An A-V Shunt for Long-Term Hyperalimentation in Azotaemic Patients

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INTRODUCTION

We have developed a compact subcutaneous arteriovenous shunt (the Buselmeier shunt*) which may be used for hyperalimentation and dialysis in the uraemic, and for long-term blood access in the non-uraemic patient (Buselmeier et al, in press).

Because this was a new form of access, it was placed only in patients where other methods had been unsuccessful or where it was felt that the standard access procedures offered too frequent complications or significant risk to the patient’s life.

This paper deals with the life span and complications of the shunt in non-uraemic patients under the most undesirable circumstances of patient condition and exhaustion of vasculature through previous blood access procedures.

SHUNT CHARACTERISTICS

The shunt exists either as a unistructural U-shaped silastic device which may have one or two plugged outlets and which is adaptable to standard vessel tips for cannulation within vessels, or it may be fitted with a fabric skirt for direct anastomosis to vessels. The latter, as yet in unproven form, is a straight silastic device similarly equipped with outlets and vascular attachments (Figure 1). The first type may be utilised to form a communication between artery and vein, while the second may be directly interposed in an artery to form an artery to artery shunt where all adjacent veins have been exhausted.

The new shunt’s shorter length (5 cm) results in less length related resistance and thus allows much faster flow than the standard Quinton-Dillard-Scribner arteriovenous shunt (20 to 25 cm tube length) (McDonald, 1968). The

*Quinton Instrument Company, Seattle, Washington, USA
faster flow diminishes the stagnation and, therefore, the clotting which occurs in the Quinton-Dillard-Scribner shunt (Berne et al., 1971; Buselmeier et al., 1971; Quinton et al., 1960). Firm and deep anchoring, and the small external dimensions reduce mobility, and the risk of infection.

SURGICAL PLACEMENT

The shunt may be placed in the three standard shunt sites, in the forearm, the leg, and the groin. Alternatively, the superficial femoral artery or profunda femoris artery may be used. However, the profunda femoris artery frequently branches early or is malpositioned for cannulation, while cannulation of the superficial femoral artery may sometimes compromise blood flow to the lower leg. We have had no complications of long-term ischaemia from utilisation of the superficial femoral artery.

Placement of the straight form of the shunt requires direct interposition in the line of flow of a major artery (Lawton & Freeman, 1970) allowing both ease of access and continuity of the artery.

The major requirements for insertion are: (1) adequate vessel mobilisation; (2) good alignment between shunt limbs and cannulated vessels; (3) estab-
lishment of fast flow (a bruit must be present or there is a technical cannulation error); (4) firm and deep anchoring to prevent migration of the shunt through the skin, and (5) intraoperative shuntography to ensure that there is no cannulation error and that neither the firm subcutaneous anchoring nor the skin closure has produced malalignment of the shunt limbs or vessels.

Post-operative success depends upon: (1) maintenance of adequate blood pressure; (2) immediate declotting where thrombosis occurs (Figure 2);

![Shunt declotting diagram]

Figure 2. Shunt declotting: (A) Suction alone; (B) Suction through polyethylene tube; (C) Fogarty catheter thrombectomy

(3) anticoagulation where possible, and (4) maintenance of sterility during wound healing and subsequent intravenous administration.

In all cases, the shunt with fabric skirt attachment offers a better chance of long-term survival than the model with vessel tips.

RESULTS

The shunt was placed in 9 non–uraemic patients and observed over a cumulative shunt life of 396 days. It was used to provide access for intravascular hyperalimentation (Figure 3), long-term intravenous antibiotics, and leucopheresis. Shunts occasionally required declotting and anticoagulation during the healing period. Once healing was established, however, shunt patency
was maintained on aspirin 320mg twice daily and cyproheptadine HCl* 8 to 12mg four times daily or dipyridamole** 50 to 100mg four times daily. The shunt remaining patent longest was inserted in a regional enteritis outpatient for intravenous supplements over 6 months (Table I).

No infections were encountered and clotting occurred only in three cases. Each clotting episode was associated with hypotension due to hypovolaemia, and two of the three shunts were declotted and restored to patency. One

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* Periactin, Merek Sharp and Dohme, West Point Pennsylvania
** Persantin, Geigy Pharmaceuticals, Ardsley, New York

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<table>
<thead>
<tr>
<th>Patient</th>
<th>Diagnosis</th>
<th>Shunt location</th>
<th>Shunt use</th>
<th>Shunt life (days)</th>
<th>Infection</th>
<th>Clotting</th>
<th>Reason for removal*</th>
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<td>(functioning on removal)</td>
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<td>6</td>
<td>mucocutaneous candidiasis diabetes mellitus septicaemia</td>
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<td>0</td>
<td>1</td>
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<td>patient expired (shunt functioning)</td>
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TOTAL 9 patients

396 0 3 1 shunt failure

*None of the shunts were removed because of shunt failure. Although some shunts were removed after a short period of time, the removal was done electively because there was no further therapeutic need and not because of shunt failure.
shunt clotted permanently during a hypotensive episode in a patient who never regained a normal blood pressure.

Over a cumulative shunt life span of 396 days in 9 non-uraemic patients, there were three clotting episodes and only one shunt failure. Although many of the shunts were removed after a relatively short period of time, this was done electively, not for shunt failure.

CONCLUSION

Buselmeier shunts were inserted in 9 non-uraemic patients observed over a cumulative shunt life of 396 days. Preliminary evidence suggests that this new form of access may be effective over the long-term in the non-uraemic patient. The fast flow which prevents clotting and the immediate access without the requirement of needling may warrant its use in long-term hyperalimentation (Figure 3).

However, the shunt has been tested only on a very small number of patients. Long-term follow-up is necessary to confirm the new shunt’s efficacy.

ACKNOWLEDGMENT

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REFERENCES