HEMODIALYSIS ACCESS
PART A – TEMPORARY

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INTRODUCTION

Since hemodialysis was first practiced clinically as a substitute for absent renal function, access to the circulation has always been a demanding and, at times, frustrating exercise. In the beginning hemodialysis was only performed for relatively short periods for acute reversible renal failure in young people with good blood vessels. Almost any method of access was adequate for this purpose. Shaldon’s semi-stiff tapered catheter with a single cylindrical lumen inserted over a guide-wire by the Seldinger technique into the femoral vein provided one blood flow pathway for removal or return of blood (1). A second conduit could be provided by means of a second catheter in the same or a different vein and these catheters could be left in place for two or three treatments. Evidence for the crucial importance and desirability of this technique is apparent in the fact that it remains widely practiced today when no safe alternative can be found. Because of its superficial position, just medial to the femoral artery in the groin, the femoral vein is easy to cannulate, even by inexperienced operators. The relatively low incidence of serious or fatal complications from femoral cannulation compared to those from cannulating the subclavian and jugular veins, in which there may be injury to the heart and lungs, explains why femoral cannulation has and probably always will remain widely used.

The development by Quinton, Dillard and Scribner of the silastic-teflon shunt allowed dialysis to be performed repeatedly from the same access site, not only for 2–3 weeks for an episode of acute reversible renal failure, but also for several months or years in patients with end-stage renal failure, thus opening up the possibility for long-term maintenance dialysis (2). Although the silastic-teflon shunt, now largely of historical interest, has been rightly replaced by arteriovenous fistulae and grafts for long-term dialysis (3, 4), their use can still be justified for episodes of acute reversible renal failure (even though they destroy a pair of peripheral blood vessels) as long as it can be confidently predicted that long-term dialysis will not be required. Shunts can be placed in the leg in order to preserve vessels at the wrist for fistula formation (5), but for obvious reasons this operation can only be done twice (providing two separate periods of temporary vascular access). Occasionally a patient with a silastic-teflon shunt placed at the wrist, for what is presumed to be reversible acute renal failure, may turn out to have end-stage renal damage, and hence may require long-term hemodialysis. In such a case it may be possible to convert the shunt into an arteriovenous fistula and so preserve the precious forearm vessels (6).

Moreover there are now easier and less damaging ways to provide vascular access for two or three weeks and this explains why most centres have not used silastic-teflon shunts for many years. Some might still wish to justify their use for the performance of continuous arteriovenous hemofiltration (CAVH) for complicated oliguric acute renal failure (7) as an alternative to femoral arterial and venous catheters (8). Femoral artery cannulation is sometimes difficult in arteriopathic individuals, and is also not without risk, but most centres are moving to pump-assisted methods of slow continuous blood purification which only require venous access (9). Thus the days of silastic-teflon shunts are numbered, if not over, and their surgical insertion is a dying art. Numerous texts are avail-
able for those who wish to continue to use them. They will not therefore be discussed further except to acknowledge their rightful place in medical history as a brilliant innovation in the evolution of access for both temporary and long-term dialysis.

Cannulation of the subclavian vein for repeated hemodialysis, first reported by Erben et al. (10) and popularized by Uldall et al. (11) and DeCubber et al. (12), owes its wide acceptance to the ease of the technique for doctors and nurses and the great convenience for patients who can remain mobile and go home. The global love affair with subclavian cannulation soon became tempered by reports of fatal traumatic complications (13–16), and later on by the realization, especially since the advent of double-lumen catheters, that subclavian cannulation, even in skilled hands, is associated with an unacceptably high incidence of subclavian vein damage in the form of thrombosis and stenosis which, by interfering with the proximal venous drainage of the upper limb, leads to intolerable swelling of the arm in the presence of an ipsilateral arteriovenous fistula (17–23). By contrast, jugular vein cannulation for temporary vascular access, does not damage the proximal venous drainage of the arm (24). The main message of this chapter is that although subclavian vein cannulation for hemodialysis may still be justified, like the silastic-teflon shunt, for predictably reversible acute renal failure, it cannot any longer be justified in patients with end-stage renal failure, any or all of whom may at some stage require a prolonged period of hemodialysis and hence need intact proximal venous drainage on the side of an arteriovenous fistula or graft. Good and reliable technology is now available for repeated short-term or long-term cannulation of the jugular veins for hemodialysis. The method is so inherently safe that traumatic complications can be largely avoided and, because the subclavian veins will never be cannulated, they will not become thrombosed or stenosed.

Temporary vascular access now depends almost exclusively on central venous cannulation of the femoral, subclavian and jugular veins. Although subclavian cannulation is still the most widely practiced I believe that very soon it will properly be restricted to patients with acute reversible renal failure. Each of these methods will be discussed; and on the principle that first and above all we should do no harm, emphasis will be on the avoidance of complications (25).

Temporary vascular access for extracorporeal blood purification is needed for three main indications:

- Acute reversible renal failure.
- The management of severe poisoning
- End-stage renal failure.

**ACUTE REVERSIBLE RENAL FAILURE**

In many patients with acute renal failure one can predict fairly confidently that dialysis will only be required for about 2 weeks. Once recovery of renal function occurs it is no more likely to be needed again in the future than it would be in any other previously healthy person.

If the patient is not fluid-overloaded and can lie flat without discomfort, insertion of a subclavian catheter which can be left in place throughout the period of treatment is easy and convenient (Figure 1). When no longer needed, the catheter is simply pulled out by the nurse and gentle pressure applied for a few minutes (26). If, on the other hand, the patient is in pulmonary edema and cannot lie flat, or has some other reason for respiratory distress, subclavian cannulation should not be attempted (25). An accidental pneumothorax, always a possibility even in skilled hands, is too great a risk. Femoral cannulation should be used to provide access for the first one or two treatments until the patient is stable enough for a subclavian catheter (Figure 2) One should never attempt