Implantation of a Plastic Valve into the Superficialised Femoral Artery

W D BRITTINGER, G v HENNING, W D TWITTENHOFF, A SCHWARZBECK, K W WITTENMEIER, W HUBER, R EWALD, R RETHEL, W KOSTERS, M STRAUCH
University of Heidelberg, Mannheim, German Federal Republic

This demonstration illustrates the principle of a new access to the circulation of patients on RDT, and publishes the first animal experimental experiences using this new technique. By developing this method the following advantages over existing situations are noted:

1. A permanent access to the circulation in a chronic animal preparation
2. Elimination of an arterio-venous shunt

Figure 1 (left)
1. needle withdrawn, stopcock closed, cannula sealed prior to connection with artificial kidney
2. cannula inserted in cannula shaft
3. stopcock valve open
4. Teflon® valve
5. Silastic® sleeve
6. Dacron® skirt
7. stenosed arteria femoralis superficialis
8. Dacron® prosthesis bypass bridge

Figure 1 (right)
1. artificial kidney inflow connection
2. valve needle open
3. valve needle closed
4. flow cannula
5. needle holding screw
6. Teflon® valve
7. Dacron® sleeve
8. Silastic® sleeve
9. anastomosis valve - arteria femoralis superficialis
3. No veno or arteriopuncture for connection of a patient to a haemodialysrer
4. Limited inoculation of infectious matter through the connection site
5. Rationalisation of the procedure for going on and off dialysis, particularly
with regard to home dialysis.

This concept relates to a plastic valve as illustrated in Figure 1. Both
models, which are different technical solutions of the same problem, are
undergoing further development.*

A TeflonR cylinder of about 4 cm in length with two channels is anastas-
mosed end to side with a large artery either by means of a DacronR skirt
(Figure 1, right) at the end of the cylinder or by means of a DacronR pros-
thesis (Figure 1, left).

The opposite end of the valve rests in situ, and protrudes about 1 cm
through the skin where connection of the circulation to an instrument (artifi-
cial kidney) may be realised. The outer surface of the valve is covered with
a Silastic sleeve to which is fixed a 1.5 cm wide DacronR skirt, which is
situated in the sub-cuticular tissue, secures the valve under the skin and
restricts the inoculation of reactive organisms through the skin perforation
(McDonald et al, 1968). Each channel is sealed during the interval between
dialyses by means of a closely fitting TeflonR pin, which is removed (Figure

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2) or withdrawn within the valve housing over a stopcock prior to connection with the administration set of an extracorporeal system. Blood is withdrawn from one channel, circulated through an extracorporeal system and returned to the circulation through the other channel with pump assistance.

The superficial femoral artery has been chosen for the implantation of this valve after the artery has been subcuticularised in tissue of the thigh (Operative technique: Brittinger et al., 1970).

The present series of animal experiments helps to answer the following questions:

1. What is the maximum calibre of a plastic cylinder that can be anastomosed end-side to a large artery, without causing thrombosis of that artery?
2. Does an implant heal well with respect to the biomaterial compatibility of that implant and what longevity of the preparation can be expected?
3. How practical is a simple valve constructed along these lines in providing a lasting access to the circulation?

METHODS

The experimental animals for these experiments are sheep, and the artery of choice is the common carotid. Massive SilasticR cylinders (Figure 2) with small DacronR skirts and valve models (Figure 3) of varying diameter at the vessel-prosthesis interface were tested.
RESULTS AND DISCUSSION

Experimental observations at the present time indicate the following information:

1. Clotting is absent when the prosthesis is positioned in less than half the vessel circumference. In one case, the artery remained patent despite blocking 2/3 of the vessel circumference by a SilasticR cylinder.

2. Implant material healed without significant irritation of the surrounding tissue and the DacronR skirt assured a stable positioning of the valve (Figure 4). Only in one animal was vessel rupture observed 4 weeks post operatively during a fight with a pasture comrade. The rupture occurred 2 mm lateral to the prosthesis-artery anastomosis.

3. A plastic valve which is constructed and implanted according to this hypothesis provides a permanent access to the blood circulation. Mechanical manipulation of the vascular prosthesis valve through movement and stress at the anastomosis site (animals are released to the pasture 24 hours post operatively with a retainer bandage) led to clotting of the vessel in only one case.
REFERENCES
