

Gracilis Muscle Flap after Superficial Inguinal Lymphadenectomy in an Irradiated Inguinal Field: A Case Report

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Case report

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Abstract

Background: The sartorius muscle transposition flap is the traditional method of femoral vessel tissue coverage after superficial inguinal lymphadenectomy for regionally-metastatic cancers to the inguinal lymph nodes. Well-vascularized muscle is the best material to cover vessels. However, if the groin has undergone radiation therapy, the sartorius muscle is contained within the irradiated field, and may be problematic for wound healing, in addition to being thin and tendinous at its insertion and intimately related to several nerves. The gracilis muscle, which is a thick well-vascularized muscle, has been used for soft tissue defects and vascular graft infections, but its utility as an alternative to the sartorius muscle flap in the setting of radiation has never been reported. Here, we report the successful use of the retroflexed gracilis muscle flap for femoral vessel coverage after superficial inguinal lymphadenectomy, in a patient who previously underwent chemoradiation for locally-metastatic anal squamous cell carcinoma to the groin.

Case Presentation: An 86-year old female presented with Stage IIIB anal squamous cell carcinoma metastatic to one left inguinal lymph node (T2N2M0). She underwent modified Nigro protocol chemoradiation treatment, which included radiation to bilateral inguinal node basins and subsequent boost radiation to the left side. A left superficial inguinal lymphadenectomy was performed with a retroflexed gracilis muscle flap to cover the femoral vessels. This was chosen over a sartorius flap because the gracilis muscle was not located within the field of radiation and was more robust to fill the defect. The patient developed a groin wound infection, and the gracilis muscle flap remained viable and successfully protected the major vessels.

Conclusions: We report the gracilis muscle flap as a viable alternative to the sartorius transposition muscle flap for femoral vessel coverage after oncologic superficial inguinal lymphadenectomy in the irradiated groin.

Background

The sartorius transposition muscle flap is the traditional method of femoral vessel coverage during superficial inguinal lymphadenectomy [1], and is commonly used for metastatic cancers to the groin such as anal squamous cell cancer, penile and vulvar cancer, and melanoma of the lower extremity [2, 3]. If the inguinal node basin has undergone radiotherapy prior to this operation, the sartorius muscle is also included within the irradiated field, and may be problematic for wound healing. Additionally, the proximity of the lateral cutaneous nerve of the thigh and the femoral nerve are near the insertion of the sartorius makes them vulnerable injury during harvesting of the sartorius, particularly in an irradiated field.

The gracilis flap was originally developed as a musculocutaneous coverage option for lower extremity and perineal soft tissue defects, as an alternative to delayed healing of these open wounds [4]. More recently, the retroflexed gracilis muscle flap was reported as a method to provide viable tissue coverage of the femoral vessels after complications of vascular surgery such as groin wound infections and vascular

graft infections [5, 6]. The gracilis flap was also innovated into an extended-dissection technique by Ducic *et al.* to potentially cover larger and more complex perineal wounds [7]. However, the utility of the gracilis muscle flap as an alternative to the sartorius flap for coverage during superficial inguinal lymphadenectomy in the setting of local radiation exposure has not been reported.

Here, we report the successful usage of a retroflexed gracilis muscle flap for femoral vessel coverage after superficial inguinal lymphadenectomy for metastatic anal squamous cell carcinoma, in the setting of an irradiated groin.

Case Presentation

The patient is an 86-year old otherwise generally healthy Hispanic female who initially presented with an anal mass, demonstrated on biopsy and imaging to be a T2 squamous cell carcinoma. A PET/CT showed no distant metastatic lesions, thus her lesion was stage IIIB (T2N2M0). A single palpable firm 3-centimeter lymph node was found in the left groin, and fine needle aspiration biopsy demonstrated malignant squamous cell carcinoma cells. She underwent chemoradiation treatment consisting of a modified Nigro Protocol, which included mitomycin with 5-fluorouracil and a course of external beam radiotherapy. The primary anal lesion clinically regressed, and repeat anal biopsy after completion of chemoradiation was negative for malignancy. The anal mass and pelvic lymph nodes received 5400 cGy, the right inguinal lymph node basin received 5040 cGy, and 6120 cGy was delivered to the left inguinal lymph node basin. However, the left groin node was noted smaller but remained palpable, and repeat fine-needle aspiration was positive for metastatic squamous cell carcinoma. In light of the metastatic left inguinal lymph node, the left lymph node basin subsequently received an additional 1080 cGy boost dose for a total of 7200 cGy.

Approximately two months after completion of radiotherapy, the patient underwent a superficial inguinal lymphadenectomy through an open left groin approach, and the palpable metastatic lymph node was included *en bloc*. This node was confirmed on final pathology to contain metastatic squamous cell carcinoma, and no additional metastases were found in the specimen.

During the same procedure, a gracilis rotational muscle flap was performed to cover and protect the femoral vessels, in lieu of a standard sartorius muscle flap, in the following fashion: A 10-centimeter longitudinal incision overlying the gracilis muscle on the mid-medial thigh was made (**Figure 1A**). The minor medial vascular pedicle of the gracilis was divided with clips, and the muscle was mobilized down to the level of the knee, and transected near its insertion site through the tendinous portion. The main blood supply of the muscle, the main vascular pedicle proximally off the profunda femoris artery, was preserved. A tunnel was created from the inguinal incision into the gracilis harvest incision, and this muscle was mobilized proximally. A 4-0 prolene stitch was placed into the gracilis tendon and passed through the tunnel, and this was used to retroflex the muscle upwards into the groin incision. 4-0 prolene interrupted stitches were used to suture the Gracilis tendon to the undersurface of the inguinal ligament adjacent to the femoral vessels. 3-0 vicryl interrupted stitches were then used to suture the gracilis muscle

to the adductor longus and sartorius muscles to complete the muscle flap coverage (**Figure 1B**). The skin flaps, as well as the muscle harvest site, were then closed in standard fashion.

The patient recovered well in the immediate post-operative period, but over the first two weeks post-operatively, she developed skin flap necrosis and a methicillin-resistant staphylococcus aureus (MRSA) wound infection which required operative debridement, washout, and negative pressure wound vacuum therapy (**Figure 2A**). The gracilis flap remained viable with complete coverage of the vessels, and no dead space was noted. The gracilis harvest incision on the thigh, which was not in the field of irradiation, healed well (**Figure 2B, inset**). The inguinal wound was allowed to heal by secondary intent over the subsequent months (**Figure 2B**), and the patient remains well to this day.

Discussion And Conclusions

We demonstrate the successful utilization of a retroflexed gracilis muscle flap to provide femoral vessel coverage in an irradiated groin after superficial inguinal lymphadenectomy for metastatic carcinoma. Despite a subsequent groin wound infection and breakdown in this patient, requiring debridement and negative pressure therapy for an extended period of time, the gracilis flap remained viable and effectively prevented vascular complications of the femoral vessels. We attribute this to several factors, especially that the gracilis muscle originated in an area that was unexposed to radiation, and thus retained its wound healing capacity. This represents an advantage over the traditional sartorius transposition flap, since this muscle would be exposed to groin radiation for lymphadenopathy. Additionally, the gracilis is a more robust muscle at this level and fills the femoral triangle, leaving little dead space. Cases of sartorius muscle necrosis have been reported due to the fact that the muscles segmental blood supply, which is lateral, can be interrupted by folding or kinking with mobilization [8].

This case is relevant to a variety of cancers in which metastasis frequently occurs in the inguinal lymph node basin. Over forty primary cancer types for inguinal lymph node metastases have been identified [9], including anal squamous cell carcinoma [10], vulvar and penile cancer [11, 12], non-melanomatous skin cancers of the lower extremity [9], and melanomas of the lower extremity and anus [13, 14].

The gracilis muscle flap is an easy technique for the surgeon to learn and does not require special training. Using the gracilis has no oncologic drawbacks, and does not add significant complexity or time to the superficial inguinal lymphadenectomy operation. Additionally, as we saw in our patient, the inclusion of an additional incision for the muscle harvest site is unlikely to add significant morbidity to the operation and is likely to heal without complication since it is unexposed to radiation.

Although this case is significant for its success, it represents only one patient. Future studies will be required to compare the sartorius transposition flap versus the retroflexed gracilis flap the irradiated field, in terms of wound and vascular outcomes.

The retroflexed gracilis muscle flap is a viable alternative to the sartorius transposition muscle flap for femoral vessel coverage during superficial inguinal lymphadenectomy operations for patients with an

irradiated groin, and is applicable to a variety of metastatic cancers.

Abbreviations

PET/CT, Positron Emission Tomography / Computed Tomography; cGy, centigray; MRSA, Methicillin-Resistant Staphylococcus Aureus.

Declarations

Ethics Approval and consent to participate:

Not applicable.

Consent for Publication:

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and materials:

Not applicable.

Competing Interests:

The authors have no commercial or financial associations that might create a conflict of interest with the information presented in this manuscript.

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Authors' Contributions:

All authors were involved in the patient care and decision-making process. CDV analyzed wrote the first draft of the manuscript. MKW, JGM, and DF are attending operative surgeons who conceived the case report. ZS is the attending plastic surgeon who researched plastic reconstructive options in this scenario, and was one of the operative surgeons. CDV, DF, ZS, JGM, and MKW have been involved in drafting the manuscript and revising it critically for important intellectual content. All authors have read and approved the final manuscript.

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Figures

A



B



Figure 1

Intraoperative photographs of (A) the gracilis muscle divided at its distal insertion through a medial mid-thigh incision, before retroflexion through a subcutaneous tunnel upwards into the (B) left groin incision to cover the femoral vessels. Stitches securing the gracilis to the inguinal ligament and sartorius muscle are visible.

A



B

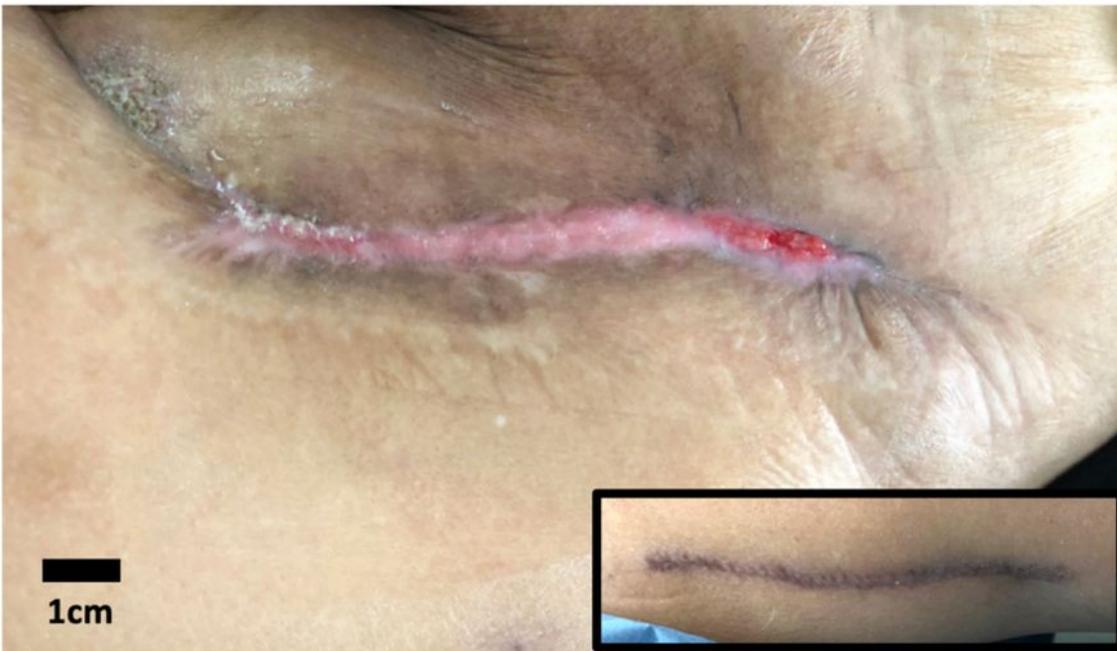


Figure 2

(A) The left groin incision on post-operative day 14, notable for wound infection with dehiscence. (B) The appearance of the left groin incision three months post-operatively, almost completely healed after wound debridement and lavage followed by two-and-a-half months of negative pressure therapy. The gracilis flap remained viable, and successfully protected the femoral vessels throughout the post-

operative course. Inset: Gracilis flap harvest site from inner thigh (Fig. 1A) at three months post-operatively. This area was not exposed to radiation, and healed without complication.

Supplementary Files

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