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The cutaneo-lymph node flap of the superficial circumflex artery

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Abstract Upper limb lymphoedema and associated radiation-damaged chest wall are complications occurring after breast cancer treatment. Previous anatomical and clinical studies have demonstrated the usefulness of inguinal lymph node autotransplantation in managing lymphoedema. The present anatomical study is a complement to previous studies about the cutaneous inguinal flap. It has demonstrated the feasibility of using a free inguinal cutaneo-lymph node flap supplied by the superficial circumflex iliac artery. The useful vascularized abdominal skin area ranged from 176 to 288 cm^2 and was contained within a vascularized skin area extending up to 928 cm^2. However, the vascularization never extended widely beyond the abdominal midline line. Although it mainly remains unilateral, this flap combining skin and lymph nodes may help in the management of lymphoedema and chest wall damage when they occur simultaneously as complications of breast cancer treatment. The French version of this article is available in the form of electronic supplementary material and can be obtained by using the Springer LINK server located at http://dx.doi.org/10.1007/s00276-002-0024-7

Le lambeau cutanéo-lymphonodal de l'artère circonflexe iliaque superficielle

Résumé Les lymphoedèmes du membre supérieur associés à une atteinte post-radique de la paroi thoracique sont une complication possible du traitement du cancer du sein. Des études anatomiques et une mise en application clinique ont démontré que l'autotransplantation des lymphonoeuds inguinaux était utile pour traiter le lymphoedème. L'étude anatomique que nous présentons est un complément d'études du lambeau libre cutanéo-inguinal. Elle a démontré qu'il était possible d'utiliser un lambeau libre cutanéo-lymphonodal alimenté par l'artère circonflexe iliaque superficielle. La surface utilisable de peau abdominale vascularisée était de 176 à 288 cm^2 et était contenue à l'intérieur d'une surface de peau vascularisée qui s'étendait jusqu'à 928 cm^2. Toutefois, la vascularisation ne s'étendait jamais au-delà de la ligne abdominale médiane. Bien que ce lambeau reste unilatéral, il peut, en combinant de la peau et des lymphonoeuds, permettre de traiter les deux complications du cancer du sein, atteinte cutanée pariétale et lymphoedème, quand elles surviennent en même temps.

Keywords Lymphoedema · Breast reconstruction · Lymph node · Transplantation · Groin flap

Introduction

Upper limb lymphoedema is a challenging complication occurring after surgery and/or radiotherapy for breast carcinoma. Transplanting lymph nodes at the root of the lymphoedematous limbs was proved effective in managing this difficult problem [3]. Another complication that is difficult to manage is when the skin overlying the previously treated mammary gland is damaged, either by chronic infection or by post-radiotherapy sequelae. In such cases the treatment consists of a large resection of all diseased tissue. The ensuing loss of skin is usually repaired by means of musculocutaneous flaps [1]. Loss of skin can also be covered by a free cutaneous flap using microsurgical techniques. A flap supplied by the superficial circumflex iliac a. (groin flap) was described by McGregor and Jackson in 1972 [10]. Both lymphoedema and damaged chest wall skin can occur at the same time. Since the inguinal lymph node transplant and the groin

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flap are supplied by the same vessels, it seemed logical to us to examine the exact extent of this combined flap, in view of its clinical use in such a situation.

Material and methods

This study was based on six adult cadavers: four female and two male, mean age 88 years (range 80–97 years). All the cadavers had been refrigerated; none had been embalmed.

The study consisted of two procedures. In the first, arteries of the left groin were approached via a skin incision parallel to the inguinal lig. that then ran downwards medial to the femoral a. and saphenous v. Dissection was performed until the origin of both superficial and deep femoral aa. was identified. All collateral arteries were dissected at their origin. The superficial circumflex iliac a. (SCIA) was isolated and the neighbouring arteries were ligated. The SCIA was then injected with blue-coloured (4%) latex (150 ml) using manual pressure.

The second procedure took place 48 or 72 h later. The surface of the blue-coloured skin was measured and its extent was described according to anatomical landmarks: anterior superior iliac spine, greater trochanter, chondrocostal margin, umbilicus and pubic symphysis. The flap was then dissected, and raised on the SCIA including the lymph nodes supplied by the artery. Anastomoses with the (perforating) vessels issuing from the superficial and deep epigastric aa. were carefully identified and divided. Once the flap was free, its dimensions were measured.

Results

The principal characteristics of the flap are shown in Table 1. The injected skin area extended from the root of the thigh up to the chondrocostal margin (Fig. 1). Medially it always extended to the abdominal midline joining the umbilicus to the pubic symphysis, and a little further to the right in four cases (extending beyond the midline for 2–3 cm). Laterally the skin area reached a vertical line drawn from the greater trochanter, and extended more posteriorly in three cases. The abdominal surface area ranged from 176 to 288 cm^2 (mean 240 cm^2). The width of the flap ranged from 11 to 17 cm at its lower part and generally extended to the iliac spine, starting from the origin of the SCIA. The mean total surface area, including the thigh and lumbar part at the level of the greater trochanter, was 850 cm^2 (range 660–928 cm^2). The origin of the SCIA, including the inguinal nodes, was always easy to identify (Fig. 2) and superficial inguinal lymph nodes were always present within the flap.

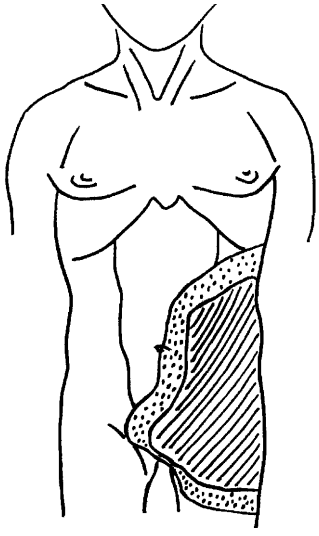

Fig. 1. The range of the injected abdominal skin area

Table 1. Characteristics of the cutaneo-lymph node flap

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Anatomical boundaries of the flap						
Above	Costal margin	4 cm below costal margin	3 cm below costal margin	3 cm below costal margin	Costal margin	Costal margin
Below	15 cm below inguinal lig.	16 cm below inguinal lig.	14 cm below inguinal lig.	16 cm below inguinal lig.	15 cm below inguinal lig.	14 cm below inguinal lig.
Laterally	16 cm posterior to the greater trochanter line	11 cm posterior to the greater trochanter line	15 cm posterior to the greater trochanter line	8 cm posterior to the greater trochanter line	10 cm posterior to the greater trochanter line	11 cm posterior to the greater trochanter line
Medially	3 cm beyond the abdominal midline	Abdominal midline	S shape 3 cm beyond the abdominal midline	S shape 3 cm beyond the abdominal midline	2 cm beyond the abdominal midline	Abdominal midline
Arterial supply						
Origin	1 cm below the inguinal lig.	At the level of the inguinal lig.	At the level of the inguinal lig.	At the level of the inguinal lig.	1 cm below the inguinal lig.	1 cm below the inguinal lig.
Diameter	3 mm	3 mm	3 mm	3 mm	2.5 mm	2 mm
Size of abdominal part (cm)						
Width	13	13	17	14	16	11
Height	17	22	17	18	18	16
Total size including the thigh (cm)						
Width	29	24	32	22	26	22
Height	32	38	31	34	33	30

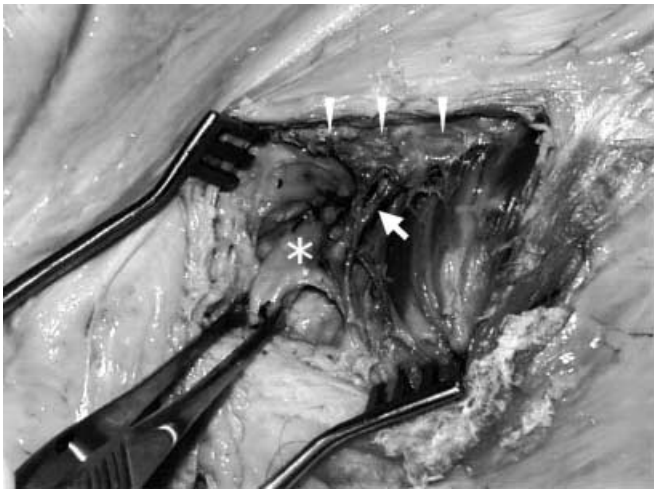

Fig. 2. Origin of the superficial circumflex iliac a. (*arrow*) and view of the lymph nodes it supplies (*arrowheads*). *Asterisk*, femoral a.

Discussion

The lymphoedema of the upper limb encountered as a complication following breast carcinoma treatments is due not only to the removal of axillary lymph nodes but also to the iatrogenic impairment of some very important alternative drainage pathways: deltopectoral, tricipital and scapular [5]. Physiotherapy is most efficient when the lymph drainage of the limb is directed into these alternative pathways [9]. When they are impaired (by surgery and/or radiotherapy), results are not so good and surgical treatment is advisable. Surgical techniques are numerous [12]. Since 1991, we have routinely used inguinal lymph node autotransplantation with good results [3]. The rationale for this technique was based on anatomical studies.

Inguinal lymph nodes are classified as deep and superficial. Rouvière [13] mentioned that most of the superior external groups of superficial lymph nodes are located along the superficial circumflex iliac blood vessels. Caplan [4] reported that these more external superolateral nodes received the lymph from the lower limbs in only 18% of cases. In an anatomical study performed on 25 cadavers [2], we demonstrated that this superior external lymph node group forms a functional unit including two to four nodes vascularized by the SCIA and draining mainly the lymph from the abdominal wall. Lymph drainage from the lower limbs was never impaired by removal of the nodes. Potential lymphoedema of the lower limb thus being unlikely, this group of nodes appeared suitable for autotransplantation using microsurgical vascular anastomosis; this was confirmed by clinical study [3]. The ''groin flap'' described by McGregor and Jackson in 1972 [10] is also supplied by the SCIA. This flap has been used in different indications to cover skin defects [6, 7, 15, 16], prioritizing its lateral extent in the line of the inguinal lig. [14].

The skin lying transversely across the lower abdomen is a very interesting donor site because it may be harvested from one anterior superior iliac spine to the other [11] and leaves an excellent donor site scar. It is used as a superiorly based rectus abdominis flap (transverse rectus abdominis muscle: TRAM).

The purpose of our work was to study which area of skin located at that level was supplied by the superficial iliac vessels. The use of an injection technique was considered. Radiopaque contrast medium had been used by Smith et al. [14] without gaining more information than that already acquired by cadaver dissection. We therefore used neurovascular injection of coloured latex because it permitted the vascularized skin area to be coloured and, since the latex solidifies, allowed the dissection of injected vessels without the risk of spillage. As the lymph nodes vascularized by the same artery had been confirmed by one of our previous studies [2], they were not simultaneously injected. A large volume of latex was used without controlling the pressure. The extent of the injected area could have been overestimated due to the richness of possible vascular anastomoses. However, the clinically useful area of skin covering the lower abdomen was always contained within the maximum injected area we obtained and is thus probably not overestimated. Furthermore, extension of the injected area contralaterally over the midline was not observed, which demonstrated that overestimation was also not possible at that level.

Our results confirm that the groin flap may be extended to the ipsilateral skin across the lower abdomen, including vascularized lymph nodes, and not only lateral to the anterior iliac spine, as reported by Smith et al. [14] and Hester et al. [8]. However, the SCIA does not supply the contralateral area beyond the midline and cannot represent an alternative to TRAM. The skin loss to be covered after resection of radiation-damaged skin following breast cancer treatment is usually not too large. The use of an ipsilateral cutaneo-lymph node free flap of the SCIA is possible. The flap, including vascularized lymph nodes, is able to treat both the skin defect and lymphoedema. In the case of larger defects, a flap raised on the same side of the patient and excised too widely across the lower abdomen over the contralateral side would risk skin necrosis. In such cases, the anatomical analysis we performed indicates that one flap is not sufficient and suggests the possibility of using the contralateral flap also. Both flaps may be used as a whole, provided right and left superficial circumflex iliac arteries and veins are harvested and anastomosed on the receiving site.

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