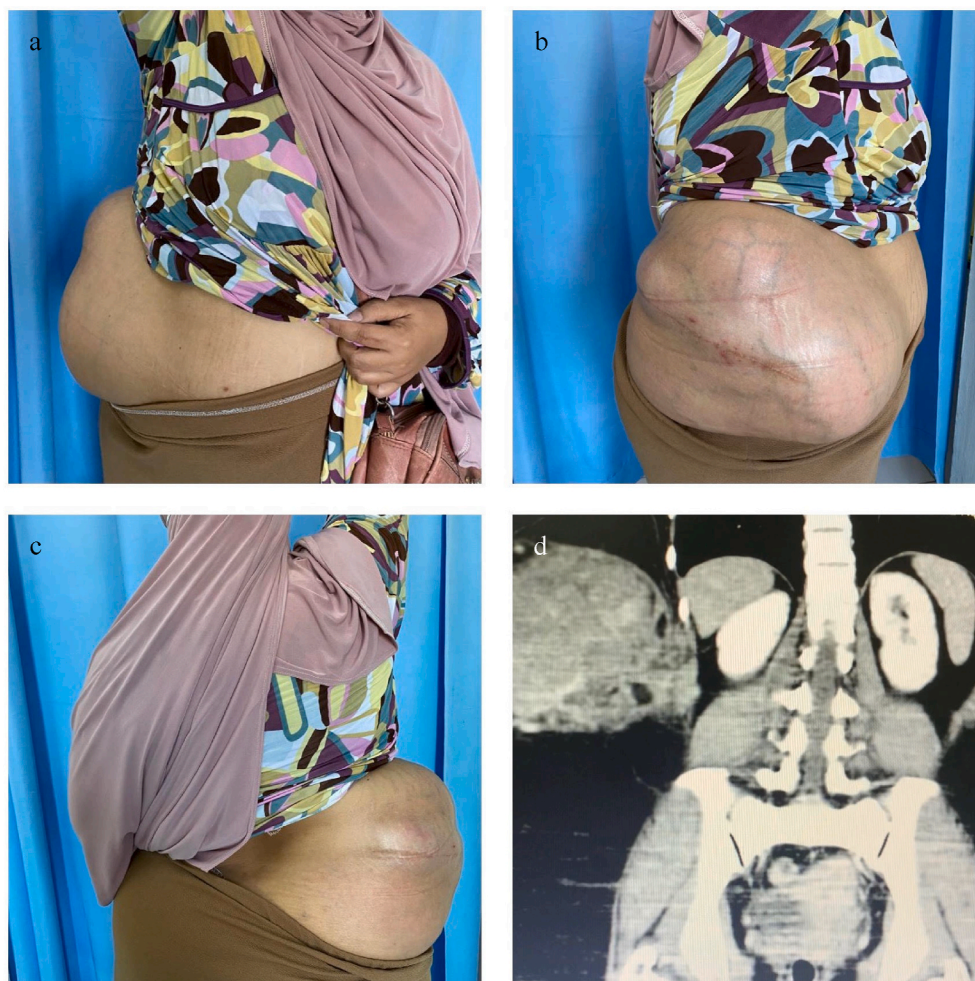


Fig. 1. a (anterior view), b (right lateral view), c (posterior)- A huge mass was seen extending anteriorly from the right lumbar region to posteriorly the right paravertebral region, measuring 30cm × 25cm × 20cm (WxCCxAP). The mass was seen directly under the scar from previous excision, with no overlying skin changes, discharge or telangiectasia.

Fig. 1d- CT thorax, abdomen and pelvis with contrast revealed a large heterogeneously enhancing mass measuring 26.6cm × 19.8cm × 21.5cm (APx WxCC) at the subcutaneous region over the previous surgical site, spacing from T10 to S1 vertebral levels, suggesting recurrence. It is also revealed that there was local invasion into right 10th and 11th intercostal muscles, right latissimus dorsi, right quadratus lumborum and almost all of the right sided abdominal muscles, namely the external, internal oblique and possible the transversus abdominis. No distant metastasis noted.



Fig. 2. a (right lateral view)- An intra-operative post-excision picture showing a huge defect over the right lateral abdomen, measuring 40.0 cm × 35.0 cm × 25.0 cm (Wx CCx AP). The breached peritoneum was repaired. The parietal pleural was repaired and chest tube was inserted.

Figure 2b (right lateral view)- The defect was subsequently downsized to 30cm × 24cm × 25.0 cm (Wx CCx AP). Right gluteal rotational flap was raised at deep fascia plane and rotated anticlockwise to fit into the defect posteriorly. Right pedicled ALT fasciocutaneous flap measuring 21 × 16cm was raised and tunneled subcutaneously to fit into the defect anteriorly.

Figure 2c (right lateral view)- Post-operation day 5. Flaps were viable. Split skin graft covering the ALT flap donor site on the right thigh was mostly stable.

Figure 2d Excised specimen weighing 8kg with overlying skin revealing previous excision scar.

external oblique muscle, internal oblique muscle, transverse abdominis muscle, and transversalis fascia with their associated neurovascular bundles [1].

In order to achieve a promising reconstructive outcome, the anatomical characteristics must be taken into consideration while

formulating the operation. Due to the off-centre location of LAW defect, there is an imbalance of distraction forces on the defect and subsequent repair. When the preserved ipsilateral rectus abdominis muscle and the contralateral hemi-abdominal wall contract in unison, the LAW defect will be exploited as the weakest point in the abdominal wall [1]. Besides,

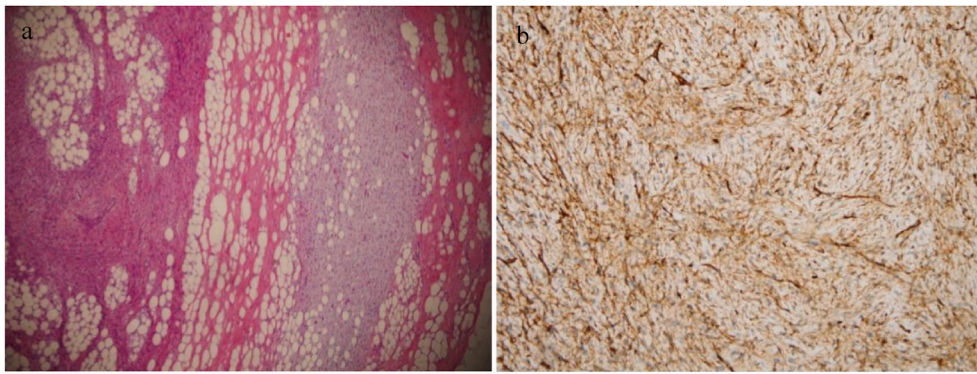


Fig. 3. a H&E (Original magnification X4): Spindle cell arranged in fascicular pattern with honeycombing of fat. Myxoid stroma is seen. Figure 3b CD34 stain (Original magnification X4).



Fig. 4. a, b, c, d- Post-operation 2 months from the first soft tissue reconstruction and post-operation 1 month from the wound debridement and secondary suturing. The wound over the ALT donor site (right thigh) had healed with primary closure and split skin graft. Re-epithelialization also noted over the split skin graft donor site (right leg). Fig. 4e, f, g, h- Post-operation 7 months from the LAW reconstruction, patient had received a course of radiotherapy. Satisfactory anaesthetic and functional outcome. There was no complaint of back pain or any restriction of movement noted.

the high ratio of muscle to fascia in the LAW also leads to reduced inherent tensile integrity of the soft tissue surrounding of the LAW defect [1]. Thus, it is extremely difficult to create a truly dynamic contoured reconstruction in the LAW. Despite the anatomical differences between the anterior and lateral abdominal walls, the goal of reconstruction is to provide a static repair that will not attenuate and form a bulge or hernia over time [1]. Therefore, the core principles of mesh application and soft tissue coverage must be taken into account in this topic.

Mesh repair is expected to ensure structural integrity in the LAW reconstruction. A typical interposition mesh repair of the musculofascial layer of a LAW defect will often result in a progressive musculofascial bulge [2]. Thus, the strategy is to avoid patching the defect but instead reinforce the entire lateral abdominal wall with a high-tensile-strength mesh, anchored to stable fixation points, these include ribs and costal margin superiorly, the linea semilunaris anteromedially, the inguinal ligament and iliac crest inferiorly, and the investing lumbar and paraspinal fascia posteriorly [2]. The mesh can be either prosthetic or synthetic based on surgeon preference, patient's comorbidities and clinical factor of the repair [3]. Despite being more costly, bioprosthetic mesh has many advantages over synthetic mesh in clinical situations. Bioprosthetic repair sites heal by tissue regeneration rather than by scar tissue formation, thus there is theoretically no longer a foreign body response once the mesh is revascularized and remodelled [1]. This reduces the risk of chronic infection and subsequent erosion through the skin. Another advantage is that cutaneous exposure of bioprosthetic mesh can usually be managed satisfactorily with local wound care, rather than explantation of the entire mesh construct as is the case with prosthetic mesh [1]. In addition, bioprosthetic mesh is preferred instead of a prosthetic mesh in a contaminated operative field, due to the ability of the bioprosthetic mesh to revascularize and incorporate in the face of bacterial contamination [1]. However, we did not apply a mesh to our patient's LAW defect. We utilised fascial inset contributed from the pedicled ALT fasciocutaneous flap and the gluteal fasciocutaneous rotational flap. The fasciae harvested were adequate to be anchored to the remaining fascia surrounding the defect. In the case of hernia, it will be broadbased and unlikely to be obstructive in view of the large original defect size.

Durable soft tissue coverage can provide a stable wound healing environment which greatly contributes to the successful LAW reconstruction. The soft tissue coverage is expected to avoid surgical site occurrences such as mesh exposure, seroma formation, periprosthetic infection, and subsequent explantation [1]. The aims are to deliver a tension-free closure and obliterate any potential dead space. The reconstruction is planar as opposed to the original LAW in convex or curvilinear form [1]. The overlapping angiosomes of the lateral abdominal wall cutaneous blood supply allow for undermining and skin advancement in great extent [1]. This can easily be achieved by local fasciocutaneous flap advancement if the defect is small. However, after the right gluteal fasciocutaneous rotational flap was raised and inset into the posterior aspect of the defect, the right pedicled ALT fasciocutaneous flap was still required for our patient who had an extensive resection. A pedicled flap is preferred over a free flap in this case, in view of its ease of dissection and more time-savvy as it does not need microsurgical complexity. When the volume of tissue loss or the arc of rotation preclude pedicled flap transfer, then a free flap is required for adequate soft tissue coverage [1].

There are numerous options of pedicled flaps for LAW reconstruction. We decided to use pedicled ALT fasciocutaneous flap because it is a versatile flap with a long consistent pedicle, a wide arc of rotation, a large potential size, a low donor site morbidity and its proximity to the defect. The identification of perforators using a handheld Doppler probe prior to the flap harvest is pivotal. However, due to the patient's morbid obesity, we were unable to identify the perforators prior to the skin incision. We made our skin markings and incisions purely based on the anatomical landmarks. The perforators of the descending branch of the lateral circumflex femoral artery are usually located within the

inferolateral quadrant of a 3-cm-radius circle centred on the midpoint of a line drawn from the anterior superior iliac spine to the upper outer edge of patella, representing the intermuscular septum [4]. In addition, the cutaneous territory of the ALT flap encompasses more than half of the circumference of the thigh and extends from the greater trochanter of the femur to above the patella, therefore offering a generous skin paddle and greater flexibility in flap design [4].

The pedicle of ALT flap has a range varies from 8 to 20 cm [4]. Short pedicle has a tendency of getting venous congestion due to kinking of the flap pedicle [4]. Length of the pedicle depends on the locations of the perforator selected. We dissected the pedicle to the maximal length which was 13cm, by selecting the distal perforators of the flap. We also elevated a cuff of vastus lateralis muscle with the flap upon encountered the musculocutaneous perforators. Since the flap was for an extensive defect, the bulk provided by the vastus lateralis muscle was an added advantage. Further dissection of flap was done to the origin of descending branch, where the vascular plane is below the rectus femoris. The medial arc of rotation of the flap was increased by tunnelling under the rectus femoris and subsequently tunnelled subcutaneously into the defect. Tunnelling the flap under rectus femoris muscle also helps in avoiding the kinking of the pedicle [4]. Potential pitfall of using this flap is increased risk of pedicle avulsion in our patient since she is morbidly obese. Cautious tunnel creation is vital especially in obese patients as the inadequacy of the dimensions of the tunnel could lead to pedicle avulsion.

A well-organized postoperative care, especially a vigilant flap monitoring is crucial for patient's recovery. For the first few days, we kept the patient sedated to prevent her from moving excessively so that the kinking of the pedicle of the ALT flap could be avoided. The patient was also put in left lateral decubitus position during the postoperative period in order to avoid the pedicle avulsion. Strict precautions were taken to make sure there was no pressure applied to the pedicle as well as the flap itself. Besides, we also prescribed her with antiemetic and mucolytic to prevent complication such as hernia formation. A nasogastric tube should be considered for intractable nausea and vomiting [2]. Although rarely occurs, attention must be paid for the signs and symptoms of compartment syndrome. Elevated peak airway pressures, difficulty weaning from the ventilator, decreased urine output, and elevated central venous pressure should alarm clinician to look into compartment syndrome [2]. It is also recommended that for patients with risk factors for poor wound healing, such prior radiation therapy, obesity, diabetes, or scarring from previous surgeries, an incisional negative pressure dressing should be considered, which is associated with significantly fewer surgical site infections and surgical site occurrences [2]. As after any operation involving the abdominal wall, the patient was restricted from heavy lifting and straining for at least 2 months to minimize the chance of formation of hernia. Patient was also compliant to her corset which aimed to prevent seroma formation.

A follow-up at 7 months after completion of a course of radiotherapy revealed no significant bulge or hernia. Patient experienced no functional limitation and was satisfied with the aesthetic outcome. Long-term follow-up is required, however, to determine the longevity of this fascial reconstitution. In addition, Dermatofibrosarcoma Protuberans (DFSP) is a low grade soft tissue tumor, which has a high local recurrence rate after surgical intervention [5]. Multiple studies have shown that radiotherapy helps in reducing the rate of recurrence after resection on large tumors. Our patient had defaulted the radiotherapy after her first wide local excision, which could be a very strong determinant for the disease recurrence [6]. Based on the reported recurrence rates within the last 20 years, WLE has been reported at 7.3% compared with 1.1% for Mohs Micrographic Surgery (MMS) [7]. Unfortunately, we did not manage to proceed with MMS for our patient as our centre did not provide that service. Thus, a long-term review is necessary not only to look out for post-operative complications, also for disease recurrence.

4. Conclusion

Management of massive soft-tissue defects in the lateral abdominal wall is considered as a major challenge for plastic surgeons. Mesh repair is imperative to ensure abdominal wall structural integrity whereas soft tissue coverage is aimed to provide a stable cutaneous coverage and obliteration of dead space. In cases where the local fasciocutaneous flaps surrounding the defect are inadequate for closure, regional pedicled flap could be recruited to achieve stable soft tissue coverage. Pedicled ALT flap is a versatile flap which provides many advantages for the soft tissue reconstruction of the lateral abdominal wall. The choice of loco-regional flaps are more favourable in this case as they shorten operation time, increase flap survival and require less expertise.

Provenance and peer review

Not commissioned, externally peer reviewed.

Declaration of competing interest

All authors declare that they have no conflict of interest

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.102933>.

Ethical approval

No ethical approval required for the mentioned case report. However, permission was obtained from local administrative and this included consent from patient.

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Author contribution

Liu Yi, Zosimo Ken L Jimeno, Ramesh A/L Sasidaran, Pan Ann Feng initiated and planned the case report. Liu Yi did the writing of the manuscript. Nik Amin Sahid supervised, reviewed and edited the manuscript. Liu Yi were involved in the writing and providing the clinical data.

Research registration number

1. Name of the registry:
2. Unique Identifying number or registration ID:
3. Hyperlink to your specific registration (must be publicly accessible and will be checked):

Guarantor

Liu Yi will be the guarantor and accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish at this given time of submission.

Consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 2013 and its later amendments. Informed consent was obtained from the patients family for being included in this case report prior to submission. Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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