

NephroCare Ile de France

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The point of view of the nephrologist

The creation of an arteriovenous fistula without surgery

Percutaneous arteriovenous fistula



Doctor El Hedia Hebibi
Doctor nephrologist

The use of hemodialysis requires the creation of a quality vascular access.

The arteriovenous fistula remains the best vascular approach. The creation is a vital step in the life of the dialysis patient. The quality of the fistula is dependent on good patient management in hemodialysis which will also affect its short and at long term survival.

The arteriovenous fistula should ideally be created early (at least six to eight weeks before the start of hemodialysis) to allow sufficient development before the start of hemodialysis.

The criteria for sufficient maturation of an arteriovenous fistula meet the rule of 6:

- Flow rate of at least 600 ml / min;
- Vein diameter of at least 6 mm;
- Maximum depth of 6 mm.

Until May 2017, in France, arteriovenous fistula was exclusively created surgically in the operating room and under locoregional anesthesia.

For the first time in Europe and France, Dr. Alexandros Mallios and the team of vascular surgery of the institute Mutualiste Montsouris have implemented a new technique for a procedure, which was originally investigated in the United States during the last two years, which allows the percutaneous creation of an arteriovenous fistula without an incision.

From May 2017 to January 2018 a team at the Institute Mutualiste Montsouris has already created 55 arteriovenous fistulas using this technique.

The first patient who benefited from this technique was dialyzed on the NephroCare Ile de France unit in Villejuif. This procedure was made using the Ellipsys® System, guided by ultrasound and left no scar after the procedure.

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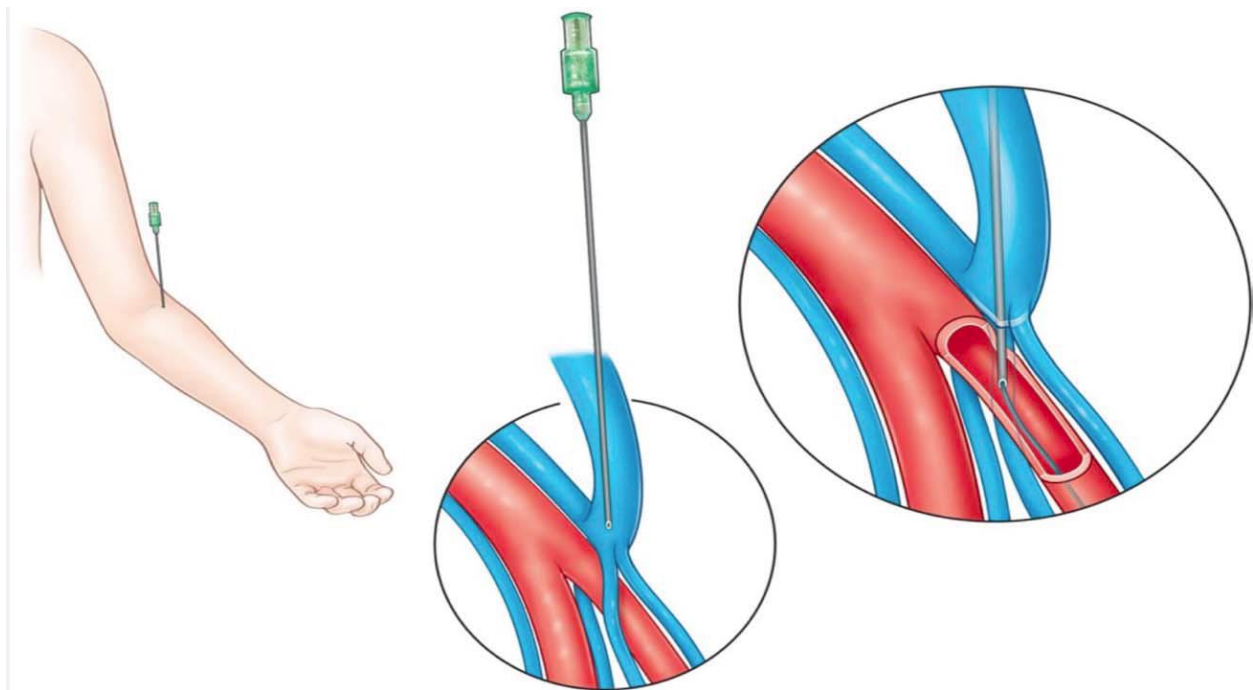
Indications and progress of the gesture

Using an apparatus that uses **thermofusion** (Ellipsys® - Avenu Medical), the anastomosis between the artery and the vein is created, thus defining an arteriovenous fistula. The patient must meet certain anatomical criteria as determined by the vascular surgeon to benefit from this procedure.

Specifically, the patient will have a perforating vein at the elbow and a **nearby proximal** radial artery (vein diameter 3 mm, artery diameter 1.5 mm, distance between the vein and artery 1.5mm).

If it is impossible to create distal radio-cephalic arteriovenous fistula and these criteria are met, this type of fistula creation can be offered to the patient.

The anastomosis is between the proximal radial artery and the perforating vein at the elbow, the proximal third of the forearm. A puncture of the vein at the level of elbow crease is performed under ultrasound control in order to pass a guidewire into the vein. A direct puncture of the proximal radial artery is performed just after the bifurcation and a guidewire is inserted into the artery through this puncture. The Ellipsys device is then inserted to make the anastomosis between the artery and the vein.



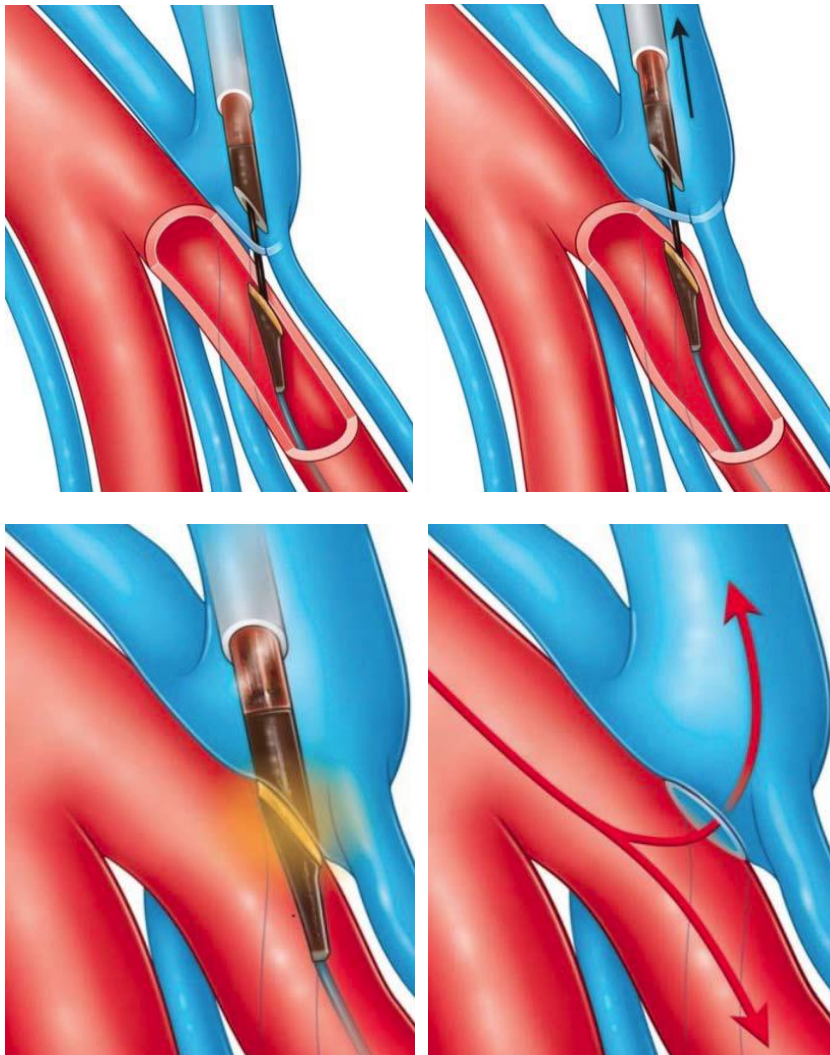
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The Ellipsys device is comprised of two elements in the open position:

- a distal element that is positioned in the artery; and
- a proximal element that is positioned in the vein.

The position of these two elements is verified under ultrasound. When this is correct, the device is closed by collapsing the arterial and venous walls between the two elements. System activation applies a thermofusion (a thermal energy) resulting in the coagulation and union of the walls of artery and the vein creating a durable and permanent arteriovenous anastomosis.



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Over the summer at the Institut Mutualiste Montsouris, a new step was added compared to the original technique used in the United States. This is the **immediate dilatation of the anastomosis** with a **5 mm balloon** for most patients. This allows **an accelerated maturation** of the fistula necessary for dialysis. The lumen width and flow is increased after this expansion. This fistula is potentially usable earlier than a classic surgical fistula. Additionally, the operating suites are a lot simpler equipped than usual. A simple dressing is affixed to the puncture area similar to a laboratory blood draw.

Thanks to this innovative technique, the Mutualiste Montsouris Institute's vascular surgery team hopes to be able to demonstrate that by avoiding the incision of the blood vessels while respecting their anatomical position would make it possible to obtain a fistula that works better in the long term and with fewer complications.

The percutaneous proximal cephalic arteriovenous fistula uses the proximal radial artery and the cephalic vein at the bend of the elbow. It is recommended in patients who have no possibility of making distal radial arteriovenous fistula due to poor vascular state related to calcifications or vessels of poor quality, especially in the elderly diabetic patient with polyvascular disease. The vascular surgeon uses ultrasound mapping to ensure that the patient possesses the anatomic criteria required for the creation of this type of fistula.



Creation of an arteriovenous fistula by Dr. Alexandros MALLIOS at the Institut Mutualiste Montsouris - Paris

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The clinical benefits of percutaneous fistulas

In addition to the aesthetic aspect related to the absence of a scar on the arm, this type of fistula may enable rapid use and eliminates a number of complications such as hyperflow, development of aneurysms, “black spots” and recurrent stenosis often requiring multiple balloon dilatations.



Humeral-cephalic AVF with black spot and risk of rupture



Surgical humeral AVF with bulky aneurysms



Percutaneous AVF cannulated for 6 months

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Experience at our sites NephroCare Isle of France

Since the implementation of this technique at the Institut Mutualiste Montsouris in May 2017, we have been able to offer it to six patients (5 men and 1 woman, whose average age is 62) dialyzed at our NephroCare sites of France from Villejuif and Bièvres. Three of these patients have already had a bi-puncture of their fistula, which allowed the removal of their Canaud catheter approximately four weeks after the percutaneous arteriovenous fistula was made.

Only one of the first three patients had puncture difficulties linked to the depth of the vein. But thanks to the perseverance of the medical team and nurse and with the help of the surgeon we managed to avoid a second superficialization surgery. This arteriovenous fistula is currently receiving two needle cannulation without difficulty.

The two other patients required a second dilation by transluminal angioplasty three weeks to four weeks after to the first dilatation. This was justified by low flow and / or occlusion of the anastomosis. One of these two patients also benefited from a banding (mini incision requiring a stitch) of the median basilic vein at its termination, to promote better development of the cephalic vein.

A fourth dialysis patient on a catheter benefited from the creation of a percutaneous arteriovenous fistula that could be punctured in the first week post-creation, without any difficulty or complication. The flow rate was estimated at 750 ml / min during the first puncture, with continued maturation over time. A second flow measurement is planned at one month, then six months post-creation.

The last two patients also had a percutaneous arteriovenous fistula creation with good maturation progress. One of them started dialysis directly two weeks after it was made without catheterization.

None of the last three patients required additional action.

Thanks to the experience of the Institut Mutualiste Montsouris surgical team (cohort of 55 patients) and the nine-month follow-up, but also thanks to the feedback from the medical and dialysis teams, the results of this innovative technique are more and more satisfying and encouraging.

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Features of Percutaneous Arteriovenous Fistulas

These fistulae created without surgical cutaneous incision are peculiar in that they have no visible scar, which is not negligible in terms of aesthetics and psychological acceptance of patients who are often hampered by the visibility of the fistula and the looks of others.

However, the absence of scar requires warning of caregivers in order to avoid accidents (blood test and / or blood pressure measurement on the affected arm). Rigorous monitoring also makes it possible to detect the occurrence of an early complication such as thrombosis.

The first puncture should be performed in the presence of the institution's nephrologist with a clampcath and tourniquet to better visualize the vein. The nephrologist physician performs a careful clinical examination of the arm to guide the puncture.



Percutaneous cephalic AVF
examined at day 7



Percutaneous AVF punctured with
2 needles (a needle in the cephalic vein
and one in the basilic vein)

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The increase in the flow rate of the blood pump must be progressive (220ml / min), as for any new fistula and guided by the venous pressures. The nephrologist in collaboration with the vascular surgeon guides the nursing team and follows the progress of the punctures.



Percutaneous AVF punctured with 2 needles at day 27



Pump flow 350 ml / min and normal PV

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Diagrams and markings on the skin are systematically performed by the surgeon to guide the puncture of the fistula. The role of the nephrologist and the nurse is essential in the good progress of the punctures, monitoring the development of the fistula and the screening of the potential complications.



Marking on the skin by the surgeon



Marking on the skin by the surgeon showing the position of tourniquet and the path of the vein

To discover percutaneous arterio-venous fistula in images

🔗 <https://www.youtube.com/watch?v=Heqxx-lwL7c>

🔗 <https://youtu.be/VoRR7LzyPGM>

🔗 https://www.lequotidiendumedecin.fr/actualites/video/emissions/medecine-augmente/2017/11/21/dialysis-but-or-is-thus-past-the-fistula-_852489

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Conclusion

This new innovative technique for the creation of percutaneous proximal radial AVF ensures patient access to a quality vascular access that is usable sooner and scar-free.

This method also provides good quality of dialysis and better patient survival. The American teams, over the last 2 years, have shown that this technique would lead to fewer complications in the short and medium term.

Moreover, this new technique motivated our nursing teams to better examine fistulas to better understand the vasculature in order to puncture them without difficulty. It has also helped to arouse their curiosity and their vigilance in order to be more responsive with respect to monitoring of the patient on dialysis.



First puncture at day 28 in a single vessel puncture of a percutaneously created AVF (first AVF created in France, May 2017) at NephroCare Island of France Villejuif

I warmly thank Dr. Alexandros Mallios, Vascular Surgeon, at Institute Mutualiste Montsouris - Paris, who initiated this technique and for photos of the Ellipsys® System.

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