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Reversed Contralateral Inferiorly Based Rectus Abdominis Myocutaneous Flap for Reconstruction of Groin Defects with Exposed Vascular Bundle

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ABSTRACT

Background: Large groin defects resulting after resection of tumours or metastatic lymph nodes to the groin or vascular intervention with exposed vascular bundle pose a problem in their reconstruction, however wound closure with well-vascularized tissue leads to early recuperation and avoids delay in instituting postoperative radiotherapy.

Aim of the Work: The aim of this work is to evaluate the efficacy of reversed contralateral inferiorly based rectus abdominis myocutaneous flap in reconstruction of large groin defects when vascular bundle exposed.

Patients and Methods: 9 patients with large groin defects following tumour ablation (3), skin sloughing following previous inguinal lymphadenectomy (3), vascular bypass (2) and Gunshot trauma (1) were admitted and underwent reconstruction using a contralaterally based vertical rectus abdominis myocutaneous flap.

Results: Defect size ranged from 30 to 420 square centimeters (mean 190cm^2). Operative time for the reconstruction procedure ranged from 112 to 171 minutes (average 146 minutes). Blood loss for the reconstruction procedure was negligible but 3 cases needed blood transfusion due to losses with the tumour resection and gunshot bleeding. One patient of flap loss after 48 hours (gunshot) which died from vascular blowout & sever haemorrhage after 72 hours, minor donor site morbidity was seen in 1 case (seruma). There were no hernias at the donor site during the follow-up. Morbidity was wound seruma (groin) 20.6% managed conservatively and chronic limb oedema (30.9%). Mean hospital stay was 11.6 days.

Conclusion: Reversed contralateral inferiorly based rectus abdominis myocutaneous flap is the technique of choice for reconstruction of groin defects with exposed vascular bundle as the blood supply of other local flaps destroyed by the tumor or vascular oblative procedures moreover, it is easy, wide dimentions with good distant vascular pedicle and combat infection and radiotherapy.

INTRODUCTION

Patients with large groin defects following tumour ablative surgery pose a particularly challenging reconstructive problem **[1]**. Although this problem is not commonly met with, when it does occur there is a need for a reliable soft tissue cover that has a low morbidity and is technically simple to perform. Likewise the procedure has to be a one stage reconstruction as it is unwise to leave the groin with its major vessels uncovered by adequate soft tissue as this carries an unacceptably high risk of infection and life threatening haemorrhage from the femoral vessels **[2]**. Skin grafts in this situation are unsuitable for permanent reconstruction and are only of use for temporary cover-as a biologic dressing till definitive reconstruction-as they cannot give adequate protection to the underlying vessels and cannot withstand radiotherapy which is frequently needed in these cases **[3]**.

Block dissection of inguinal lymph nodes is done in cases of malignant inguinal lymphadenopathy, which requires the removal of skin where it is involved, or elevation of the flaps which have precarious blood supply leading to necrosis. Thus, wound closure presents a big challenge. It can be done either by primary closure which is frequently complicated by necrosis, or by split thickness skin graft which is complicated by rejection on radiotherapy **[4]**.

Trauma too is a leading cause of groin skin disruption. In the traumatic setting there is usually associated vascular injury which often necessitates restoration of limb vascularity using synthetic grafts. Here it is imperative to provide immediate well vascularized dependable soft tissue cover preferably including muscle to adequately protect the graft **[2,3,12,13]**.

The inferiorly based rectus abdominis myocutaneous flap has grown in popularity both as a pedicled flap and as a free vascularised flap **[5]**.

Taylor et al., have carefully detailed the vascular territory of the deep inferior epigastric artery [5]. They along with others have demonstrated the versality of this flap in abdominal, perineal and vaginal reconstruction [7,8,9]. The arc of its rotation was pushed to its apparent limit by Gottleib et al., who reported on an inferiorly based rectus abdominis myocutaneous flap reaching the lower thigh and knee region [10].

Although free flaps are now very popular they suffer from several drawbacks including long operating times, more intensive postoperative monitoring, the need for microsurgical skills and the small but ever present risk of total flap loss. In addition in the post lymphadenectomy setting and possible infection suitable vessels for the microsurgical anastomosis may not always be present [14].

Likewise local flaps such as the tensor fascia lata and rectus femoris flaps may have their blood supply compromised by the tumour ablative procedure. The contralateral rectus abdominis flap has the added advantage of having its blood supply from a distant site uncompromised by the resection [13].

Aim of the work:

The aim of this work is to evaluate the efficacy of reversed contralateral inferiorly based rectus abdominis myocutaneous flap in reconstruction of large groin defects when vascular bundle exposed.

PATIENTS AND METHODS

During the period from October 2007 to June 2009 nine patients with large groin skin defects after vascular and tumour ablative surgery had the defects reconstructed using a contralateral inferiorly based rectus abdominis myocutaneous flap at the Menoufiya University Hospital.

Patients' ages ranged from 32 to 67 years with an average of 53 years. Three cases had primary resection of tumour followed by reconstruction at the same sitting while three patients underwent only reconstruction of defects following previous inguinal dissections with skin flap sloughing, 2 patients after vascular bypass and one patient after gunshot to the groin.

All patients underwent routine laboratory investigations, chest radiograph and ECG preoperatively. Anaesthesia used was general endotracheal anaesthesia in all cases. Mapping of the deep inferior epigastric artery with a Doppler probe was performed on table for all patients before skin preparation and surface markings of the artery and skin paddle were marked on the skin. All patients received preoperative broad spectrum antibiotic prophylaxis and prophylaxis against deep vein thrombosis was by 5000 IU heparin subcutaneously every 8 hours, elastic stockings and early ambulation.

Technique (Figs. 1-4):

In seven cases the operation began with resection of the tumour and achievement of proper haemostasis after which dissection of the flap was started while in four cases preparation of the defect for reconstruction was effected by freshening of the sloughed skin edges till healthy skin was realized all around and the bed was debrided of any sloughs. In cases where resection of the tumour was performed before the reconstruction a separate instrument tray was used for the reconstruction to avoid possible inplantation.

Generally the skin paddle is based on the paraumbilical perforators and extends laterally as far as the anterior axillary line. Across the midline the skin harvested with the flap should extend no further than the lateral border of the rectus sheath.

The elevation of the flap was begun by incising the skin island required to the level of the external oblique aponeurosis. Elevation is continued medially until the lateral border of the rectus abdominis muscle is reached. The anterior rectus sheath is incised along the superior border of the flap and the rectus muscle is divided at this level. The dissection then proceeds inferiorly harvesting a disk of anterior rectus sheath only beneath the skin paddle. Care is taken to preserve a 1 to 2 centimeter cuff of the anterior rectus sheath both medially and laterally in this area. The rest of the rectus sheath is incised longitudinally down to the pubis through the paramedian approach. The entire rectus muscle inferior to the skin paddle is elevated. Division of the rectus muscle at its origin on the pubis suspends the flap by the deep inferior epigastric vascular pedicle. Generally, however, it is not usually necessary to disattach the muscle from the pubis for adequate mobilization of the flap. In fact keeping the origin of the muscle intact may provide protection against tension on the vessels. A subcutaneous tunnel is created in the lower abdomen through which the flap is delivered to the groin defect. This tunnel should be generous enough in size to allow for postoperative oedema of the muscle. Once passed through the tunnel the pedicle should be checked for any kinking, then insetting in the usual fashion is done. The anterior

rectus sheath is closed (when possible) using a continuous 0 Proline suture after adequate haemostasis. We used a proline mesh to reinforce the anterior abdominal wall in all cases. Closure of the donor site skin defect is facilitated by generous undermining in the subcutaneous plane. A closed suction drain was used both at the donor site and in the groin. Broad spectrum antibiotics were continued for 5 days and heparin till hospital discharge.

Follow-up ranged from 6 to 18 month.

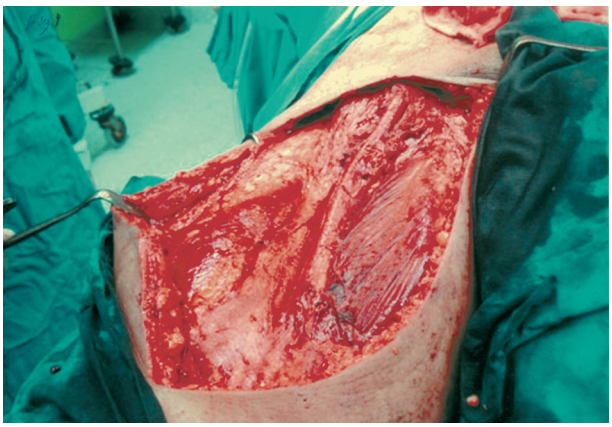

Fig. (1): Tumour excision and inguinal block dissection with exposed vascular bundle.

Fig. (2): Contralateral reversed rectus flap elevation.

Fig. (3): Intraoperative groin reconstruction and good coverage for the vascular bundle by the rectus flap.

Fig. (4): Postoperative after groin reconstruction by reversed contralateral rectus flap.

RESULTS

The contralateral inferiorly based rectus abdominis myocutaneous flap was used to reconstruct large groin defects in 9 patients in this study. 5 patients were females and 4 males. The only risk factors in our patients were diabetes mellitus (4/9), chronic cigarette smoking (2/9) and history of previous radiotherapy (1/9) (Table 1).

Operative time for the reconstruction procedure ranged from 112 to 171 minutes (average 146 minutes). For patients with an accompanying resection the operative time was calculated from the end of the resection procedure and the beginning of the reconstruction procedure. No patients needed blood transfusion for the reconstruction procedure although 3 patients needed a transfusion due to the accompanying tumour resection (1 unit each) and gunshot injury (3 units). Defect size was calculated in square centimeters and ranged from 30 to 420 square centimeters with a mean of 190cm^2.

All donor sites were closed directly and healing was by primary intention in 8 cases while 1 case needed secondary sutures for wound infection and parial disruption of the donor site wound (skin only). Donor site drains were removed at 5 to 7 days postoperative. One case had a seruma which responded to aspiration.

Flaps were monitored on a daily basis, 8 flaps survived. One case (traumatic gunshot) of failure after 48 hours which may be due to sever resistant infection that lead to pedicle thrombosis. Groin suction drains were removed when the amount of discharge was below 50cc (average 8 days). Seruma occurred in 2 cases (20.6%) and responded well to repeated aspiration (Table 2).

Table (1): Patient risk factors.

Risk factor	Number
Diabetes mellitus	4
Smoking	2
Previous Radiotherapy	1
Multiple	0

Table (2): Complications.

Complication	Number	%
Total flap loss	1	10.3
Partial flap loss	0	0
Donor site seruma	1	10.3
Donor site infection	1	10.3
Hernia	0	0
Groin seruma	2	20.6
Groin infection	1	10.3
Lymphedema	3	30.9

Hospital stay ranged from 7 to 15 days with an average of 11.6 days.

Long term follow-up showed that the flaps all withstood radiotherapy well with no ulceration or breakdown of the wounds. Hypertrophic scar was the only donor site complication seen during follow-up and no hernias were seen. Chronic lymphoedema was the most commonly met with complication and was exacerbated by the radiotherapy received after the operation. It was seen in 3 patients (30.9%) and responded well to conservative measures (stockings, foot elevation and intermittent diuretic therapy).

DISCUSSION

The reconstructive options to provide coverage of groin defects wounds would be local, distant flaps, or free-tissue transfer. VRAM flaps have been used successfully in coverage of defects of the groin, hip, perineal, vaginal, and gluteal regions with good functional outcomes **[15]**. The advantages of pedicled standard VRAM are providing ample skin, soft tissue bulk, simplicity of execution, low complication rate, and high success rate in which a safe and fast forward flap procedure is the reconstructive goal especially in high-risk group.

The design of the lateral orientation is based on a well-established vascular anatomy of inferior epigastric vessels which give rise to large fasciocutaneous perforators that communicate by means of choke vessels to anterior branches of lateral intercostals vessels at a 45-degree angle to the anterior axillary line. Also, the superior epigastric artery divides into 2-3 branches almost immediately upon entering the rectus muscle; the lateral segmental branch skirts the costal margin in the neurovascular plane and eventually becomes the eighth intercostal artery. These muscular branches give rise to musculocutaneous perforators, which also anastomose with deep inferior epigastric pedicle. Buchel et al., have found that preservation of the origin of the rectus muscle to the pubis protected the pedicle from undo or twist **[16]**.

The local effects of infections and/or surgical trauma create a dearth of local soft tissue available to provide stable coverage of these complex wounds. In previous studies, trials have reported to cover proximal lower limb defects with either single or combined large lower extremities flaps **[17]**. The local muscle flaps in this region are often hypovascular and fibrotic rendering them insufficient to provide sufficient soft tissue coverage, in addition, the use of local muscle flaps may result in loss of extremity and joint stability **[18]**.

While microvascular options could be considered, the limited availability of recipient vessels with higher incidence of vascular complications, proximity of anastomosis to potentially infected zone following previous radical surgery, opening new dissection plane, and lengthy operative time in immunocompromosed patients would preclude the use of this option in these settings as the first option **[18]**. In addition, venous drainage and tissue oedema may also be more problematic with such flaps in dependant portion of the lower extremity **[19]**.

Radical surgery for malignancies at the groin carries a high complication rate. Wound infection and breakdown following radical inguinal lymph node dissection in cases with carcinoma of the vulva were reported to be as high as 54% in some series **[14]**. Although with modifications of the technique and the use of separate transversely oriented incisions this rate has fallen to about 14% in some reports, it is still a far from rare complication in any patient undergoing inguinal block dissection for metastatic lymph nodes from whatever primary **[20]**. Likewise for patients with skin invasion from the nodes (and fungation) the surgeon is faced with trying to provide adequate soft tissue

cover to the groin with its major vessels. That this reconstructive procedure should be well vascularised, dependable, able to withstand postoperative irradiation, and technically simple with a low morbidity goes without saying **[21]**.

The same prerequisites apart from the ability to withstand irradiation are needed when reconstructing groin defects following traumatic loss especially when a vascular prothesis has been employed. In this setting reconstruction with a well-vascularized flap preferably including muscle to combat infection and protect the graft is imperative **[12,13,22]**.

Although several options exist for reconstruction of groin defects such as the tensor fascia lata flap, rectus femoris myocutaneous flap, sartorius muscle flap, internal oblique muscle pedicle flap, free flaps (rectus abdominis or latismus dorsi) and skin grafts, the rectus abdominis myocutaneous flap meets all the prerequisites for reconstruction with minimal drawbacks **[23-25]**.

In this study we used a contralateral reversed rectus abdominis myocutaneous flap to reconstruct large groin defects following radical tumour surgery or to manage large groin defects resulting from skin sloughing after previous inguinal block dissection or defects due to vascular bypass surgery or groin trauma. Defect size in our cases ranged from 30 to 420 square centimeters. All these defects were adequately covered by the flap. This is to be expected as this flap can include a skin island of up to 30 by 15cms with primary closure of donor site and excellent flap vascularity and even greater dimensions as reported by Reece et al who used it to cover defects larger than 500cm^2 **[26]**.

In this study, the operative time for flap raising and insetting ranged from 112 to 171 minutes with a mean of 146 minutes. This operating time of less than two and a half hours compares very favourably with operating times for free flaps which take at least twice as long and is similar to other reports utilizing this flap **[6,27,28]**.

The reconstructive procedure was not associated with blood loss needing transfusion in any of the cases although blood transfusion was needed in three cases due to losses occurred during the tumour resection and gunshot bleeding. 8 flaps survived with only one flap loss 48 hours after operation (Gunshot) which may be due to pedicle thrombosis from sever sepsis and two donor site related complications (parial skin disruption requiring secondary sutures and seruma in one case). Good wound healing was seen in all the cases and we attribute this to the meticulous preparation of the recipient bed especially in the post-sloughing cases, here a very thorough wound debridement is an integral part of the procedure. Long term donor site complication was hypertrophic scar seen in two cases. Minor complications in the form of seruma was seen in 2 cases (20.6%) which responded well to conservative measures, although we believe that this complication is related rather to the tumour ablative procedure (inguinal block dissection) than the flap. Likewise the only long term complication seen was chronic lymphoedema of the limb which was more evident after radiation therapy-here again we believe the tumour resection is responsible rather than the type of reconstruction employed. This is supported by the literature discussing inguinal and inguinoiliac dissections **[29,30]**. Reece et al., reported similar complication rates in their report on 25 cases. They had a total complication rate of 68% with chronic lymphoedema forming 42% and seruma 29% of complications seen. Hospital stay in the cases ranged from 7 to 15 days with a mean of 11.6 days which is comparable to other studies **[29]**.

In this work, we used routine Doppler mapping of the deep inferior epigastric artery prior to commencing the procedure. Other authors have advocated Doppler mapping while others advocate preoperative angiography. We have not found it necessary to use angiography although this may be indicated in cases where previous trauma or surgery may have damaged the pedicle **[10,32]**.

Nesmith et al., however demonstrated that major donor site morbidity is higher in critically ill patients with severe nutritional disturbances or patients with poorly healed previous laparotomies or patients on mechanical ventilation **[33]**.

In this work, there were no incisional hernias seen. We attribute this to the fact that a fascia sparing technique was used which allowed adequate closure of the abdominal fascia without tension and the routine use of a proline mesh to reinforce the anterior abdominal wall. This is in accordance with other reports **[34]**. Likewise no cases of deep vein thrombosis which could be attributed to our routine use of subcutaneous heparin, elastic stockings and early ambulation.

Most of the cases received postoperative radiotherapy and this did not lead to any flap related complications. One of the advantages of this flap was that it did not lead to any delay in starting the radiation therapy.

Some authors have gone as far as recommending the routine prophylatic use of inferiorly based rectus flaps after inguinal block dissection to avoid wound breakdown **[35]** although most would prefer not to use prophylactic flaps as good wound healing can be expected in the majority of cases.

Vergote et al believe that this flap is the best suited for reconstruction of groin defects and should be the technique of choice whenever feasible **[36]**. The use of this flap in this study would certainly support this conclusion. Other authors have stressed the usefulness of this flap in the traumatic setting and in covering and protecting vascular prothesis. They also report on its value in infected wounds as it promotes healing by virtue of its good blood supply **[36]**. We have found that preoperative Doppler mapping of the vascular supply, thorough debridement in post sloughing cases, meticulous haemostasis, good undermining and avoidance of tension at the donor site, generous tunneling for the flap, use of fascia sparing technique, and routine use of a synthetic mesh in addition to deep vein thrombosis prophylaxis and broad spectrum antibiotic prophylaxis all contribute to its success.

Conclusion:

Reversed contralateral inferiorly based rectus abdominis myocutaneous flap is the technique of choice for reconstruction of groin defects with exposed vascular bundle as the blood supply of other local flaps destroyed by the tumor or vascular oblative procedures moreover, it is ease, wide dimensions with good distant vascular pedicle and combat infection and radiotherapy.

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