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The use of polytetrafluoroethylene to facilitate the vascular access in recurrent melanoma to limbs

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ABSTRACT

INTRODUCTION: Melanoma with recurrent loco-regional metastases to limbs often makes difficult a second surgical approach because of the adhesions affecting the vascular access. Our aim was to evaluate whether the placement of a polytetrafluoroethylene (PTFE) membrane around vessels might facilitate a surgical re-approach.

PRESENTATION OF CASE: We reported a case of a 64-year-old male with a melanoma on the left foot who developed *in transit* metastases after LND. While performing the inguinopelvic LND we coated the iliac vessels with PTFE patch to facilitate the vascular access in case of re-intervention for a ILP. In the second surgical approach we made a cutaneous incision in the left iliac region and we proceeded through the subcutaneous tissue until detection of iliac vessels, more clearly visible because of the PTFE patch fixed around vascular walls to minimize adhesions. We removed the PTFE coating and easily performed arteriotomy and venotomy for the completion of the ILP.

DISCUSSION: This case report seems to demonstrate the efficacy of a PTFE membrane applied in a patient around iliac vessels during inguinopelvic dissection, to reduce adhesion density. In fact this membrane provided a barrier to adhesions of the iliac vessels, decreasing the risk of vascular injury thereby facilitating a subsequent vascular access. Re-coating of the iliac vessels with PTFE could be preparatory to a better identification of the vascular structures in cases of a surgical re-approach.

CONCLUSION: The use of PTFE effectively simplifies the second approach to vessels in event of a melanoma metastasizing to limbs.

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1. Introduction

The standard of care for cutaneous melanoma (CM) classified at stage III by the American Joint Committee on Cancer (AJCC)¹ is a radical lymph-node dissection (LND) in case of regional lymph-node involvement or an isolated limb perfusion (ILP) in presence of *in transit* metastases.^{2–4} A significant rate of stage III melanomas undergo to new recurrences after the first surgical treatment so that a further surgical approach has to be considered for the management of these cases of bulky lymph-node or recurrent *in transit* metastases, in absence of extra-regional disease. The main difficulty in treating these patients is connected to the previous surgical treatment they underwent, that could have caused surgical adhesions affecting vascular fragility and sometimes the inability of a new access to vessels.^{5–7} Our aim was to evaluate the ability of a

device, the polytetrafluoroethylene (PTFE), applied as a membrane around vascular walls, to minimize the formation of adhesions between the vessels thereby providing a plane of dissection (separation of tissues) in event of needing a further surgical approach.

2. Presentation of case

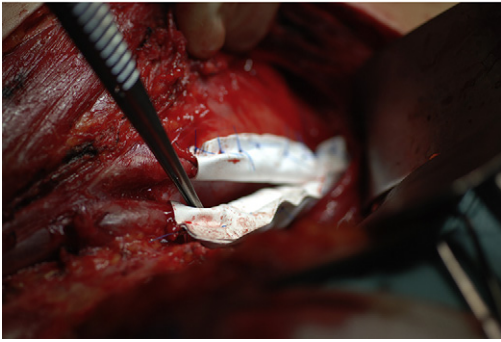
A 64-year-old male was first seen in March 2004 at our Institute by the Melanoma Unit. The physical examination revealed the presence, on the plantar region of the left foot, of an irregular, heterochromic pigmented lesion of 1 cm in diameter; no palpable loco-regional groin lymphadenopathy were detected.

We performed an excisional biopsy of the pigmented skin lesion; the histopathology revealed an acral lentiginous melanoma with a Breslow thickness of 1.48 mm, the presence of ulceration and of a high mitotic rate (AJCC Stage IIA). The resection margins were negative for malignancy. Three weeks later the patient underwent to a wider excision in the plantar region, with a plastic reconstruction by skin graft, and to a groin sentinel lymph-node biopsy (SLNB). Histopathology was negative in both cases. The SLNs were

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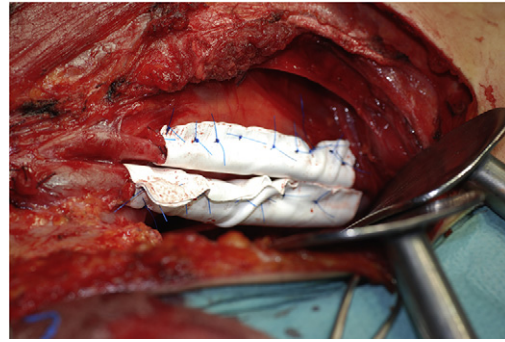


Fig. 1. (1.1) Operative photograph showing the technique of coating the iliac vein and artery during inguinopelvic lymph-node dissection. The PTFE membrane was hydrated in sterile saline at room temperature for 15 min; then we proceeded to cut strips about 5 cm long \times 3.5 cm high for use during the surgery, with small variations in size due to the caliber of the vessels. (1.2) The vessels were lined by strip that was inserted using a synthetic monofilament of non-absorbable polypropylene suture between the two extremities of the long side, leaving a few millimeters between the membrane and the vessel. No sutures are placed between the vessel wall and the membrane.

reviewed as permanent sections; multiple sections were carefully examined by immunohistochemical staining for S-100, HMB-45, and later MART-1 or Melan-A.^{8–10}

The patient was submitted to a regular follow-up and 15 months later a groin lymphadenopathy of 2.5 cm was detected, the cytology after a fine needle aspiration confirmed the clinical suspicion of a regional metastasis. Thus a complete inguinopelvic LND was performed. Inguinal dissection was completed via a longitudinal curvilinear incision beginning medial to the anterior superior iliac spine and terminating at the apex of the femoral triangle inclusive of the SLN biopsy site. Prior SLN biopsy incisions were incorporated and removed. Dissection was carried to the pubic tubercle medially, sartorius laterally, femoral triangle apex distally, and inguinal ligament proximally. The saphenous vein and lymphatic vessels were ligated. Contents of the inguinofemoral triangle were cleared off the femoral vessels and submitted. Pelvic dissection was performed via the same incision. The inguinal ligament was divided 1–2 cm lateral to the femoral vessels. The external oblique, internal oblique, and transversalis fascia were also divided. Preperitoneal fat and peritoneum were swept medially. External iliac nodes were then removed and submitted. The pelvic side wall was then dissected with retraction of the external iliac vessels. The obturator fossa was entered with preservation of the ureter, obturator nerve, and hypogastric branches. Obturator node specimens were submitted. The histopathology showed the presence of metastases to 6 crural inguinal lymph-nodes over 15 examined and no evidence of metastases in 5 external iliac and obturator lymph-nodes.

Considering that the patient had a IIIC stage melanoma, related with an high risk of recurrence, and that the disease was still having a loco-regional involvement, without distant metastases, while performing the groin lymph-node dissection we decided to protect the iliac vessels from surgical adhesions, in case of needing a second surgical approach to this district for a new loco-regional relapse. A membrane of PTFE, commonly experimented as an effective solution to minimize the tissue adhesion in surgical reconstructive procedures^{11–13} was used; composed of the inert biomaterial expanded, it features a microporous structure allowing for host tissue incorporation. The biological inertness of the prosthesis, combined with softness and conformability *in vivo*, should minimize foreign-body response and adhesions to surrounding structures. The PTFE membrane was hydrated in sterile saline at room temperature for 15 min; then we proceeded to cut strips about 5 cm long \times 3.5 cm high for use during the surgery, with small variations in size due to the caliber of the vessels. A segment (5 cm in length) of the iliac vessel was covered, in order to be able to cannulate the vases in a hypothetical second surgical approach to perform a ILP. The vessels were lined by strip that was inserted



Fig. 2. Multiple cutaneous – subcutaneous *in transit* metastases to left lower limb.

using a synthetic monofilament of non-absorbable polypropylene suture between the two extremities of the long side, leaving a few millimeters between the membrane and the vessel. The iliac artery and vein were wrapped separately; no sutures are placed between the vessel wall and the membrane. The technique performed is illustrated in Figs. 1.1 and 1.2.

Thirteen months after the inguinopelvic dissection a physical examination performed during a follow-up, showed multiple *in transit* to left lower limb (Fig. 2), for which a conventional surgical approach was not suitable. The patient was so candidate for a ILP of the left lower limb with an iliac vascular access.

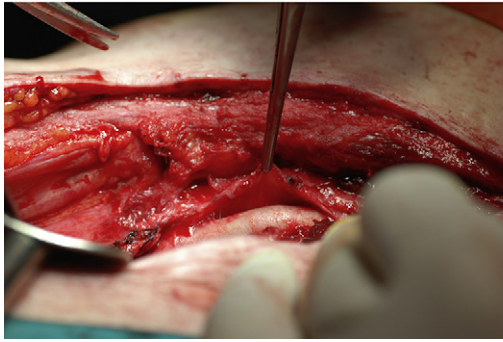
Therefore in this case the technique of limb perfusion was complex; having locally the tissues already subjected to previous surgery, but was more facilitated by positioning the PTFE to cover vessels. This solution allowed us to identify and use a cleavage plane obtaining a second vascular approach less risky, we removed the PTFE coating and easily performed arteriotomy and venotomy, the vessels were cannulated and the ILP was completed (Figs. 3.1 and 3.2).

The patient had no significant post-operative complications and currently he is disease-free and is undergoing to a close and regular follow-up.

3. Discussion

This case report seems to demonstrate the efficacy of a PTFE membrane applied in a patient around iliac vessels during inguinopelvic dissection, to reduce adhesion density. In fact this

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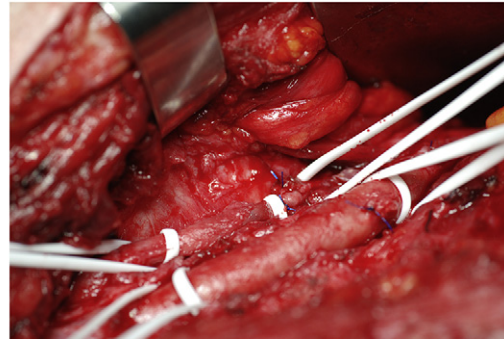


Fig. 3. (3.1) We exceeded the sub-cutaneous tissues searching for the iliac vessels till we identified the PTFE patch fixed around vascular walls that allowed us to detect the iliac artery and vein. Furthermore the PTFE membrane gave us the possibility to identify and use a cleavage plane obtaining a less risky approach to vessels walls. (3.2) We removed the PTFE patch in order to have an easier access to the vascular structures. We performed arteriotomy and venotomy and cannulated the vessels.

membrane provided a barrier to adhesions of the iliac vessels, decreasing the risk of vascular injury thereby facilitating a subsequent vascular access.

The impact of post-operative adhesions on the surgical patient and on re-operative surgery are increasingly realized.^{14,15} Their presence may impose re-operative problems in both cardiac and general surgery, as well as producing post-operative complications peculiar to the type of primary surgery. A vascular approach in melanoma patients is commonly used in the surgical treatment of regional lymph-node metastases or *in transit* metastases as primary melanoma of the limbs often shows a spreading of disease long the lymphatic ways.^{2–4} However, while treatment of a positive regional lymph-nodes with a therapeutic lymph-node dissection (TLND) is a highly diffuse procedure, ILP in case of *in transit* metastases to limbs is only used in a few centers for the principal reason that although the procedure is simple in concept, it is surgically and technically complex, and demanding in practice, and related to a high risk of post-operative vascular complications.¹⁶ Even more difficult may be the approach to vessels when performing an ILP in patients already submitted to a TLND or to a previous ILP that caused adhesions on the vascular structures. The best treatment for adhesions should be prevent or minimize their formation. Nevertheless, in the absence of a universally accepted method for preventing adhesions, several techniques and disease states have been suggested to predispose to adhesion formation and various experiences have been performed to document this. They include incomplete haemostasis, foreign bodies, tissue injury, type of suture utilized, amount of crushing and tissue destruction from instrumentation, tissue desiccation, and underlying infection. Many practical techniques may be utilized to minimize aberration from optimal techniques: the use of gauze and minimally moistened dry sponges may cause significant surface injury as well as the use of frequent irrigation has been recommended to limit tissue desiccation and keep tissues moistened. The use of the most acceptable minimally reactive sutures and an effort to not suture unless necessary helps avoid tissue reactions.

In the last years some new materials were tested in order to reduce the extent and severity of adhesion formation between the vessels walls.^{17–19} The PTFE membrane, which became commercially available for clinical use in 2007, is flexible, biocompatible, and similar to PTFE materials that have been used successfully in clinical procedures as interpositional membranes.²⁰

4. Conclusion

Our preliminary experience suggests that the placement of PTFE patch membrane may represent an effective method for reducing the extent and severity of the adhesion formation as well as for preventing the adverse outcomes for re-operations in case of recurrent

melanoma to limbs. In fact the recoating of the vessels walls with PTFE could be preparatory to a better identification of the vascular structures in the event of subsequent surgical approach like an ILP. A large number of cases as well as a careful criteria in eligible patients selection are needed to confirm our findings and validate this experimental method.

Conflict of interest statement

All authors disclose that there are no financial and personal relationship with other people or organizations that could inappropriately influence their work.

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Ethical approval statement

Authors obtained written and signed consent from the patient to publish anonymously the case report.

Authors' contribution

Roberta Ruggeri had done acquisition of data, analysis and interpretation of data along with Tiziana Camerini, Riccardo Pirovano, Ilaria Mattavelli, Federica Crippa, Daniele Moglia and Annabella Di Florio. Besides, Roberta Ruggeri had done the critical revision together with Roberto Patuzzo, Andrea Maurichi and Elena Tolomio, who also helped in critical revision of the article. Mario Santinami had approved the final version for submission.

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