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Centro de Cirugía de Mínima Invasión Minimally Invasive Surgery Centre Jesús Usón

IN VITRO AND IN VIVO PRECLINICAL EVALUATION OF A NOVEL TISSUE-ENGINEERED VASCULAR GRAFT

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INTRODUCTION

Tissue-engineered vascular grafts (TEVGs) are capable of replacing or repairing the biological functions of blood vessels. Synthetic grafts such as **expanded polytetrafluoroethylene (ePTFE)** are intrinsically limited by their limited surface bioactivity, low endothelial adhesion, and a mismatch compliance that promote neo-intima formation

Electrospun poly(vinylidenefluoride) (PVDF) fibers combine excellent biological performance, including the promotion of endothelial cell proliferation, with piezoelectric properties that make them highly suitable for repairing electroactive tissues such as vascular endothelium.

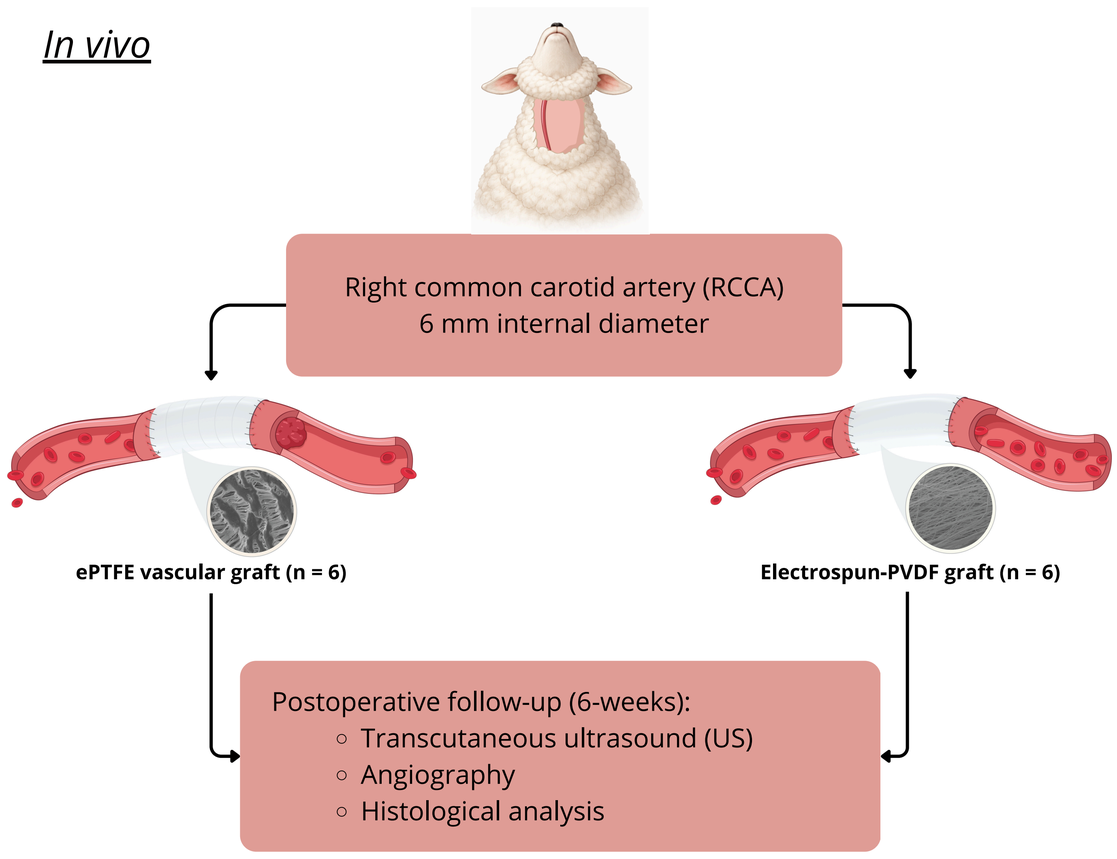
The aim of this study is perform the **physicochemical characterization** of electrospun PVDF-based grafts, evaluate their **biological activity** through ***in vitro* assays**, and assess their ***in vivo* performance in a pilot study using a large-animal model**, in comparison with ePTFE vascular grafts.

MATERIALS AND METHODS

In vitro

- Scanning electron microscopy (SEM)
- Human Umbilical Vein Endothelial Cell (HUVEC) culture
- Nitric oxide (NO) assay

In vivo



RESULTS AND DISCUSSION

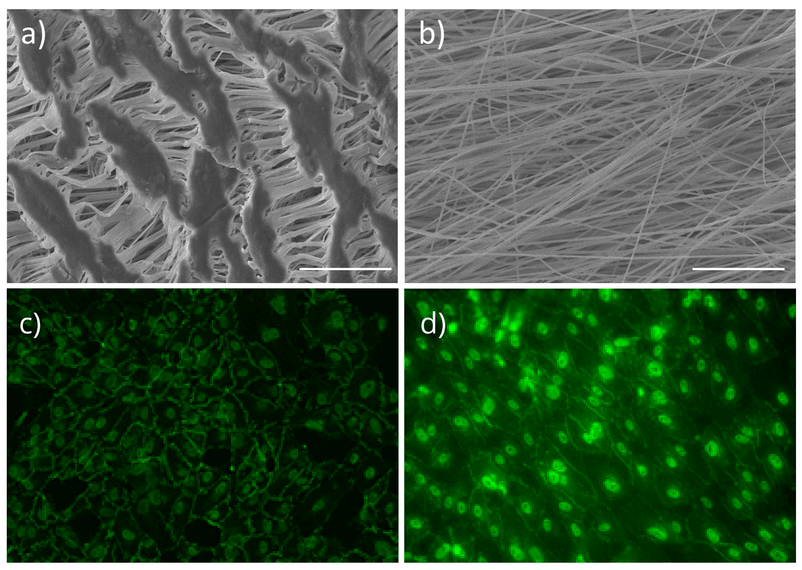


Figure 1. Representative SEM images of the commercial ePTFE (**a**) and electrospun-PVDF (**b**) grafts. Immunofluorescent staining of CD144 (VE-cadherin) in HUVECs adhering to commercial ePTFE (**c**) and electrospun-PVDF (**d**) grafts.

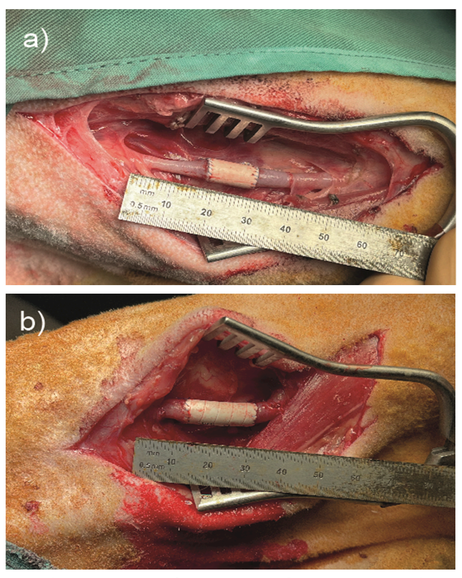


Figure 2. Implantation of PVDF (**a**) and ePTFE (**b**) vascular graft in the RCCA.

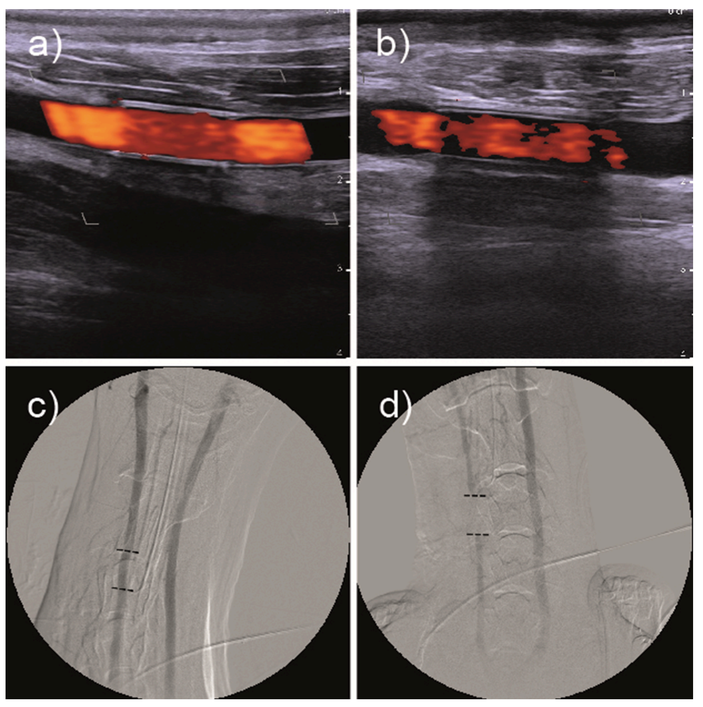


Figure 3. Power Doppler ultrasound of PVDF (**a**) and ePTFE vascular grafts (**b**). Angiography revealed that the RCCA exhibited patency comparable to the contralateral side in PVDF graft (**c**), whereas no intraluminal patency was observed in the ePTFE graftS (**d**). Dashed lines delineate the estimated position of the vascular grafts.

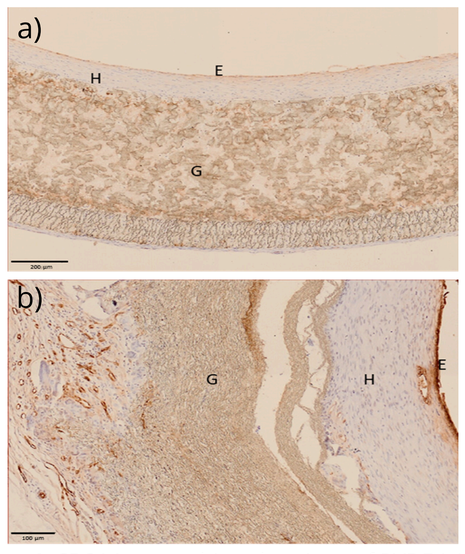


Figure 4. CD31 immunohistochemistry of PVDF (**a**) and ePTFE (**b**) vascular grafts. Captions: graft (G), neointima hyperplasia (H), and endothelium (E).

Table 1. Summary of key *in vitro* and *in vivo* findings.

Experimental readout	ePTFE	PVDF
Nitric oxide	0.2±0.05 µM	0.31±0.1 µM
Patency	33% (2/6)	67% (4/6)
Endothelization	21.6%	57.4%
Cellularization	101 cells/mm^2	129 cells/mm^2

CONCLUSION

PVDF shows strong potential as an innovative material for vascular grafts, although further studies are needed to confirm its clinical applicability.

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