



## Case Series

## Local/regional flaps for extensive abdominal wall defects: Case series

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## ABSTRACT

**INTRODUCTION:** Extensive abdominal wall defects requiring reconstruction with flaps are best done with free flaps. However, free flaps are not readily available in many countries. Free flaps are associated with long operative hours, technically demanding and are prone to complications. However, local or regional flaps are a better option in managing such defects especially in resource-limited settings.

**OBJECTIVE:** This was a prospective study to determine the outcome of patients with extensive abdominal defects managed with local or regional flaps.

**RESULTS:** A total of fifteen patients with extensive abdominal wall defects were reconstructed with local/regional flaps. Ten of these patients were managed with pedicle anterior lateral thigh flaps with two tensor fascia lata flap and three para-umbilical abdominal flaps. The defect ranged from 90 to 300 cm<sup>2</sup> in size. All the flaps were successful, with only one patient experiencing flap dehiscence in a wound that had sepsis. Donor site wounds in one patient had partial skin graft failure necessitating regular dressing and repeat grafting later.

**CONCLUSION:** Local/regional flaps are reliable, good options for the management of majority of the anterior abdominal wall defects, as they are less demanding, do not require long operative hours and are easy to monitor post operatively. They should be considered in most reconstructive needs of the abdominal wall.

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## 1. Introduction

Full thickness anterior abdominal wall defects require urgent reconstruction to ensure coverage and protection of the viscera. Irrespective of the cause, reconstruction should target provision of soft tissues and rectus sheath. Soft tissue reconstruction could be managed with local, regional or free flaps [1–3]. Local and regional flaps have traditionally been limited to smaller defects. Bigger defects have been managed by free flaps [4,5]. However, free flaps are not universally available [5]. They are technically demanding, require long operative hours and are prone to complications leading to flap failures. We present a case series of fifteen patients with anterior abdominal wall defects managed with local and regional flaps.

## 1.1. Objective

This was a prospective audit to determine the outcome of patients with extensive abdominal defects managed with local or regional flaps between January 2014 and December 2019.

## 1.2. Settings

Department of Surgery, College of Health Sciences, University of Nairobi, Kenyatta National Hospital, Kenya.

## 2. Patients and methods

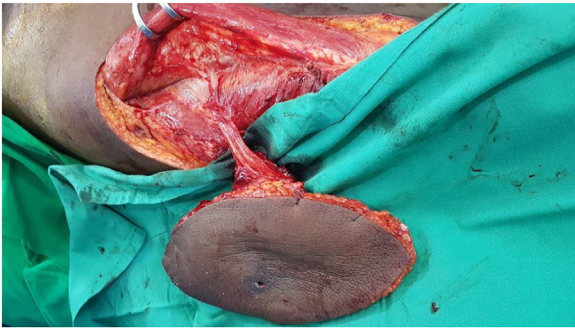
Ethical approval for the study was sought from the local ethics and review board. Patients with anterior abdominal defects were prospectively followed up during the study period. Patients' demographics and etiological causes of the defect were noted. Only patients whose defects were closed by either local or regional flaps were followed up. Patients with other methods of reconstruction including component separation or free flaps were excluded from the study. The size of the defect was measured and recorded. Defects were classified as small, less than 90 cm<sup>2</sup>, medium between 90 and 150 cm<sup>2</sup> and large more than 150 cm<sup>2</sup>. Only patients with defects greater than 90 cm<sup>2</sup> were followed up in the study. All surgeries were done by a consultant plastic surgeon of more than five years' experience. Before wound closure, surgical debridement and wound dressing were done until the wounds were clean. The choice of the flap was determined by the size of the wound, anatomical location and surgeon's preference. Perforators were identified using a hand-held Doppler for both the para-umbilical flaps and the anterior lateral thigh flaps (Fig. 1). The flaps were meticulously

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**Fig. 1.** Abdominal wound, which is planned to be closed with pedicle anterior lateral thigh flap, Arrow indicates location of the perforator.



**Fig. 2.** Alt flap meticulously raised to ensure no perforators are injured. Note the long pedicle length achieved by ligating all the branches.



**Fig. 3.** Flap advanced into defect while ensuring no tension on the pedicle.

raised while ensuring no injuries to perforators. Maximum pedicle length was achieved by ligating any vascular branches (Fig. 2). The flap was then advanced into the defect while ensuring tension-free closure of the wound (Fig. 3). A drain was inserted underneath the flap (Fig. 4). The wound was then closed in layers. Donor site was closed primarily or a split thickness skin graft was done. Post-operatively, patients were monitored for any complications including flap necrosis and donor site morbidities for at least one year (Fig. 5). This research work has been reported in line with the process criteria [6].

### 3. Results

A total of 15 patients with anterior abdominal wall defects requiring reconstruction with flaps were seen by the authors during the five-year study period. The age range for the patients was



**Fig. 4.** Alt flap fully advanced into the defect with a drain *in situ*.



**Fig. 5.** Patient with ALT flap at one year of follow up.

17–45 years with a mean age of 29 years. The male to female ratio was 2–1. The anatomical location of the defects were para-umbilical 3 patients (20%), both para-umbilical and hypo-gastic regions 9 patients (60%) and hypo-gastic region 3 patients (20%). Of the 15 patients, three were reconstructed with para-umbilical flaps (Fig. 6A and B), two with tensor fascia lata flap (TFL) and ten with pedicle anterior lateral thigh flap (ALT) (Figs. 2–4). The etiological causes were abdominal wall tumor extirpation (seven), post-surgical wound sepsis (four), bladder ex-strophy (three) and Fournier's gangrene (one). The defect reconstructed for all patients ranged from 90 to 300 cm<sup>2</sup> with a mean of 212 cm<sup>2</sup>. Polypropylene mesh was utilized in eleven patients whose wounds were considered clean with minimal risks of wound sepsis. All flaps were successful. Partial dehiscence was noted in one patient who developed post-surgical wound sepsis. Donor site had skin graft loss in one patient necessitating a repeat graft. No incidence of post-surgical herniation was observed in any of the patients at one year of follow up (Table 1).

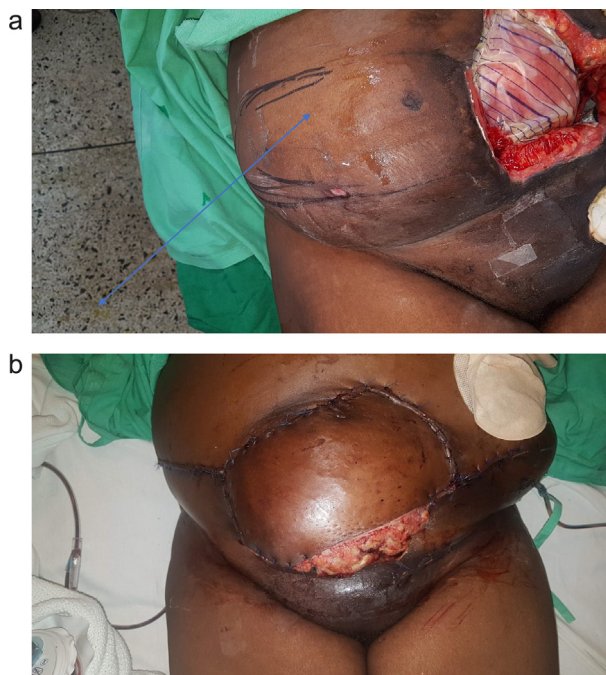
### 4. Discussion

Abdominal defects with exposed viscera are associated with high morbidity and mortality if not well managed. Immediate complications include evisceration of abdominal contents, peritonitis and intra-abdominal abscesses. Late or long-term complications include ventral abdominal hernias and contractures. This may affect the quality of life of the patients and result in depression and psycho-social symptoms [6]. Ideally, all anatomical elements should be reconstructed to allow for proper functional and aesthetic outcomes of the abdomen. To achieve this, one must be familiar with various reconstructive options ranging from component separation, either anterior or posterior, local, regional and free



**Table 1**  
Patient factors, surgical procedures done and outcome.

Patients No	Diagnosis	Size of the defect (cm <sup>2</sup> )	Flap utilized
1	Bladder ex-strophy	90	Para-umbilical flap
2	Bladder ex-strophy	110	Para-umbilical flap
3	Abdominal wound dehiscence	125	TFL flap
4	Ventral umbilical hernia	140	Para-umbilical flap
5	Post-surgical sepsis	170	AL T flap
6	Post-surgical abdominal sepsis	186	ALT flap
7	Post-surgical abdominal sepsis	160	AIT flap
8	Dermato-fibro-sarcoma	250	ALT flap
9	Dermato-fibro-sarcoma	220	ALT flap
10	Fibro-sarcoma	300	Bil ALT Flap
11	Rhabdomyo-sarcoma	220	ALT Flap
12	Fibro-sarcoma	210	ALT flap
13	Peritonitis	196	ALT flap
14	Bladder ex-strophy	188	ALT flap
15	Bladder ex-strophy	140	TFL flap

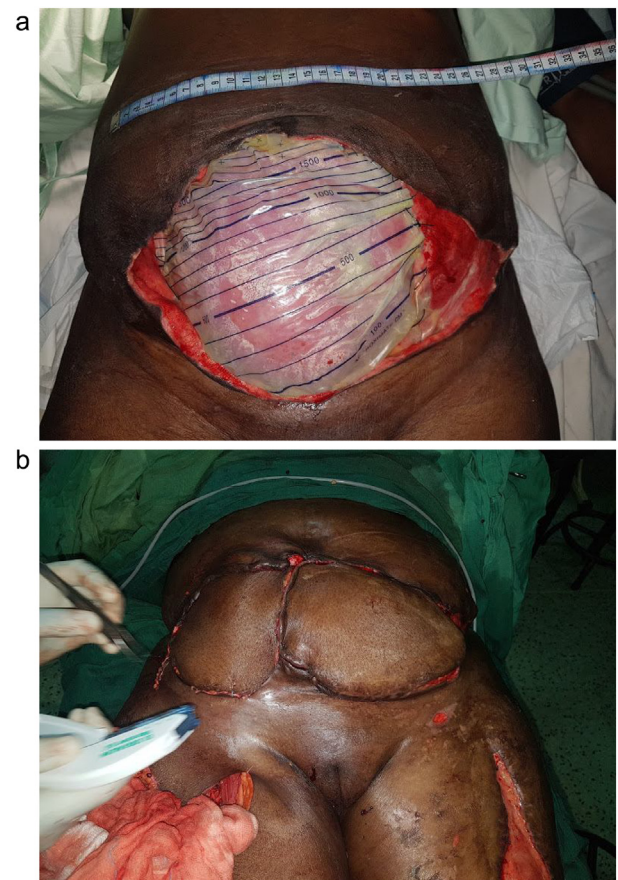


**Fig. 6.** A: Patient with full thickness abdominal defect, left para-umbilical area, ready for closure with contralateral para-umbilical flap. Note flap markings (arrow). B: Abdominal defect in Fig. 6A above successfully closed with para-umbilical flap.

flaps. Healing by secondary intention may not be desirable as it is associated with contracture formation that may lead to flexion deformity of the abdomen. Skin grafts may only be useful as a short-term measure as they may not provide the necessary protection to the viscera.

A good proportion of the wounds may not be ready for closure initially due to wound sepsis. Temporary measures that can be employed while stabilizing the patient may include negative pressure wound therapy (NPWT) or 'Bogota bag' (Fig. 7A) [7,8]. NPWT ensures complete sealing of the abdominal contents from the environment, thus reducing chances of contamination while reducing the size of the defect. It promotes tissue granulation and could allow for less extensive reconstructive options for closing the wounds [7]. It is, however, limited as it promotes healing by secondary intention that could lead to contracture formation. It may also not be ideal for patients with intestinal fistula or exposed vascular structures.

Definite reconstructive options are best summarized by the reconstructive ladder. Superficial defects may be left to heal by secondary intention or skin grafted if they are extensive. Small or medium midline defects (less than 10 cm diameter or 150 cm<sup>2</sup>) may



**Fig. 7.** A: Huge abdominal defect planned for closure with bilateral ALT flap, note the Bogota bag utilized to cover the abdominal contents. B: Defects in 7A successfully closed with bilateral ALT flaps.

be repaired by component separation allowing for mobilization of tissues from lateral to the medial aspect of the abdomen [3]. This allows for both skin and fascial repair of the defect reducing chances of hernial formation. Component separation technique is however limited in defects with extensive skin loss like majority of cases that we managed in our series. Other options for such defects include local or regional flaps. Local flaps as evidenced in this study included para-umbilical perforator flaps, either ipsi-lateral or contra-lateral depending on the location of the defect (Figs. 5–6). The flap is raised as a perforator flap based on a para-umbilical perforator. It has mainly been described for reconstruction of defects of the forearm as a distant flap [8]. It can be raised on one or several perforators and rotated into the defect. It is limited by the abil-

ity to close the donor site primarily and the short pedicle. It is thus effective for only defects around the umbilicus. Rectus abdominis musculo-cutaneous flap either based superiorly or inferiorly can be utilized to cover supra or infra-umbilical defects [9]. Regional flaps that could be employed in small to medium defects include rectus femoris, tensor fascia lata, and anterior lateral thigh flap [10–12].

Tensor fascial lata muscle flap is based on the transverse branch of the lateral circumflex femoral artery. It is a reliable musculo-cutaneous flap that has been described to cover defects of the infra-umbilical region predominantly in the lateral lower abdomen [10,11]. The flap also allows for fascia lata to be utilized in strengthening the rectus sheath and thus reducing chances of hernia formation. The flap is however limited by the short pedicle that limits its reach to only the lower abdomen.

Huge abdominal defects, more than 150 cm<sup>2</sup> have traditionally been covered by free flaps [3,5]. Commonly used free flaps have been anterior lateral thigh flap and latissimus dorsi muscle flap. However, free flaps may not be available in many settings [5].

Pedicle anterior lateral thigh flap has been described as a workhorse flap for many defects around the abdomen, perineum, thigh and knee regions [12–17]. The flap has a reliable and long pedicle that makes it easy to use. Its use in literature for the abdominal defects has been limited predominantly to defects less than 150 cm<sup>2</sup> and in the lower abdomen [15,13–17]. However, as described in our series, the flap can be utilized for even larger defects with virtually any part of the abdomen being covered with the flap. The mean surface area covered by the flap in our patient was 210 cm<sup>2</sup> with a range from 160 cm<sup>2</sup> to 300 cm<sup>2</sup>. All flaps survived with no incidence of flap necrosis recorded. To improve the reliability and size of the flap, at least two to three perforators were recruited in the flap with one distal perforator. To improve the reach of the flap, we skeletonized the pedicle to the lateral circumflex femoral artery sacrificing muscular branches to rectus femoris and the transverse branch to tensor fascia lata. Further, we ensured tension free tunnel allowing for the flap to be tunneled under the skin. Post-operatively, we managed the patient in a flexed position to reduce the tension on the flap. With these maneuvers, we were able to achieve closure of huge abdominal defects. Defects that could not be closed by one ALT flap were closed with two flaps, 300 cm<sup>2</sup> defect in our series (Fig. 7B). Walia *et al.* in a retrospective review of seven patients had a mean size of 189 cm<sup>2</sup> of patients reconstructed with a pedicle ALT flap for the abdominal defects [16]. They reported complication of infection in two patients with no flap failure noted. Bin Zhou reported the use of bilateral pedicle ALT flap in huge defects of about 18 by 25 cm in dimension [18].

Though good results were achieved in this study some of the limitations could be the few number of patients that were captured. It would be important to have a study with a large series of patients to determine fully the effectiveness of local or regional flaps in reconstruction of large abdominal defects.

## 5. Conclusion

Majority of abdominal wall defects can be reconstructed with local or regional flaps. These flaps are easy to raise compared with the free flaps and are less prone to complications demonstrated in our series. Defects around the umbilicus can be repaired with the para-umbilical perforator flaps while sub-umbilical defects can be reconstructed with either tensor fascia lata or pedicle anterior lateral thigh flaps. Huge abdominal defects are, however, best reconstructed with anterior lateral thigh flaps.

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I state that nobody funded me for this study, the study was carried out by myself and the co author.

## Ethical approval

The study was approved by KNH/ERC ethics approval board with the approval number P/429/8/13.

## Consent

All patients participating in this study had a written consent obtained from them and that some of these photos may be utilised in the study.

## Author contribution

The authors contribution to this study was as follows  
DR Nangole; study concept design, data collection, data analysis, writing the paper.

Dr Kiptoon, study concept, Data collection, Data analysis.

## Registration of research studies

1. Name of the registry: Researchregistry
2. Unique identifying number or registration ID: 5527
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## Guarantor

Dr Nangole Wanjala Ferdinand.

## Provenance and peer review

Not commissioned, externally peer-reviewed.

## Declaration of Competing Interest

I state that there is no conflict of interest while writing this manuscript with the intent to publish it. I have no consultancy, or ownership with any organisation or any body that could influence this study.

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