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Sixth Course on Vascular Access

Sexto curso de accesos vasculares

110.1

Vascular access for haemodialysis. Position of the tip of the vascular catheter and its relationship in the input opening (superior vena cava or inferior vena cava). Correlationship with the recirculation

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Vascular Accesses for Haemodialysis can be classified in many ways: They can be temporary or permanent, dual-lumen or single-lumen, made of different materials, etc. and they can be placed in the superior or inferior vena cava area. But, what we are most interested in is its correct functioning, with maximum duration and minimum complications, above all with respect to infections or coagulation.

The most important aspect, to avoid infections, is to choose a good place to locate it, to use adequate materials, with good placement and handling techniques, and prophylaxis. Ideally, polyurethane polymers should be used, locating them in the right jugular vein, via the retroclavicular, tunnelled placement technique, and handled in sterile conditions.

Preventing infection is a basic aspect to avoid coagulation (the less infection, the less coagulation). But, the internal location of the tips is the most important factor to avoid a lack of flow due to coagulation and entrapment. It must be in a place that permits constant mobility, which does not favour adhesion to the vascular wall. It must also be a place that has a good blood flow, much greater than what we are going to require for the catheter. In this sense, the right atrium is the place with the greatest flow and it is broader than any vessel of the organism.

But coagulation is often physiological, as the organism tends to entrap and isolate foreign bodies located inside. And the blood tissue or space is not an exception. So the tendency is for it to entrap the catheter, coagulating it and fibrosing it, and then epithelising it and isolating it from the bloodstream. If this coagulation takes place all along the catheter, this can be a positive feature, but if it takes place in the area of the catheter tips, where the blood has to come in and out, it prevents having acceptable flows and worsens the operating pressures. This makes the life and permanence of the catheter unfeasible. To avoid this, the internal tips must be in constant motion within the blood, thus preventing entrapment (its entrapment by coagulation is prevented by constant motion). The only place where the catheter will be in constant motion, morning, afternoon and night, and every day whilst it is needed, is the atrium with its constant alternating contractions of systole and diastole. In all the other vessels of the organism, the catheters tend to act as a wall, facilitating the formation of clogs on the side walls of the vessels (veins), adhering to them due to coagulation and causing the incorrect functioning of the catheter and even intravascular thrombosis with its respective symptoms (e.g. vena cava syndrome).

Having said that, it is clear that the ideal place to locate the internal tips of the vascular catheters for haemodialysis, is the right atrium. Not recommending the superior or inferior vena cavas or iliac arteries.

But access to the right atrium can be made through the superior vena cava or inferior vena cava.

If access is made through the superior vena cava, the internal tip that acts as the arterial tip must be higher than the venous tip. If we access through the inferior vena cava, that is the other way round, the arterial tip will be lower than the venous tip.

But we must bear in mind that the two vena cavas end in the right atrium. So the upper half of the atrium is submitted to descending blood influx from the superior vena cava and the lower half is submitted to the ascending blood influx from the inferior vena cava.

If one catheter tip is in the superior vena cava influx area and the other is lower, in the inferior vena cava influx area,

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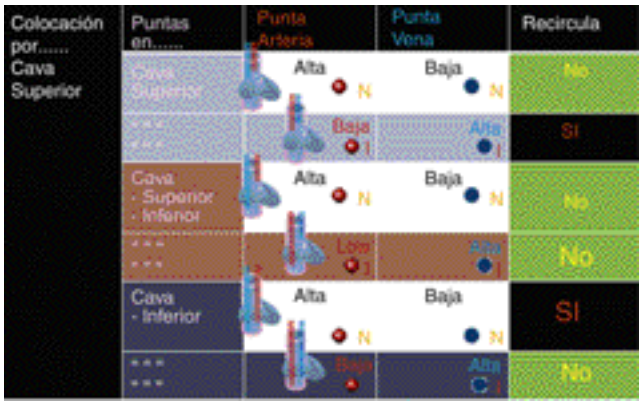


Figure 1 Position of the tip of the vascular catheter and its relationship in the input opening (superior vena cava or inferior vena cava). Correlationship with the recirculation.

the recirculation will be minimal and even though we invert the lines, the recirculation will be similar. It will be possible, then, to dialyse indifferently, with or without inverted branches.

If we access the right atrium through the superior vena cava and the tips are in the high descending influx atrium area, the arterial tip must be the top one and the venous tip the bottom one. Inverting them will involve an increase in recirculation.

If we access the atrium through the inferior vena cava and the tips are in the lower area, low influx of inferior ascending flow; the arterial tip must be the lowest and the venous tip the highest.

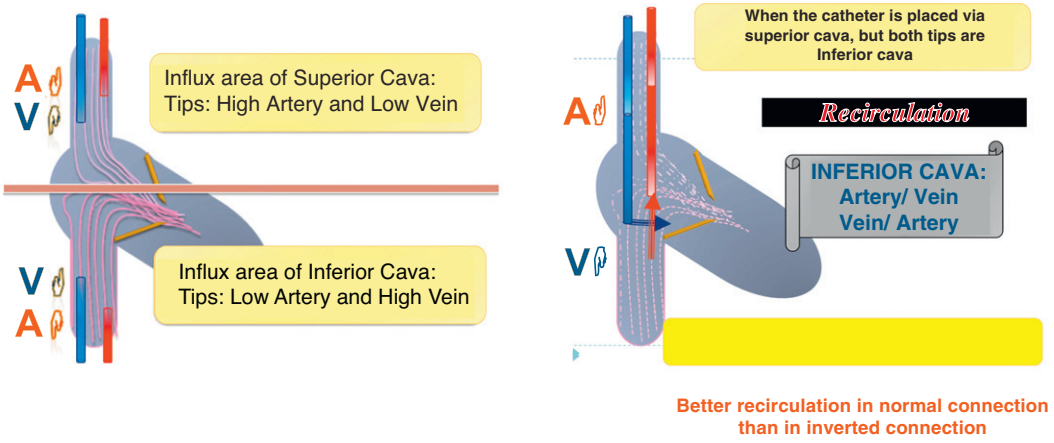
But we could access through superior vena cava and place both tips very low down, in the inferior atrium area. In other words, we would have entered the superior vena cava but we would be located in the inferior vena cava influx area, so we should dialyse with inverted branches. We will have less recirculation with inverted branches (venous branch as arterial and arterial for vein, than if we connect the branches normally (arterial for artery and venous for return).

The same would occur if we were to access the right atrium through the inferior vena cava, but we place the tips in the upper half, that is, the superior vena cava influx area. In this case, too, it recirculates less with inverted branches than in normal position (Fig. 1).

If we do not have a biosensor to measure the recirculation, but we do have a biosensor to measure clearance via ionic dialysance (Diascan – OCM), we can discover the location of the internal tips of the haemodialysis catheter. Thus:

If we enter through the superior vena cava and we are in superior vena cava influx area (above the half of the right atrium), the dialysance will be greater in normal connection position than if we invert branches.

But, if they are both situated low down, in inferior vena cava influx area (below the half of the right atrium), we will get better clearances with inverted branches than in normal position.



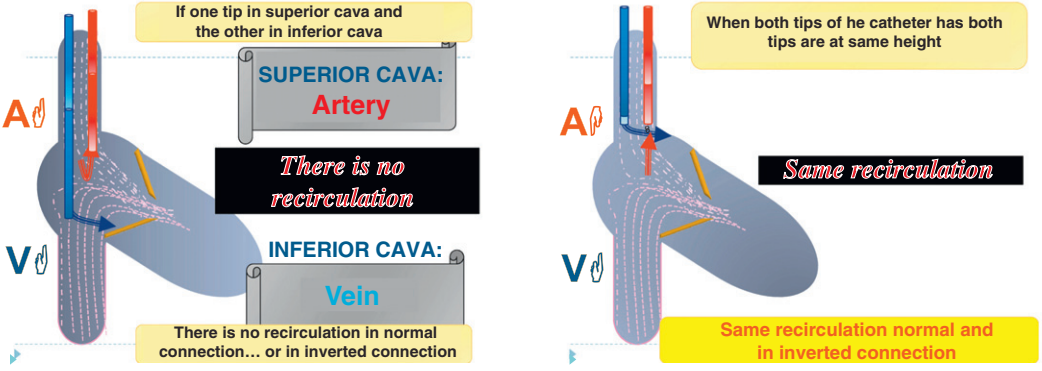


Figure 2 Summary of the tips of the venous catheter and recirculation in each position.

If it is indifferent, and we have the same clearances in normal connection as in inverted connection, the tips are in the centre of the atrium, with arterial tip below superior vena cava influx and venous tip lower than inferior vena cava influx.

In the event that ''palyndromic'' catheters or two individual catheters (Twin-Cath) are used, if they give us equal dialysances, this is because the two tips (arterial and venous) are at the same height, regardless of where the tips are located (Fig. 2).

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