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- Arteriovenous fistula. This is an infrequent complication that sometimes occurs when we perforate the femoral vein and artery. It is clinically expressed with pain and inflammation and a murmur is heard in the area. Its treatment is surgical.

Over the last few years, the need for ultrasound monitoring in cannulation of central veins has been discussed. In the case of jugular approach, there are studies that prove its efficacy. However, the use of ultrasound monitoring in femoral puncture has hardly been studied, perhaps due to its ease and the lack of serious complications of this access. In the few studies performed, a discrete reduction in failures as well as a reduction in the number of punctures and complications has been found. Thus, a reasonable attitude would be to use ultrasound monitoring whenever we have it or at least in those more complicated situations: obese patients, with weak pulse due to low blood pressure, with important coagulation alterations, with anatomic alterations in the area due to operation, etc.

More and more articles are also appearing in literature about the usefulness of tunnelled femoral catheters. Their usefulness has been described in patients with acute renal failure to reduce morbidity and increase the efficacy of dialysis and in patients with Chronic Renal Disease (CRD) with thrombosis of the superior vena cava or when all other possibilities have been exhausted. The tunnelled femoral catheter placement technique is similar to that described above, except that a subcutaneous trajectory is added. The catheters are longer than the jugular tunnelled catheters and than the temporary femoral ones. Fluoroscopic control is advised. The raised tunnel femoral catheter usually has a lower survival rate than jugular catheter due to infection or thrombosis.

In short, femoral access is an interesting alternative providing that its use is considered for a short period of time. Its main advantages are that it is easy and quick to place and that no radiological control is required and the patient does not have to lie down. Furthermore, there are few complications and if they do appear they are normally not very severe.

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History of vascular access for haemodialysis

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The History of Vascular Access for Haemodialysis is different to that of other technological developments and discoveries. What normally occurs in R&D is that a need stimulates inventiveness and after some initial developments, the involvement of Industry produces an exponential growth in the R&D, which ends up solving (often partially) the problem. After this development phase, the research declines, unless a genius develops a new channel or approach to the initial problem. In this new phase it is more difficult to involve Industry, as the initial solutions have already solved the problem.

In the case of Vascular Access for HD, decades went by from the first HD on a human being (Haas G, 1924) and the first survival (Kolff W, 1944) until it was possible to permanently maintain a patient in chronic HD (Clyde Shields, from 1960 to 1970). And this delay was derived from the lack of an adequate Vascular Access.

Only six years later (Cimino & Brescia, 1966) the VA Fistula was described, which, since then, has not been surpassed by any other type of access. The problem, from my viewpoint as a nephrologist and researcher is that since 1966 we have accepted that the problem of Access for HD is ''adequately solved'' and we have not proposed any new channels in R&D to solve the serious problems that are continuously posed by Vascular Access in our patients in Dialysis. Not only have we accepted that the problem is no longer pressing, but we have delegated it upon other specialists (vascular surgeons and radiologists, mainly), who are technically better qualified but who do not perceive the problem of the lack of adequate vascular access in our HD Units. If the cardiologists were to have delegated haemodynamics and

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ultrasound on radiologists, and the therapy of coronaries on heart surgeons, we would not have the present-day development of angioplasties and other interventionist cardiology therapies.

The history of access for HD starts in 1960 with the Scribner Shunt (Seattle) which made it possible to carry out the first chronic dialysis (Clyde Shields). Before then, glass cannulas had to be used in artery and vein that were not suitable for chronic use. The Scribner shunt was possible thanks to the use of Teflon and Silicone, both of which were patented at the end of the 2nd World War. Small developments such as the Buselmeier shunt made their use possible during the sixties, but the VA Fistula described by Cimino & Brescia in 1966 remained as the type of access of choice.

Attempts to use own saphenous vein grafts, umbilical chord, lyophilised bovine carotids, etc. failed and the only suitable graft has been and continues to be that of expanded PTFE, described in 1976. I would like to recall the non-nephrologists in these developments, first the creators of materials (DuPont with Teflon, and Gore with ePTFE) but also Dr. Cimino, who was not a nephrologist although some believed he was. He published an article in 1962 with Brescia, based on his experience in venipunture in a transfusion centre, highlighting the flow obtained by means of proximal venous compression with a pressure cuff. After the experiments with one single puncture, they devised the VAF. Dr. Apell was the team surgeon; of his first 14 VAF published, 12 worked; a genuine success for the current ratios, and even more so considering that he was not a vascular surgeon and that after a few years, he left the Veterans Adm **(VA),** Bronx Hospital, to work as a rural general surgeon until his retirement.

Dr. Cimino left the AV Hospital at the beginning of the 70 s, to join the Calvary Hospital in the Bronx, where he engaged in Palliative Medicine.

Dr. Scribner was aware from the start of the limitations of his shunt, and he sent them the first non-New York resident patient, who joined the group of the 14 initial patients who had a VAF.

Among the Spaniards, I must make a special mention of Drs. García-Alfageme (Bilbao) and Polo (Madrid), benchmarks in proximal fistulas and in PTFE prosthesis, respectively,

But, returning to the Fistulas, the initial VAF was latero-lateral. The termino-terminal VAF was described a year later in Würtzburg, Germany (Sperling M, 1967), but it did not have good results and was abandoned. In 1968, Lars Rol, also in Germany, described the latero-terminal VAF, which is the technique that has persisted until today.

Ten years went by until Gracz described the proximal VAF, using the humeral artery and the perforating vein. Between 1978 and 2000 variations of proximal VAF were described (Garcia-Alfageme, Konner, etc.) which were indicated as ideal in diabetic patients or patients with a bad arterial bed. In 2007, PTFE prosthesis coated in cells (fibroblasts or endothelial) were described, which supposedly increase their durability.

The ePTFE prosthesis solved the lack of venous beds, both in straight designs and handle designs, or even the stenoses or thromboses of subclavian or axillary veins by means of brachial-jugular bridges. But the lack of adequate arteries is posed as a great problem when diabetes and elderly people are included in our haemodialysis programmes. It is normal for 30% of today's HD patients to be dialysed via tunnelled catheters due to the lack of possibilities of carrying out an adequate access via VAF.

For the lack of arteries, the solution involves accesses to thick veins via catheters or valvular devices. In 1961 Sydney Shaldon proposed the use of two polyurethane catheters for acute dialysis. Between 1965 and 1980 the use of two catheters in thick veins was generalised for this purpose. The femoral veins were used, with the end of the catheters in inferior vena cava. In 1969 Josef Erben (Prague) used them in subclavian vein, but until the development of dual lumen catheters (end of the 70 s), the subclavian was used little (due to the double puncture) and in the 80 s it was already advised against for chronic patients due to the frequent residual venous stenoses that prevent carrying out a VAF on that side.

The use of catheters for chronic patients required the development of dual-lumen catheters, first of silicone and today of carbotane, with subcutaneous tunnelled trajectory and fixation with a ring. The silicone ones were used in the eighties and nineties, with which blood flows of scarcely 250 to 300 ml/min were achieved. The carbotane ones, from 2000 on, achieved flows of up to 450 ml/min, adequate for high efficiency or convective HD. The Achilles' heel of catheters was the bacteraemia, which were frequent but with an important Centre Effect.

The most recent novelty is the incorporation of valve seat plugs into the catheter seal (1998). These plugs were devised as anti-puncture devices (to avoid the needles) but soon an anti-infectious potential was seen, as they did not allow either the circuit or the catheter to be open to the exterior at any time. The current plugs with valve permit high flows without providing any additional resistance and they were recommended by the CDC of Atlanta at the end of 2009.

A quick note on the economic problem of Vascular Access. Haemodialysis is the most expensive therapy among chronic therapies (6 to 7 times more than AIDS). Of the almost 50,000 Euros a year per patient, the access represents between 2 and 10% (€1000 to €5000/year, or €6 to €30 per HD session). The difference is that the patient starts dialysis with the access already made and puncturable, or on the contrary this is done with a provisional access, often requiring hospital admission and with a survival in the first year of 50% less than the survival achieved if the HD is started in a programmed fashion and with a usable VAF. This is just another example of how good practice improves the economic results as well as, logically, the healthcare results.

To end, I wish to highlight, once again, that the advances in vascular access for HD (and in general in HD) have been scarce, since the description of the FAV in 1966. And the small though numerous improvements must not hide the limited R&D in this field. Those of us who see the problem in our patients on a daily basis, must put our neurons to work to devise innovative solutions to the main limiting (as well as economic) problem of the Renal Replacement Therapy, via Haemodialysis.

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