Treatment of infected hybrid arch prosthesis with self-assembled bovine elephant trunk grafts

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Abstract

Graft infections are associated with severe morbidity and mortality. The widespread use of the frozen elephant technique (FET) increases the incidence of complex aortic patients to suffer from graft infections. Surgery of these patients is challenging. Removal of the stent graft portion of the FET prosthesis via sternotomy carries the risk of irreparable damage to the descending aorta. There is currently no single-stage surgical strategy that allows for removal of all infected material apart from a hemi-clamshell approach. This approach is technically demanding and associated with significant morbidity and mortality. This results in conservative treatment in a substantial number of patients.

Pericardial tube grafts have shown to be an excellent option in treating graft infections in various aortic segments with promising results concerning freedom of re-infection and survival.

We report a single-stage, trans-sternal approach to remove all infected material and simultaneous treat the descending aorta to prevent aortic catastrophe in two consecutive cases.

Case 1

A 56-year-old male patient with type A dissection underwent aortic root replacement with a mechanical conduit and total arch repair using the FET technique. Recovery was uneventful.

One year later, the patient presented himself in our emergency department and was diagnosed with an endocarditis (Streptococcus oralis) and a PET positive infection (Fig.1A) of his prostheses. Echocardiography revealed vegetations on the aortic valve prosthesis. CT scanning showed abscess formation around the graft.

The patient was re-operated 7 days after start of antibiotic treatment. Both, the composite graft and the FET prosthesis were replaced with an intraoperatively constructed valved conduit and a conventional elephant trunk made of bovine pericardium (Fig.2D). The removal of the stentgraft caused considerable intimal damage, which was confirmed in the first postoperative CT (Fig.1B).

Eight weeks later the patient received a TEVAR (Cook ZTA, 32-28mm) (Fig.1C) with a favorable post-interventional CT scan. At 4 months the patient is free from infection without antibiotic treatment.

Case 2

A 39-year-old male patient presented with mediastinitis two years after receiving a mechanical conduit and FET following type A dissection. Blood cultures were positive for Staphylococcus aureus. The CT scan showed fluid collections and possible abscess formation around the graft (Fig.1D). Transesophageal echocardiography showed no signs of vegetations, but cMRI demonstrated multiple emboli.

The patient was re-operated. The root and the FET were replaced as described in the first case with an intraoperatively constructed valved conduit and conventional elephant trunk. The removal of the stentgraft again caused intimal damage in the proximal descending aorta, necessitating TEVAR one week later (Medtronic Valiant Thoracic, 28mm) (Fig.1F,G). The patient could be discharged a week after the intervention on the descending aorta. At 6 months, there are no signs of infections and antibiotic treatment has been discontinued.

Technical note:

The size of the constructed bovine graft should orientate itself on previously implanted prosthesis dimensions. Mechanical valves were replaced with biological valves due to morbidity of this operation. The operation should be performed in a two-team setting: One for constructing the bovine graft (Supple-Peri-Guard®) according to an exact blueprint (Fig.2A) and a second for re-opening the chest. For sizing the prosthesis two options exist: using Hegar dilators (Fig.2B) or calculating dimensions by multiplicating the desired diameter by π. A 28mm graft needs a 9cm patch multiplicated by the length. The composite graft is constructed separately and should be 3mm larger than the valve. The graft should be pressurized in order to check for leaks (Fig.2C). Suture lines must face cranial (Fig.2D) so that remaining leaks can be easily repaired and do not interfere with the placement of the coronary buttons.

Discussion

Apart from a short technical guide our cases should convey two messages:

While the use of pericardial tubes has been well documented in the ascending and downstream aorta, a combined treatment of infected graft material in the root and arch with a self-assembled branched prosthesis has not been shown before and proved successful in these two cases (1,2,3).

Second: Only during the procedure itself we discovered the extensive intimal damage caused by removing the prosthesis. Therefore, it is of paramount importance to not only replace the complete FET prosthesis for infection control but also prepare an adequate landing zone with a conventional elephant trunk. Timing of TEVAR should take into account the lesion morphology in the descending aorta and the risk of ongoing bacteremia with subsequent re-infection. In one case the lesion in the descending from FET-stent part removal was at high risk of rupture. In this case, the TEVAR was done 1 week following arch repair already but after negative blood cultures and on effective antibiotic treatment. In the other case, the lesion was less severe and we waited until antibiotic treatment was terminated.

The operation should be performed in a hybrid room to have all necessary options at hand in case of substantial damage in the descending aorta that necessitates immediate religning. Team and patient should be prepared to proceed to a left sided hemi-clamshell for additional open replacement of the descending aorta using a bovine extension of the elephant trunk part of the arch graft.

ACKNOWLEDGMENTS

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FIGURE LEGENDS

Figure 1

A PET positive result along the aortic prostheses (*)

B,F CT showing intimal damage of the descending aorta (arrow)

C,G CT scan post TEVAR

D CT showing fluid collection (arrow)

Figure 2

A blueprint of bovine prosthesis

B Construction of side-branch

C pressurized prosthesis

D Implanted prosthesis

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Figures

Fig. 1

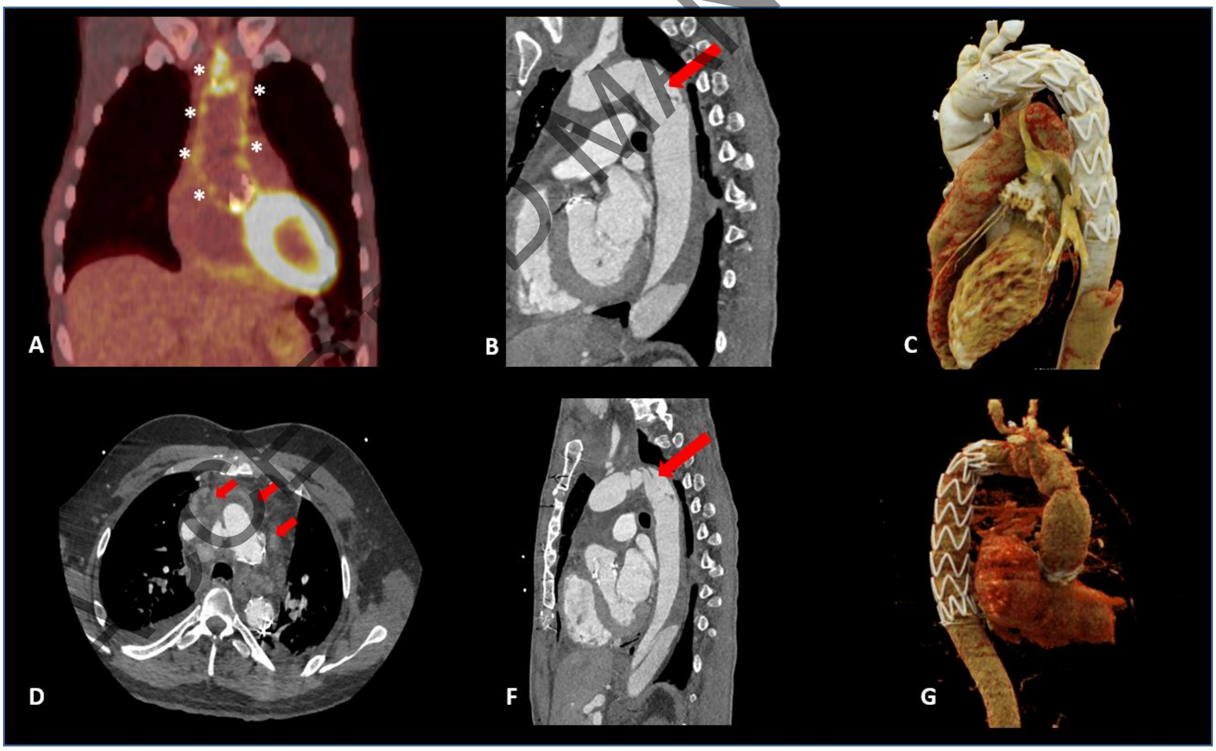

Fig. 2

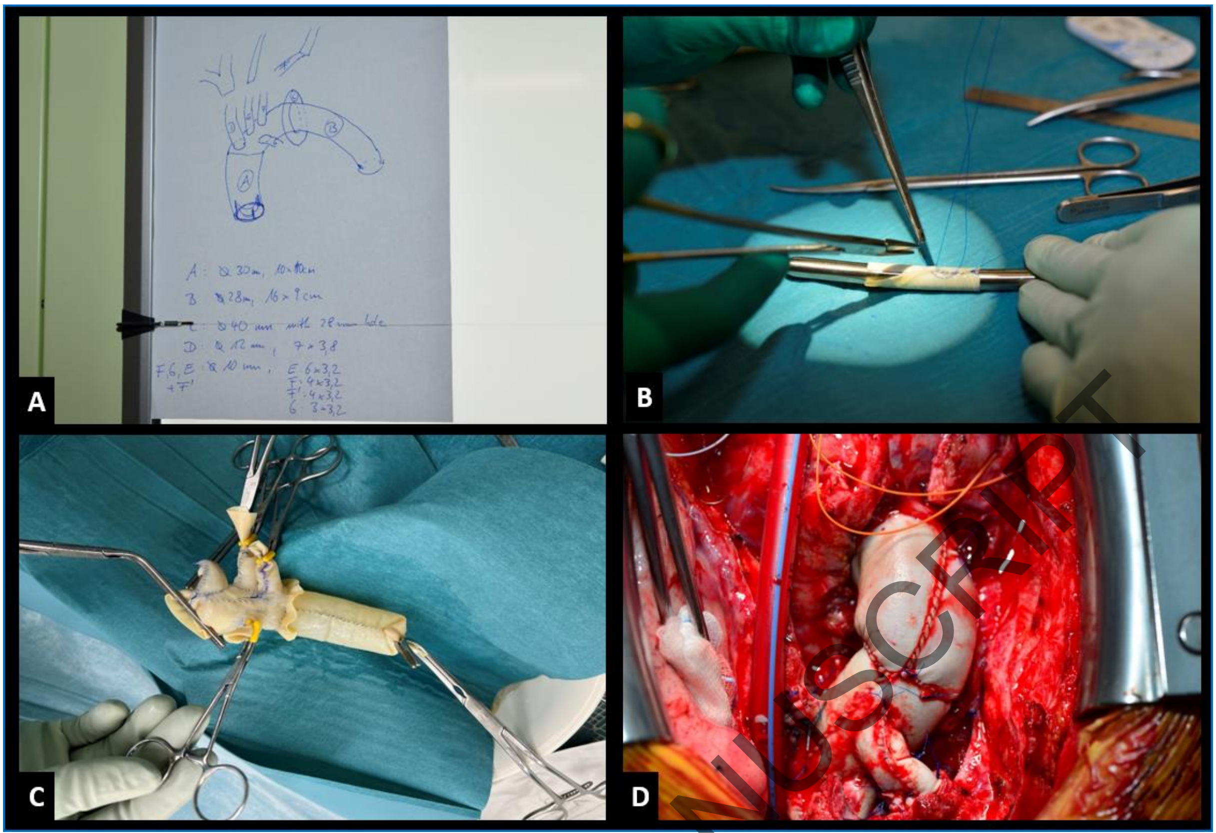
A
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Figure

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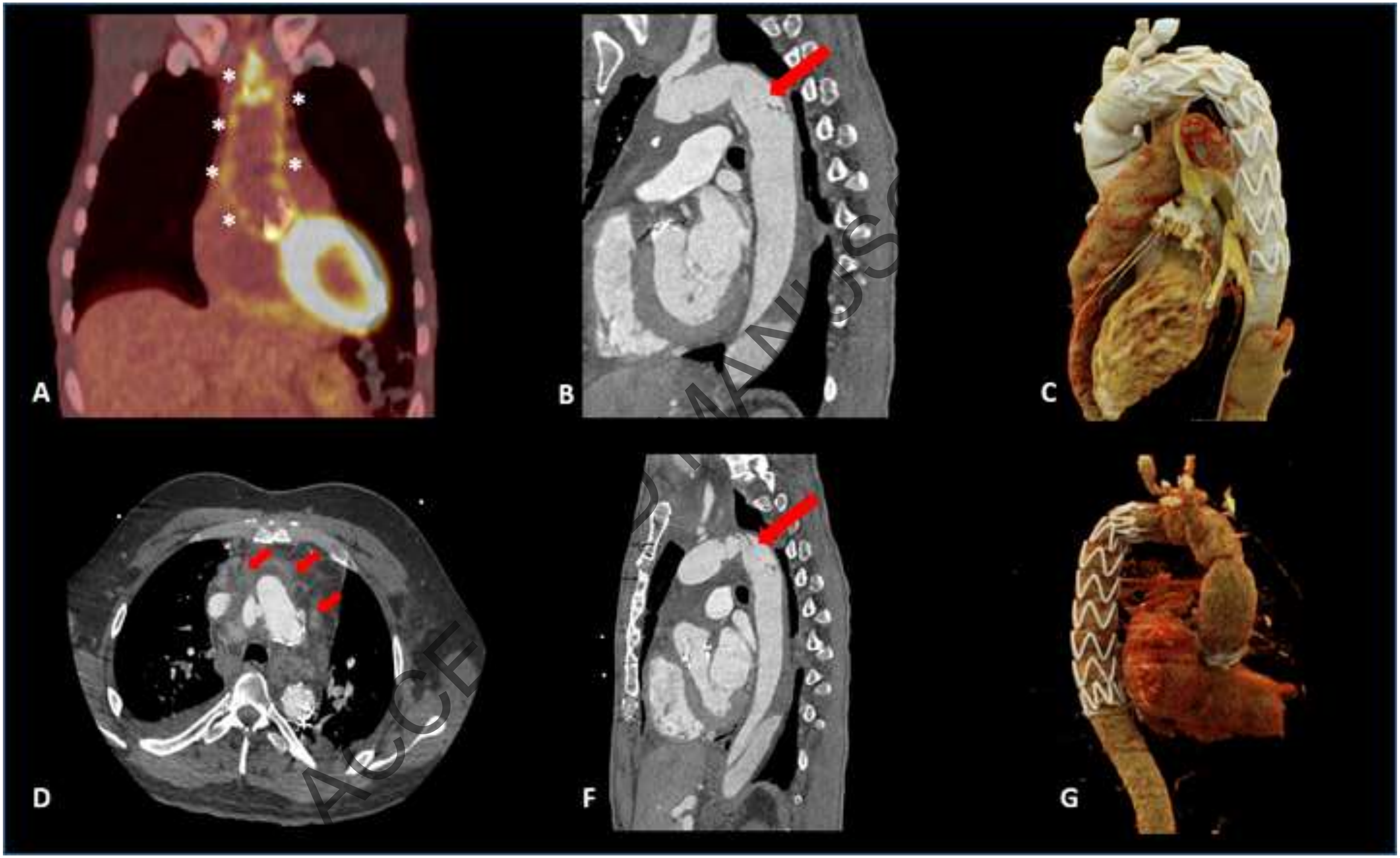

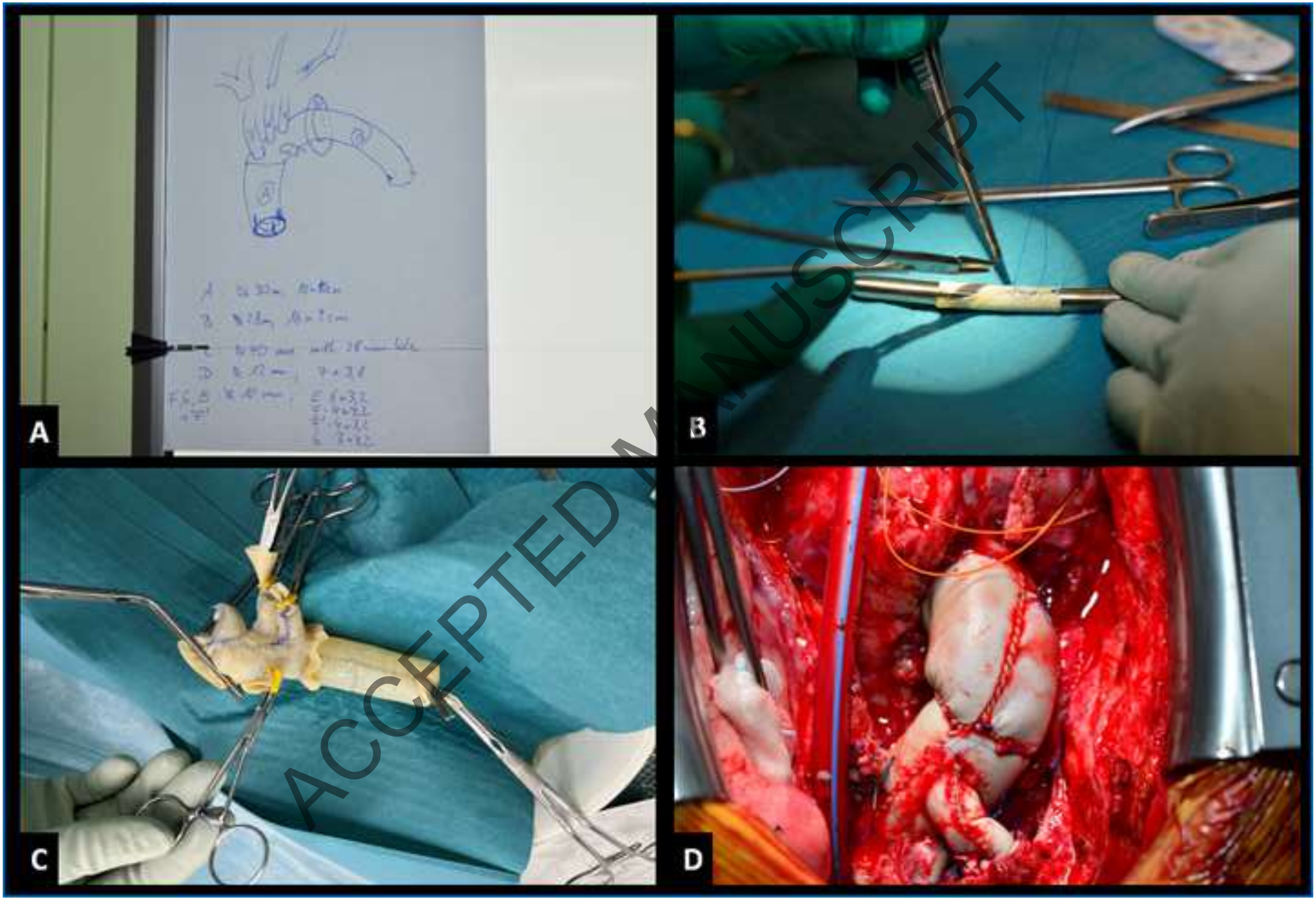
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