Dialysis Shunt Surgery using Autologous Material

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Summary: Background: In order to enable effective haemodialysis the dialysis shunt should provide function and good puncture capacity. Fistulae with autologous material are the best prerequisites.

Methods: The available vessels must be treated economically. The surgeon works from peripheral to central. The first-order shunt location is the forearm, second the upper arm and third the upper thigh. Cimino fistula in the distal forearm is the golden standard. However, in principle, an autologous fistula is possible at any point on the forearm. The ulnar fistula should also be considered for differential surgery. The brachial fistula affords many possibilities.

Results: Shunt revisions should be carried out in the early stage of a failing shunt. At this time, the revisions are still relatively simple in technical terms and avoid damage to the shunt extremity. Reanastomosis (also termed proximal displacement) affords the best preconditions. The aim is to achieve immediate reuse of the old puncture site and avoidance of a Shaldon catheter which is most frequently applied.

Conclusions: Shunt surgery is a highly difficult procedure which requires great vascular surgical skill and the ability to improvise. It is hence not a suitable operation to be embarked on by the beginner in vascular surgery.

Chirurgie des Dialyseshunts mit autologem Material

Zusammenfassung: Grundlagen: Ein Dialyseshunt muss langfristig funktionieren bei guter Punktierbarkeit, um die Hämodialyse effektiv zu ermöglichen. Die besten Voraussetzungen bieten die Fisteln mit autologem Material.

t dabei auch ins differentialoperative Kalkül miteinbezogen werden. Die Brachialisfistel bietet viele Möglichkeiten.


Schlussfolgerungen: Shuncht chirurgie ist eine sehr diffizile Chirurgie, die hohes gefäßchirurgische Können und Improvisationsfähigkeit erfordert, und daher keine Operation für den gefäßchirurgischen Anfänger darstellt.

Introduction

The beginning of modern intermittent haemodialysis treatment coincides with the development of the internal direct arteriovenous fistula by Cimino and Hurwich in 1967. This was supplemented at the end of the 1970s and at the beginning of the 1980s by implantation of arteriovenous interponates that can be immediately punctated. The fistula with autologous material is the first-order shunt with regard to puncture characteristics and function duration. Shunt surgery should only be carried out with prism magnifying spectacles, since the calibre of the vessel is mostly small.

Clinical planning

As a rule, palpation of the vein (mostly with application of a tourniquet sleeve to the upper arm) is sufficient to evaluate the veins in the forearm and in the elbow (cephalic vein over its entire course, especially in the distal forearm, basilic vein of large calibre, veins in the region of the bend of the elbow). The Allen test is adequate to appraise a sufficient arterial blood flow in the hand. When the clinical appraisalability of arteries and veins before the first application is poor, prior clarification by duplex sonography (method of first choice) or by angiography (rare) is required. On the other hand, the diagnostic measures are often more advantageous and may indeed be necessary in shunt revisions, and especially to plan a service operation in imminent dysfunction.

Objective: Since there are practically no contraindications to the inception of haemodialysis treatment nowadays and the survival time of patients with terminal kidney failure and under dialysis treatment is about 50% of that in the normal population, it is necessary to be economical with the vessels that are available. One aim is to establish and to preserve functional effective vascular accesses as long as possible. An additional objective both in planning and in selecting donor and recipient vessels is to proceed in such a way that it is still possible to create a new fistula after the predecessor has failed. The surgeon thus proceeds from peripheral to central.
In principle, the forearm is the first-choice shunt location, and the upper arm is the second choice. Initial establishment of an arterial venous interponate on the forearm or even more centrally must remain an exception that must be well-justified. The third-choice shunt location is the thigh because it requires the vessels of the groin. Since the groin is a site of substantially higher incidence of infection, all the means of creating a shunt in the arm should have been exploited before resorting to this alternative.

Attention should be paid to whether the patient is right-handed or left-handed. Provided the vessel conditions are suitable, the nondominant arm is chosen to create the first shunt. "Save the veins": Circumspect consideration of this aspect must already commence when the prospect of dialysis treatment emerges. Consequently, the veins that are important for creating a shunt may no longer be used as an access to take blood or for intravenous infusions.

Preparation of the patient: Subcutaneous veins can be "developed" by training. Continuous fist closure raised blood flow through the veins and consequent dilatation. To support this, the patient is given a small sponge or ball on which to clench his/her fist. Additional application of a tourniquet to the upper arm which is intended to occlude only the subcutaneous veins briefly intensifies the effect of training.

**Standard surgical procedure**

**Anaesthesia**

In principle, all first operations can be carried out in infiltration anaesthesia, as is done at many centres. However, the greater difficulty of dissection and the vasoconstriction are drawbacks. Should a change of the area of surgery become necessary in difficult vascular conditions, this can be problematical under local anaesthesia. The author therefore considers that dialysis shunt surgery should be performed as a matter of principle in regional anaesthesia (axillary plexus or higher supraclavicular block in the arm) in first operations. He has also applied this principle since the middle of the 1980s. This has the additional advantage that a certain vasodilatation is induced by local medication.

General anaesthesia is reserved for first operations in polymorbid and uncooperative patients. This also applies in revision operations, although general anaesthesia has to be resorted to occasionally depending on the number of previous operations and the location of the shunt.

**Brescia-Cimino fistula**

Typically, the Brescia-Cimino fistula is created by means of an anastomosis between the radial artery and the cephalic vein in the distal forearm. An access route is also possible with the snuffbox fistula. This fistula is the most frequent type of dialysis fistula and is regarded as the golden standard of vascular access for long-term haemodialysis treatment.

**Surgical technique**: A longitudinal section along the radius margin is carried out as distally as possible on the forearm. This should be staggered in relation to the radial artery on the ulnar side or may be made exactly above it. First of all, it must be ensured that the calibre of the vein is adequate before it is isolated (Cave: early venous spasm!). The fascia covering the artery is now incised longitudinally and is exposed avoiding damage to the superficial rami of the radial nerve. If this is seen, it should be exposed by dissection over a long distance and displaced to the ulnar side of the radial artery. The side branches are ligated with resorbable monofil suture material in order to avoid troublesome bleeding. Only then is farther dissection of the cephalic vein carried out. A major tributary flow from the dorsal forearm/back of the hand is often found at this level. This bifurcation is severed about 0.5 cm distally, the distal stumps are ligated and the two tributaries are connected by longitudinal incision.

This has the advantage that the anastomosis can be created more safely as a “trumpet anastomosis” (Fig. 1). The vein is transposed to the artery avoiding an acute angle. Sometimes, a small loop is also appropriate. Alternatively, the vein is incised a little longitudinally on the ulnar side. Arteriotomy is only performed when its position is assured by establishing the length of the vein. The length of the anastomosis should not be more than 2 to 2.5 times the calibre of the vein. The arteriotomy is carried out laterally more in the direction of the vein and the vein itself is given a slight outward rotation to avoid later torque (Fig. 2). The artery is clamped with two fine bulldog clips and the vein is occluded by means of a rubber tourniquet or a fine bulldog clip, sometimes also by the assistant’s finger. Heparin saline is now instilled into the vein which is slightly dilated by digital compression of the central cephalic vein. With impeccable drainage and good dilatability, routine balloon catheter probing with stretching of the vein is if anything dangerous rather than useful. The artery is also only probed and stretched somewhat with the balloon catheter when the blood inflow is inadequate and its calibre is small. In contrast to earlier suture techniques, we now commence the suture (monofil suture material of suture strength 6/0 and 7/0 which can be absorbed in the medium term) in the middle of the side opposite to the surgeon and first of all place some stitches up to the upper suture pole and down the opposite side using inversion technique. An analogous procedure is then applied to the other end of the suture (Fig. 1). Before knotting the thread, the artery is flushed and the venous reflux is checked. Immediate onset of typical thrill is proof of functional capacity. A loud typical shunt noise also indicates perfect function. The vein is now inspected in the subcutaneous segment that is readily overlooked. It is then dissected out at the anterior wall so that it can be dilated well at this point. Any small strictures or short narrow segments can be quickly eliminated by central digital venous compression. If appropriate, adventitial strands must be severed separately.

The artery should not be displaced towards the vein on any account. This can lead to kink stenoses and thus to rapid impairment of shunt function. As a matter of principle, a suc-