

Pediced Anterolateral Thigh Flaps and Their Use in Abdominal Wall Reconstruction: A Case Series

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Abstract

Large full-thickness abdominal wall defects pose a great challenge to the reconstructive surgeon. Multiple strategies for adequate soft tissue coverage have been described. This case series aims to present the pediced Antero-Lateral Thigh (ALT) flap as a possible method of choice for reconstruction of full-thickness abdominal wall defects. After a retrospective review of our clinical records, three patients were selected who best describe our strategy. All operations were performed by the chief physician (MG) of the department. A classification of abdominal wall defects is presented for a standardized preoperative planning, as well as related advantages of the ALT flap.

Keywords: Anterolateral Thigh Flap; ALT flap; Perforator Flap; Pediced Flap; Abdominal Wall Defect; Full- Thickness Defect

Introduction

Reconstruction of full-thickness abdominal wall defects remains a major challenge for the plastic surgeon. These defects can be classified by their depth or by location. A partial defect is limited to loss of either only skin and fat (superficial layer) or of myofascial tissue (deep layer). A complete full-thickness defect involves loss in both the superficial and myofascial layers with the resulting risk of evisceration [1]. According to Mathes et al. abdominal wall defects are categorized according their location into zones 1A, 1B, 2 and 3 [Figure 1] [2]. The most common causes resulting in abdominal wall defects include incisional hernias, tumor resection, infection, irradiation and trauma [2, 3].

Many strategies have been described in the reconstruction of abdominal wall defects. Direct closure is possible in small partial defects where sufficient soft tissue ensures tension-free closure [2]. A split-thickness skin graft (STSG) may also be applied on superficial defects not involving the fascia and with granulation tissue already present. Synthetic meshes can be utilised to repair the integrity of the abdominal fascia [4]. Finally, flaps can be employed, either as regional flaps (rectus abdominis, external oblique) or as pediced or free distant flaps (e.g. ALT, rectus femoris, tensor fascia latae) [2]. At our clinic, the pediced ALT has become a favourable method for reconstruction of complex abdominal wall defects.

The ALT flap, first described from Song et al. in 1986, is seen as a very versatile flap, used as a free flap for reconstruction of defects from head to toe [5-9]. Its vascular supply typically arises from septo-cutaneous or musculocutaneous perforators from the descending branch of the lateral circumflex femoral artery and it can be harvested

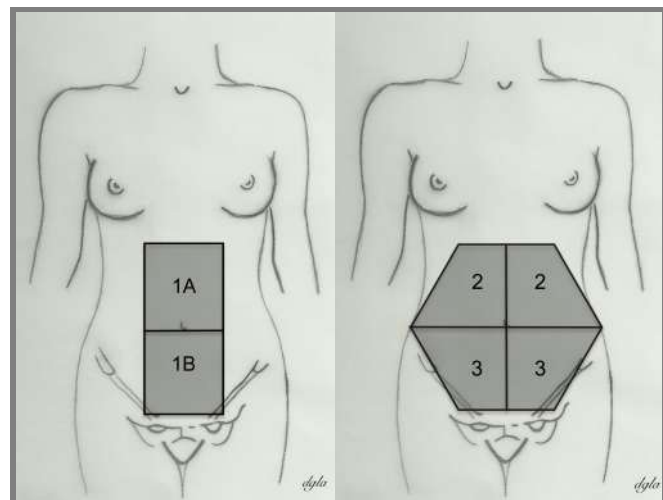


Figure 1: Classification of reconstructive abdominal zones according to location. 1A, representing the upper abdominal midline, 1B the lower midline, 2 the upper quadrant and 3 the lower quadrant

as a free or pediced fasciocutaneous, adipocutaneous or musculocutaneous perforator flap [3, 6, 10]. It can be harvested with a relatively large skin paddle and offers a long and reliable pedicle [3, 7, 8, 11, 12]. Another characteristic is the relative ease of dissection and, most importantly, minimal donor site morbidity [3, 6, 10]. Finally, its vascular anatomy enables it to act as a "flow-through flap", meaning a free flap in which both the proximal and distal ends of its vascular pedicle are anastomosed to provide uninterrupted arterial blood flow to distal tissues [15, 16].

Case Reports

After systematically analyzing our clinical records, we have chosen the following three cases to best describe the use of pediced ALT flaps for the reconstruction of full-thickness abdominal wall defects. All operations were performed by the chief physician (MG) of the department. A standardized harvesting technique was used in each of the operations. As part of the preoperative planning, the axial line of the flap was drawn running between the anterior superior iliac

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spine and the superolateral patellar pole. Then, a handheld doppler ultrasound was used to assist perforator localization. After skin incision and subcutaneous preparation, the perforator was identified. In case of a septocutaneous perforator, preparation of the flap's pedicle was performed straightforward by continuing the dissection up to the deep femoral vessels. However, if a musculocutaneous perforator was identified, preparation was more challenging as dissection through the vastus lateralis muscle was necessary to harvest the flap. After the harvesting procedure, the flap was tunneled to the defect either subcutaneously or, if needed, under the rectus femoris and sartorius to achieve greater pedicle length. Careful attention was paid during this manoeuvre in order to preserve femoral nerve branches to the rectus femoris. When possible, the donor site was closed primarily. If the size of the donor site defect did not allow primary closure, it was closed through STSG or delayed primary closure after 3-5 days of wound conditioning via negative-pressure therapy. After surgery the patients were placed in a supine position with light hip flexion for 5 days for flap stabilization. Mobilization afterwards was carried out with restriction in hip-joint extension. No postoperative flap failure was observed. All patients were discharged with stable wounds and without the need of a mobility aid for ambulation.

Case number 1 of the selected case series is of a 56-year-old female who presented with a ca. 350 cm² complex lower and partly upper midline abdominal defect after explorative laparotomy due to an acute incarcerated abdominal wall hernia [Figure 2]. Part of the synthetic mesh, which was placed by the abdominal surgeons to reinforce the missing fascia in the abdominal wall, was extruding on the left paramedian side. After thorough debridement of all necrotic tissue along with the removal of the extruding mesh, the defect was covered with a pedicled ALT flap from the left thigh [Figure 3] Part of the right paramedian defect showed integrity of the fascial layer as well as healthy granulation tissue and was covered with STSG [Figure 4]. A single Penrose drain was placed under the flap to prevent fluid accumulation. The donor site was temporarily covered with a negative-pressure wound therapy system for wound conditioning and suture closed on the 4th postoperative day. Part of the STSG failed and was allowed to heal by secondary intention [Figure 5]. The patient was discharged on the 14th postoperative day. The donor site, which showed delayed wound healing, was completely healed on the 6-week follow-up.



Figure 3: Intra-operative photograph showing the harvested flap and long pedicle before tunneling and inseting.



Figure 4: Immediate postoperative result with the flap primarily on the left paramedian side and STSG on the right.



Figure 2: Preoperative photograph showing the extent of the ca. 350 cm² complex lower and partly upper midline abdominal defect.



Figure 5: Postoperative photograph showing a stable flap.

Case number 2 is a male 74-year-old prostate and urothelial bladder carcinoma patient with a full-thickness lower midline abdominal defect ca. 210 cm² in size after radical prostatovesiculectomy with pelvic lymphadenectomy [Figure 6]. During flap pedicle preparation from the right thigh, relevant anatomical perforator variation prevented the harvesting of a flap capable of full defect coverage. Therefore, an intraoperative change to the left sided ALT flap was conducted. The donor site was closed primarily. The patient was discharged 13 days after the operation with closed wounds [Figure 7 & 8].



Figure 6: Preoperative photograph showing the ca. 210 cm² full-thickness lower midline abdominal defect.



Figure 7



Figure 8

Figure 7 & 8: Postoperative photographs after abdominal wall reconstruction through a pedicled ALT flap from the left thigh.

Case number 3 is that of a 71 year old female with a full thickness lower midline abdominal defect ca. 180 cm² in size with exposition of intestines after hysterectomy and bilateral salpingo-oophorectomy due to ovarian cancer [Figure 9]. Before the first presentation at our department, the patient underwent multiple operations with debridement and conditioning of the wound with a negative-pressure wound therapy system. Her chemotherapy had to be interrupted as a result of the abdominal defect and critical impairment in wound healing. The defect was covered with a pedicled ALT flap from the left thigh [Figure 10 & 11]. The donor site was closed primarily. The patient was discharged on the 12th post-operative day with closed wounds and was able to continue her chemotherapy [Figure 12&13]



Figure 9: Full thickness lower midline abdominal defect after hysterectomy and bilateral salpingo-oophorectomy.



Figure 10



Figure 11

Figure 10 & 11: Intra- and immediate post-operative photographs showing the harvested ALT flap before and after inset to cover the lower abdominal defect.



Figure 12



Figure 13

Figure 12 & 13: Stable flap with no complications at the final patient follow-up.

Discussion

In our case series, pedicled ALT flaps were used to treat full-thickness abdominal wall defects up to 350 cm² in size. All operations concluded in viable flaps. No major complications occurred and no flap revision surgery was necessary. All patients were discharged within 14 days with closed wounds and satisfactory mobility aid-free ambulation.

Several strategies can be employed in dealing with abdominal wall defects. All three illustrated cases involved large full-thickness defects, preventing a tension-free primary wound closure. As reconstruction of the myofascial layer is necessary, covering the defect with a STSG alone would not have restored the abdominal wall's structural integrity. Although synthetic meshes may be used in abdominal wall reconstruction, they carry the risk of infection and formation of intraabdominal adhesions and fistulas [1-3, 12, 14].

The ALT flap offers several advantages in the reconstruction of complex, full-thickness abdominal wall defects. It is relatively easy to dissect, it offers a long pedicle, and allows for inclusion of the vastus lateralis muscle to provide the flap with more bulk [3, 8, 10]. It offers a reliable vascular supply and can be harvested as a free or pedicled flap [3, 6, 10]. In order to keep the operation time to a minimum [12], we prefer pedicled ALT flaps for abdominal defects.

One of the most reported advantages of the ALT flap is the minimal donor site morbidity [3, 6, 10]. In the majority of cases we have found that the donor site can be closed primarily, leaving only a vertical scar along the anterior thigh. If this is not possible, it is either covered with a STSG or through delayed primary closure once the swelling subsides. We mobilize the patients within a week after surgery, without any long-term need of a mobility aid or restriction in daily activities.

Conclusion

Even though the versatility of the ALT flap has been well-described, we believe it is still under-utilised in the reconstruction of abdominal wall defects. At our clinic, the pedicled ALT flap has established itself over the years as the frontrunner in the reconstruction of complex, full-thickness abdominal wall defects. Due to its relative ease of dissection, durable blood supply and long pedicle length, it allows for a safe and reliable method in dealing with this kind of

defects. Moreover, minimal donor site morbidity allows for quick ambulation of the patient and early discharge from the hospital. In conclusion, we advocate that the pedicled ALT flap should be considered as one of the first-line surgical strategies in dealing with full-thickness abdominal wall defects.

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- **Ethics approval and consent to participate:** This was a retrospective study of past cases in our clinic. All data used was in anonymised form.
- **Consent of publication:** All patients were informed about the publication. A written informed consent can be made available to the Editor upon request.
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