Reconstruction of Complex Abdominal Wall Defects with Pedicled Anterolateral Thigh Flap

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Abstract
Aim: Traumatic abdominal injuries, surgical wound dehiscences, oncologic resections, transplant related complications or abdominal sepsis related visceral edema and abdominal compartment syndrome can cause enormous abdominal defects Abdominal defects are treated differently according to etiology and chronicity, size and thickness of the defect. ALT flap can be used pedicled or as a free flap for abdominal defect reconstruction.
Methods: Medical records of 8 patients who underwent pedicled ALT flap reconstruction of abdominal defects between August 2019 and November 2020 were retrospectively reviewed demographic data, flap size, perforator number, complications, hospital stay, use of alloplastic mesh for fascia repair were recorded.
Results: 50% of patients received only 1 reconstructive operation while other 50% received more than one (min:2, max:4) operations. Total flap loss was seen at 12.5%. 25% of patients were lost due to non-flap related complications. Mean (min/max) hospital stay was 33,1 (12/90) days.
Conclusions: The pedicled ALT flap is a reliable and reproducable flap for reconstruction of abdominal defects without need for microsurgical vessel anastomosis. It has low donor and recipient site morbidity and potential complications can be easily managed with minor secondary operations.
Keywords: *Anterolateral thigh flap, abdominal defect, reconstruction*

1. Introduction

Abdominal surgeries are classified as clean-contaminated or contaminated procedures, but under emergency circumstances the operation can be included contaminated or dirty wound category[1]. Abdominal defects are treated differently according to etiology and chronicity. Traumatic abdominal injuries, surgical wound dehiscences, oncologic resections, transplant related complications or abdominal sepsis related visceral edema and abdominal compartment syndrome can cause enormous abdominal defects[2].
Negative pressure wound therapy or Bogota Bag are used for temporary closure. Immediate reconstruction can be performed in acute injuries, after oncologic resections or dehiscence related defects. However, reconstruction should be delayed in the presence of sepsis, fasciitis or intestinal edema until the patient's hemodynamic stabilization and surgical debridements are completed[3].

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Received: 13.08.2023, Accepted: 22.08.2023, Available Online Date: 31.08.2023
Cite this article as: Kokacya O, Gencel D. Reconstruction of Complex Abdominal Wall Defects with Pedicled Anterolateral Thigh Flap. J Cukurova Anesth Surg. 2023; 6(2): 345-9. doi: 10.36516/jocass.1342375

The main purpose of reconstruction is providing fascia and soft tissue integrity. Flaps are commonly used as free or pedicled fashion for soft tissue coverage. Meshes or fascia are combined with them to reconstruct "like with like". Anterolateral thigh (ALT) flap is first described by Song as a free flap, then Wei and colleagues spread out his technique. Both free and pedicled ALT flaps are widely used as workhorse[4,5]. Here in this article is discussed using of pedicled ALT flap for full thickness abdominal wounds.

2. Materials and methods

2.1. Patients

This study was conducted in accordance with the Helsinki Declaration after the approval of the local ethics committee.

Eight patients who underwent surgical reconstruction of abdominal defects between August 2019 and November 2020 were retrospectively evaluated. Age, sex, etiology of defects, body mass index, comorbidities and smoking status were recorded.

2.2. Surgical technique

Patients were evaluated preoperatively for the anterolateral thigh flap perforators and any previous lower limb scar. Radiological imaging for the flap pedicle was not performed in any of the patients. Under general anesthesia in supine position skin perforators were identified using a handheld Doppler with 8 Mhz probes (Huntleigh Mini

Dopplex, Huntleigh Health Care Limited, Cardiff, UK). After flap elevation on descending branch of lateral circumflex femoral artery pedicle, it moved to the defect area either under a subcutaneous tunnel or by incising skin. Donor sites were closed primarily or with a skin graft. Patients were followed for 1 year or until the patient's death.

2.3. Perioperative patient management

A 50 year-old male patient was consulted for reconstruction of the defect that will occur after resection of recurrent epitheloid sarcoma on the left groin region. On physical examination, tumoral mass was palpable at left groin region under the incision scar that belongs to previous tumor resection operation (Figure 1).

Figure 1
Previous tumor resection operation's incision scar on the left groin region.

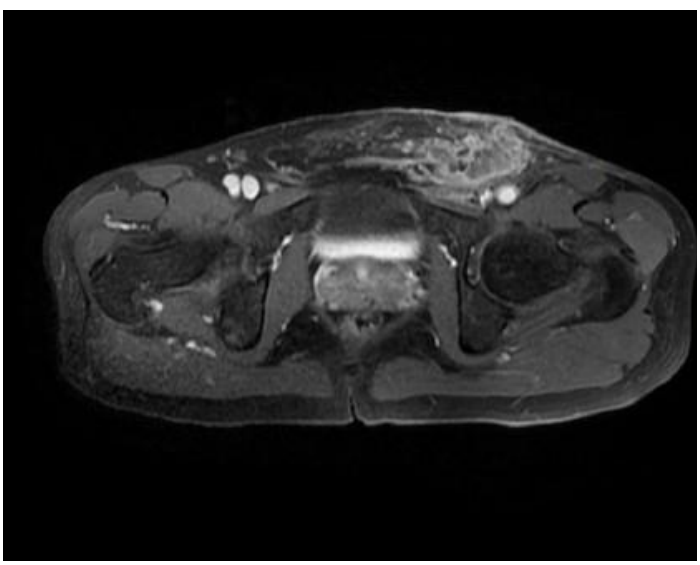

Figure 2
Computer tomographic view of mass located anteriorly to the left common femoral artery and vein.

6×5.5 cm size mass was located anteriorly to the left common femoral artery and vein (Figure 2). Tumor excision was performed by oncologic surgeon. Left inguinal ligament and sartorius muscle were resected, then dual polypropylene mesh was applied for fascia repair (Figure 3).

30×25 cm sized ALT flap was harvested on three perforators (Figure 4). There was no skin left between the flap and the defect to incise or prepare a subcutaneous tunnel. After flap was sutured to its new place (Figure 5), donor area was covered with split thickness skin graft. Scrotal edema and hyperemia were seen in early postoperative period. Symptoms revealed spontaneously and patient was discharged uneventfully (Figure 6).

Another 66-year-old male patient who underwent liver transplantation surgery due to Hepatitis C infection 9 years ago at our hospital applied with squamous cell carcinoma at the abdominal region. He had upper abdominal incision scars due to previous surgery and he had ventral herniation. Tumoral mass was resected with 60 cm bowel segment and anastomosis proceeded with insetting a dual polypropylene mesh. Defect was reconstructed with 32×15 cm sized ALT flap that was harvested on 2 perforators. Skin between the defect and flap donor area was incised to prevent pedicle compression.

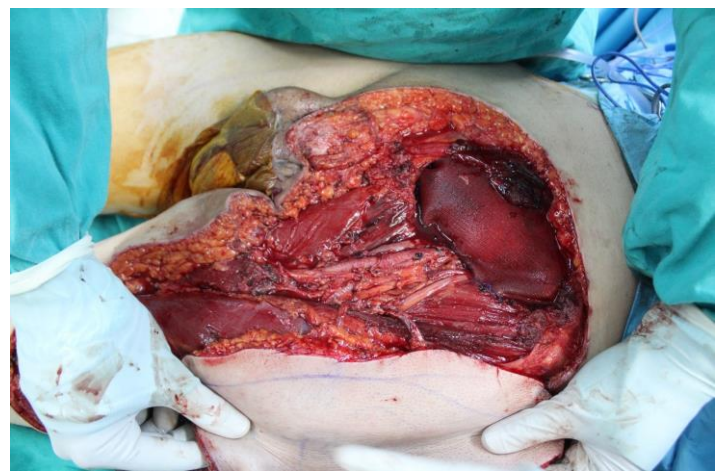

Figure 3
Fascia repaired with dual polypropylene mesh after tumor resection.

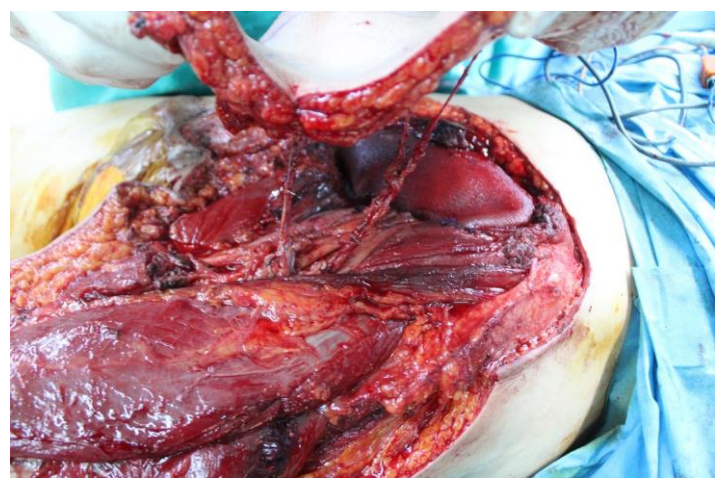

Figure 4
Anterolateral thigh flap harvested on 3 perforators..

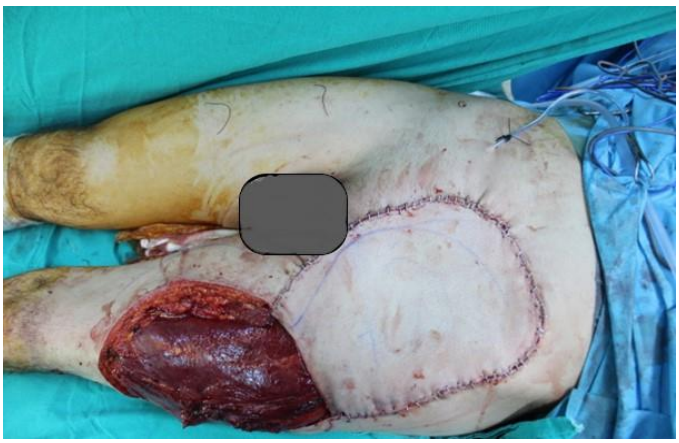

Figure 5
Flap inset

Figure 6
Early postoperative result at discharge

Figure 7
Superficial necrosis at vastus lasteralis muscle.

Donor areas was covered with split thickness skin graft but necrosis at the superficial part of vastus lateralis muscle was seen. (Figure 7). After debridement, defect was covered again with split thickness skin graft. Flap and donor area healed uneventfully (Figure 8).

3. Results

A total of thirteen surgeries were performed over a 16-month period in 8 patients who underwent ALT flaps in a tertiary level teaching hospital. Mean age of the patients was 60.8 years (range 48-72 years). Five (62.5%) of the patients were female and three (37.5%) were male. The mean BMI of the patients was 31.4 kg/cm2 (range 26-35 kg/cm2). Majority of the defect types were necrotizing fasciitis (37.5%) and tumor ablation defect (37.5%). There was any additional disease in 75% of the patients. Among comorbidities, the most common concomitant disease was diabetes mellitus (50%). The rate of smokers among the patients was 37.5% (Table 1).

Figure 8
Postoperative view of flap and donor site.

Defect size, flap details, operative and follow-up data are shown in Table 2. The mean defect size was 325.1 cm2 (range 144-750 cm2). While 25% of the flap donor area was repaired with a split-thickness skin graft, the other 75% was closed primarily. The mean number of perforators were 1.6 (range 1-3 perforators). In 50% of the patients, the flap pedicle was passed under a skin tunnel, while an incision was made in the skin bridge between the flap and the recipient site in 50% of the patients. Fascia defect in the abdominal wall was repaired with an alloplastic surgical patch in 37.5% of the patients. While 50% of the patients had only one reconstructive operation, the other 50% had more than one operation (range 2-4 operations). The overall flap success rate was 87.5% (1 flap loss out of 8). 25% of the patients died due to non-flap complications. The mean length of hospital stay was 33.1 days (range 12-90 days).

Table 1
Patient characteristics and demographic data

Patient No	Age	Sex	Etiology	BMI (kg/cm^2)	Comorbidity	Smoking
1	50	M	Epithelioid Sarcoma	28	None	No
2	66	M	Squamous Cell Carcinoma	26	Liver Transplant Hepatitis C	Yes
3	64	F	Complication of Ventral Hernia Repair with Abdominoplasty	32	Diabetes Hypertension Cardiac Failure	No
4	60	F	Endometrium Adenocarcinoma	32	None	No
5	71	F	Necrotizing Fasciitis	34	Bladder carcinoma Hypertension	No
6	72	F	Perforated Ileus	33	Diabetes Hypertension Asthma	No
7	55	M	Necrotizing Fasciitis	35	Diabetes	Yes
8	48	F	Necrotizing Fasciitis	31	Diabetes Hypertension	Yes

Abbreviations: *M*, male; *F*, female; *BMI*, body mass index.

4. Discussion

Open abdominal wounds can be challenging for surgeon due to multilayered components of abdominal wall and inflammatory etiologies. Primary objective of reconstruction is repair like with like. Abdominal reconstruction includes skin and soft tissue defect repair, fulfilling the abdominal wall strength, and preventing incisional hernia[7]. There are different flaps and various techniques applied for abdominal reconstruction[5-10]. Versatility of anterolateral thigh flap is commonly analyzed for free tissue transfer, pedicled locoregional transfer, anterolateral thigh flap combined with fascia lata, vastus lateralis muscle, functional vastus lateralis[4,6,11].

In this study, we performed pedicled anterolateral thigh flap maintaining maximal pedicle length and safety while considering patients' hemodynamic status and comorbidities. Mobilization of the pedicle give a wide range of motion which lets the wound to be closed under minimal tension.

To perform defect coverage we harvest flaps on subfascial plane, larger than the actual defect size. Free latissimus dorsi or free ALT flap achieves excellent soft tissue coverage for abdominal defects but longer operation times are needed and employment of microvascular procedures makes the operation more complex.

Due to partial loss of abdominal fascia, appropriate synthetic materials are applied to prevent hernia in various cases. ALT flap ensures excellent soft tissue coverage of alloplastic materials used to reconstruct abdominal fascia. Primary closure of the donor site ensures good cosmetic result of the thigh.

5. Conclusions

With pedicled ALT flap the entire abdominal wall can be reliably and safely reconstructed. Its versatility offers satisfactory solutions to problems without need for microsurgical vessel anastomosis. The use of completely autologous tissue in a single stage offers a definite advantage. If alloplastic materials are used for fascia repair, ALT flap provides adequate soft tissue coverage. It has low donor and recipient site morbidity and potential complications can be easily managed with minor secondary operations.

Table 2
Operative and follow-up data

Patient No	Defect size (cm)	Donor area closure	Number of perforators	Skin tunnel or incision	Mesh use	Complications	Number of operations	Duration of hospitalization (day)	Postop follow-up time (month)
1	30x25	Skin graft	3	Incision	Yes	Scrotal edema	1	15	12
2	32x15	Skin graft	2	Incision	Yes	Partial superficial necrosis of vastus lateralis muscle	2	28	12
3	23x14	Primary	1	Incision	Yes	Total flap necrosis managed by other ALT flap	4	90	12
4	17x9	Primary	1	Incision	No	None	1	6	12
5	25x12	Primary	2	Tunnel	Yes	Colostomy related	2	54	Death at postop 54th day
6	20x15	Primary	1	Tunnel	Yes	None	1	42	Death at postop 42th day
7	19x8	Primary	1	Tunnel	No	None	1	12	12
8	16x9	Primary	2	Tunnel	No	None	1	18	12

Abbreviations: ALT, anterolateral thigh.

Acknowledgements

Some of the cases reported in this study were presented in a poster presentation at 43rd Annual Meeting of Turkish Society of Plastic Reconstructive and Aesthetics Surgery, November 10-14, Antalya, Turkey.

Statement of ethics

This was a retrospective and single-center study which was approved by the Cukurova University local Ethics Committee (protocol no: 2021-107-45 and was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

Conflict of interest statement

The authors declare that they have no financial conflict of interest

with regard to the content of this report.

Funding source

The authors received no financial support for the research, authorship, and/or publication of this article.

Author contributions

All authors read and approved the final manuscript.

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