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Management of flap venous congestion: The role of heparin local subcutaneous injection

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Summary Objective: The study aimed to propose an alternative salvage technique based on local subcutaneous injection of low molecular-weight heparin (LMWH) for the management of venous congested pedicle and free flaps in which venous outflow could not be surgically restored.

Methods: A retrospective review of all patients who received the proposed protocol at a single centre was performed.

Results: Fifteen patients were treated (six free flaps and nine regional flaps). The LMWH protocol was applied for a mean of 11 days (10–14 days). Thirteen patients required transfusions with a mean number of 5 U (0–12 U) of packed red blood cells (PRBCs) transfused per patient. All flaps were successfully salvaged (seven totally and eight partially). There were two associated complications: one patient developed a recipient-site haematoma and another patient suffered a syncope episode, related to anaemia.

Conclusions: Local subcutaneous injection of LMWH was proven to be an effective alternative in improving flap venous congestion. The main advantages of this procedure are availability, easy application and local limited action. However, the associated morbidity should be balanced against the risk of flap loss and a judicious application is mandatory.

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Venous congestion of regional and free tissue transfers is a common cause of flap failure.^{1–5} This complication can be related to a number of contributing factors, such as intrinsic venous anatomy, absence of venous repair, venous spasm, venous thrombosis, local oedema, pedicle torsion,

etc.^{1,2,6} Given the irreversible nature of the microcirculatory changes in venous insufficiency, it should be recognised and solved as early as possible.^{7–11}

Surgical exploration remains the gold standard for flap venous congestion^{1,3,4,12,13}; but, if surgical correction is not

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feasible or fails, then alternative exsanguination techniques are employed.^{1–3,11,14} These salvage treatments are used to increase tissue perfusion and decrease congestion until neovascularisation occurs (approximately between the seventh and tenth postsurgical day^{1–4,12,14}). Since the first reference of its application in failing flaps in 1960,¹⁵ many authors considered medicinal leech therapy (MLT) as one of the first choices for the treatment of flaps with venous congestion not otherwise salvageable by surgical means.^{3,4,9,16–18} However, our main concern is related to its limited availability^{4,14,17,19,20} as certain administrative processes may delay its application up to 24–48 h. Given that early action is critical at the slightest sign of congestion^{1,2,12,14} and because of the aforementioned difficulty, we began to employ another medical alternative for the treatment of flap venous insufficiency: local subcutaneous heparin injection in the congestive area of the flap.^{12,21–23} To the best of our knowledge, there is no published study about the application of this therapy in flaps with an established protocol regarding the dose, frequency of administration and duration of treatment. The aim of this study is to propose a salvage therapy protocol for the management of regional and free flap venous insufficiency with local subcutaneous low molecular-weight heparin (LMWH) injection.

Materials and methods

We performed a retrospective review of patients undergoing reconstruction with a regional flap or a free flap between April 2007 and July 2013 at the Department of Plastic and Reconstructive Surgery and Burn Centre of the University Hospital Vall d'Hebron, Barcelona, Spain. Of the approximately 2400 flaps performed by the 12 surgeons of the team during the reviewed period, 15 patients requiring LMWH therapy for flap salvage were identified through departmental databases.

The therapy using LMWH was initiated when one of the following criteria were met:

- a) persistent flap venous insufficiency despite surgical revision,
- b) no stated reason for surgical intervention (flaps with only focal areas of venous congestion, lack of adequate

veins to do vascular anastomoses, microcirculation problems, errors in pre-surgical flap planning, etc.) or c) contraindication for surgery from a medical standpoint.

All patients signed an informed consent emphasising the rescue character of this therapy and its associated risks, especially the need for regular transfusions. The therapy contraindications were:

- a) patients in whom prolonged bleeding may involve unacceptable risks in terms of their clinical context,
- b) patients who refused blood transfusions and
- c) flaps with signs of inadequate arterial inflow.

Patients' demographic data, flap characteristics (type and size) and cause of congestion were recorded. Outcomes were evaluated, including flap survival (total salvage, partial salvage or total loss), start and duration of LMWH therapy, amount of blood transfused following the initiation of treatment, complications other than flap loss and need for secondary surgery.

The applied protocol has been designed based on the results of our clinical experience and the evidence established by Barnett et al.²¹ (Table 1). LMWH injections are administered subcutaneously and intradermally over the congestive surface of the flap. Next, multiple punctiform incisions are made with a scalpel in order to facilitate the venous blood outflow. The incisions should be cleared in each administration to remove clots that might occlude them, together with manual drainage of the flap. Therapy starts with the maximum dose and frequency of administration, determined by the congestive area and the degree of congestion of the flap. Table 2 provides the therapeutic scheme with LMWH (enoxaparin sodium) that has been employed in our department, divided into two groups depending on the flap congestive area in square centimetres. The therapy should last a minimum of 10 days, the time frame required for the reestablishment of neovascularisation,^{1,4,12,14,24–26} adjusting the pattern according to the local response. During the entire treatment, the haematocrit and vital signs should be strictly monitored, assessing the need for transfusion according to both analytical results (haemoglobin level of $<8 \text{ g dl}^{-1}$) and clinical status of the patient.

Table 1 Keypoints of the LMWH treatment protocol.

1. Peripheral venous access
2. Flap decompression (remove of suture materials, dressings, etc.)
3. Make small incisions with an 11 scalpel blade on the venous-congested area of the flap
4. Subcutaneous LMWH injection in a decreasing pattern:
 - a. 1st–3rd day: maximum dose every 4–6 h
 - b. 4th–6th day: half of previous dose every 8 h
 - c. 7th–9th day: decrease frequency of injection to every 12 h
 - d. *10th–14th day: decrease frequency of injection to every 24 h
- *From the 10th day: stop the therapy if congestion resolution is achieved
5. Remove blood clots before every administration and squeeze the flap to express the excess of blood
6. Adjust the guideline depending on local evolution and patient clinical status
7. Check vital signs and haemoglobin level frequently (according to the frequency of LMWH injection)
8. Indicate blood transfusion if Hb level $<8 \text{ g dl}^{-1}$

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