Platelet-Rich Fibrin-Mesh Technique for Inguinal Hernia Repair: Results of a Feasibility Pilot Study

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ABSTRACT

Background: Open mesh repair is one of the most frequently performed general surgery operations worldwide. Unfortunately, the classic technique using stitches to fix the mesh is still associated with a high risk of chronic pain. We propose a new technique that uses autologous Platelet-Rich Fibrin (PRF) to fix the mesh.

Methods: PRF is prepared in theatre by centrifugation of the patient's own blood and immediately applied to fix the mesh. In this feasibility pilot study, five patients were operated upon with the PRF-mesh repair technique. Postoperative pain was evaluated with a visual analogue scale (VAS) up to 6 months after surgery. Time to recovery was also recorded for all patients. VAS in this small group of patients was grossly compared with that in a historical cohort of patients who underwent Lichtenstein repair; due to the small sample size, no statistical comparison was performed.

Results: Postoperative pain remained at low levels and no patient experienced chronic pain, recurrence or any other complication within 6 months. All patients returned to their usual activities within 3 days after surgery. The VAS scores confirmed that PRF-mesh repair may be associated with less pain than the Lichtenstein technique.

Conclusions: PRF-mesh repair is a safe and effective option in the treatment of inguinal hernias as it couples the safety of physiologically enhanced healing with the efficacy of prompt fixation of the mesh.

INTRODUCTION

Inguinal hernia open mesh repair is one of the most frequently performed surgical procedures.

Fixation of the mesh is a much-debated step of the operation. Multiple options are currently available to try to reduce the risk of postoperative pain due to nerve entrapment (incidence of 10-12%), which often causes long-term disability and requires specific treatment.[1] It has been suggested that classic suture fixation should be abandoned in favour of less invasive alternatives such as cyanoacrylate glue,[2] but this is also a permanent material with a long-term destiny that has not yet been clarified.

We propose here a new technique of mesh fixation that uses patient-derived Platelet-Rich Fibrin (PRF).

MATERIALS AND METHODS

Platelet-rich fibrin (PRF) is a second-generation autologous platelet concentrate, obtained from fresh blood by centrifugation. Centrifugation creates a fibrin clot through the activation of autologous thrombin. The clot itself contains a great amount of exudate, which is rich in growth factors (GF) that can be pressed out by gentle compression of the clot to obtain PRF membranes. The serum squeezed out from the PRF clot, called 'hyper-acute serum', has a great proliferative effect on connective cells. The PRF membrane is a three-dimensional, adhesive, biocompatible and biodegradable scaffold that facilitates contact and cell interactions and releases bioactive molecules that facilitate migration, adhesion and proliferation of local stem cells, acting as an ideal adhesive scaffold.[3] The activated platelets and some leukocytes are entrapped in the fibrin net (Leukocyte-Platelet-Rich Fibrin; L-PRF) and a storage pool of GF is formed from platelets and leukocytes upon activation.[4]

We used L-PRF to fix the mesh in 5 male patients undergoing open mesh repair of unilateral primary inguinal hernia. Their mean age was 52 years and the mean body mass index was 26. None of the patients had significant comorbidities that could impair the perception of pain or affect postoperative recovery. Four patients were operated upon under general anaesthesia, while one opted for local anaesthesia. This pilot study was conducted in accordance with the Code of Ethics of the World Medical Association [5] and approved by the Ethical-Scientific Committee of the Villa Aurora Hospital, Foligno (Italy), where the operations were performed. All patients gave their informed consent to the PRF-mesh repair, to participate in the study using their own blood to extract the L-PRF, and to have their data collected for the scope of this research. Completely anonymised demographic and clinical data were prospectively recorded into an electronical database and analysed. The original intent was to use the same technique on a larger number of cases, but the restrictions on elective surgery due to the Covid-19 pandemic required a change of plans.

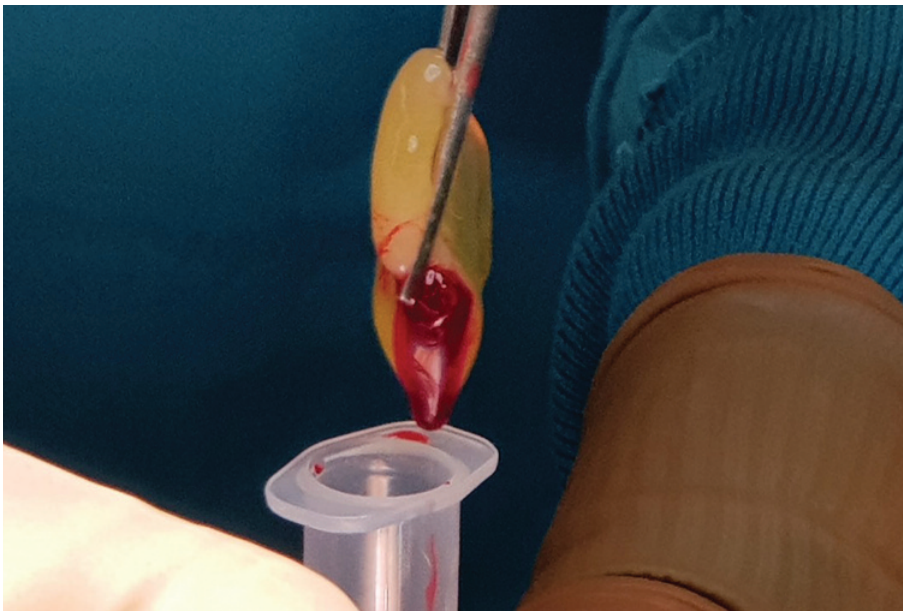

Figure 1. The L-PRF clot was removed from the tube with surgical tweezers

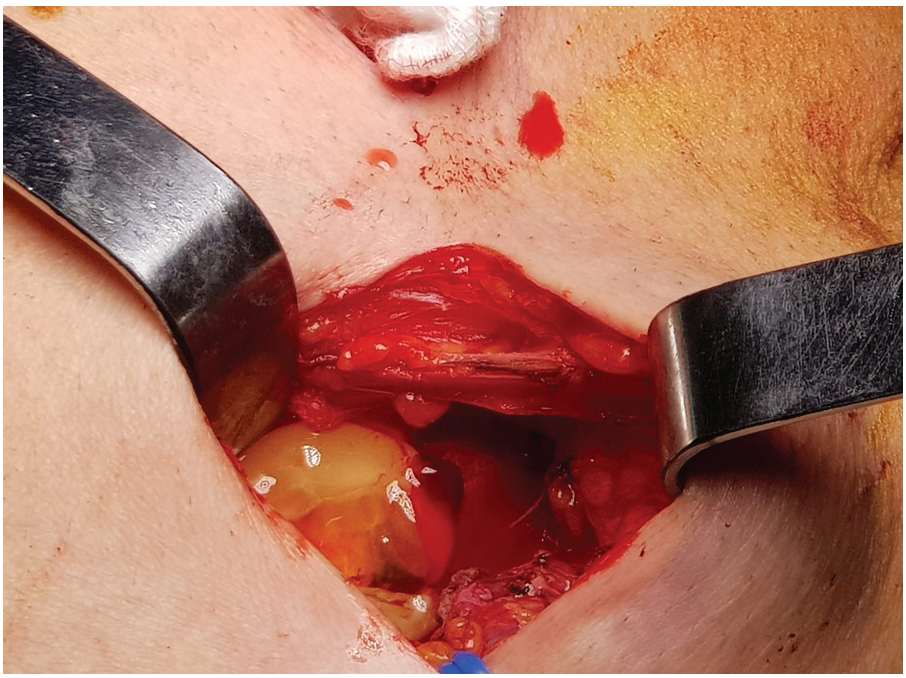

Figure 2. PRF membrane positioning.

Each operation was performed through a 5-6 cm transverse incision in the inguinal region. Minimal manipulation was used to dissect the sac from the cord and to prepare the space where the mesh would be located. The L-PRF clot was prepared in theatre using 9 ml of the patient's fresh blood in glass-coated plastic tubes centrifuged (IntraSpin®, BioHorizons, Birmingham, AL, USA) at 2700 rpm for 12 minutes.[3] After centrifugation, the tube contained three distinct layers: red blood corpuscles at the bottom of the tube, platelet-poor plasma at the top, and the L-PRF clot in the middle. The L-PRF clot was removed from the tube with surgical tweezers (Fig. 1). Three to five clots were used for each patient. The serum squeezed out from the PRF clot generates PRF membranes and hyper-acute serum. Both were applied to the posterior wall of the inguinal canal and a shaped polypropylene mesh was attached over them (Fig. 2). The operation was then concluded as usual. Bupivacaine 20 ml 0.5% was locally infiltrated at the end of the procedure. Oral paracetamol was prescribed after discharge 1 gr three times a day for 5 days.

Postoperative pain was measured with a VAS (Visual Analog Scale) by direct or phone interview at 3 hours, 24 hours, 48 hours, 7 days, 15 days, 1 month, 3 months and 6 months after the opera-

tion. Clinical follow-up was set at 1 and 6 months. The time needed to restart daily activities and time to return to work (when applicable) were recorded. Data were completely anonymised and analysed in an electronic database.

The time profile of VAS for this group of patients was compared with analogous data for a historical matching cohort of 20 patients who underwent Lichtenstein repair. A full statistical comparison would be meaningless due to the small size of the sample and the preliminary nature of this study; therefore, we decided to report the two curves in the same graph simply to give an idea of the non-inferiority of the PRF-mesh repair technique.

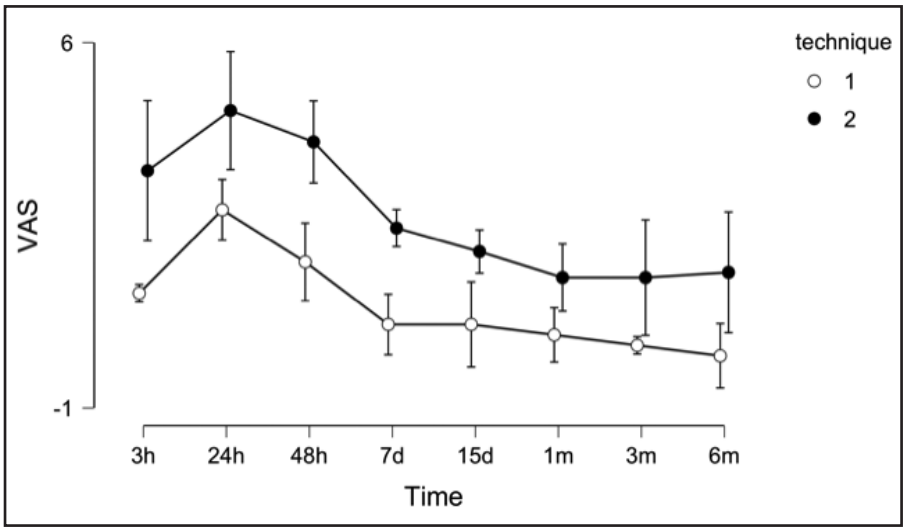

Figure 3. Time profile of postoperative pain measured with the VAS scale and compared with a historical cohort of patients operated on with the Lichtenstein technique. 1 = PRF-mesh repair. 2 = suture-mesh repair (Lichtenstein).

RESULTS

All patients were discharged within 24 hours after the operation. No acute short-term complications were reported. The progress of postoperative pain is reported in Fig. 3, in comparison with a historical series of patients who underwent a formal Lichtenstein repair. The perceived pain was quite low in all patients. All patients returned to their normal daily activities within 3 days after surgery and to work within 2 weeks. At the 6-month follow up, none of the patients complained about pain, symptoms or discomfort and there was no sign of recurrence.

DISCUSSION

L-PRF is made of a strong fibrin matrix that variably contains platelets, leucocytes, mesenchymal stem-cells, cytokines, high concentrations of GF, fibrin, fibronectin, vitronectin, and thrombospondin, and a variable pool of heat-shock proteins.

Due to its regenerative properties, PRF has been successfully used to treat chronic skin ulcers and to enhance skin and bone healing.[3,6]

The use of L-PRF to fix the mesh in open repair of inguinal hernias has clear advantages in terms of efficacy and tolerability. In fact, it is known to reduce oedema, collections and postoperative acute inflammation, which are the main factors that hinder the integration process and trigger postoperative pain. L-PRF combines the benefits of fibrin glue with its connective tissue regenerative properties to streamline the integration of the mesh. Moreover, it should prevent chronic fibrotic inflammation, hard and painful scars and chronic nerve entrapment syndrome. Finally, unlike cyanoacrylate glue and other fixation materials, L-PRF is completely biocompatible as it is derived from autologous blood and is most definitely less expensive, as its preparation requires only a normal laboratory centrifuge, a syringe for the blood sample and a plastic tube. The physiology of L-PRF, its healing-enhancing benefits and tissue-regeneration properties have been largely discussed in another paper.[3]

Clearly, this pilot study on a minimal number of patients has no statistical significance. However, it suggests that this technique is feasible and at least non-inferior to the formal Lichtenstein technique.

The profile of VAS shows that pain is generally minimal and apparently less than that with the suture-mesh technique. The very low level of pain allowed the patients to return to their usual commitments very shortly after surgery, as would be expected with a low-invasiveness technique.

Obviously, the present work must be considered only as a pilot study to evaluate the feasibility of a technique which is 'per se' safe and effective. A large randomised study may be necessary to confirm its clinical validity and to highlight its critical points, if any, including the risk of long-term recurrence, in comparison with other well-established techniques.

In conclusion, the PRF-open mesh repair is a physiologic "tension-free technique" that follows sound regenerative surgery principles. The regenerative properties of PRF minimise wound-site inflammation and assist the correct integration of the mesh for prompt and painless recovery after inguinal hernia surgery. STI

AUTHORS' DISCLOSURES

The authors declare that there are no conflicts of interest.

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