

Anatomic features in preoperative vascular mapping by colour doppler ultrasound

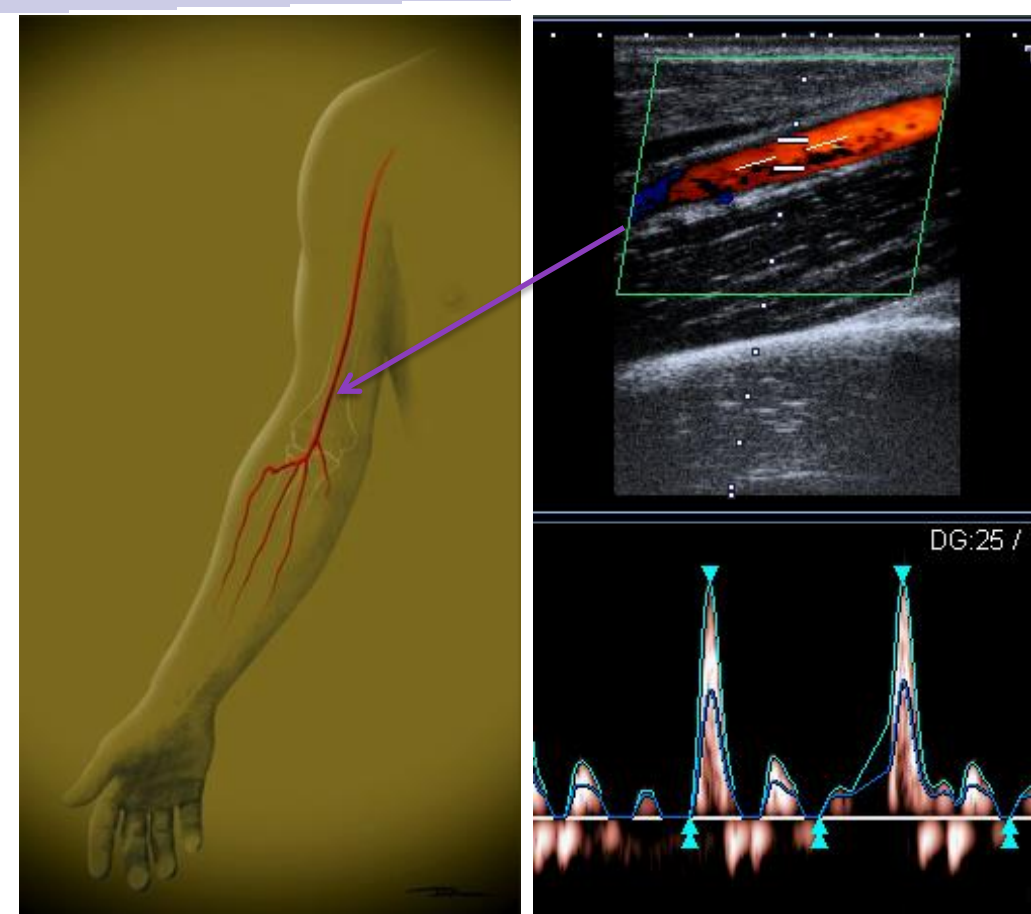
Background and methods

The preoperative evaluation of every patient before construction of a vascular access for hemodialysis should include a doppler ultrasound examination, with the aim of building a vascular map and evaluate morphology, patency and flow of arteries and veins.

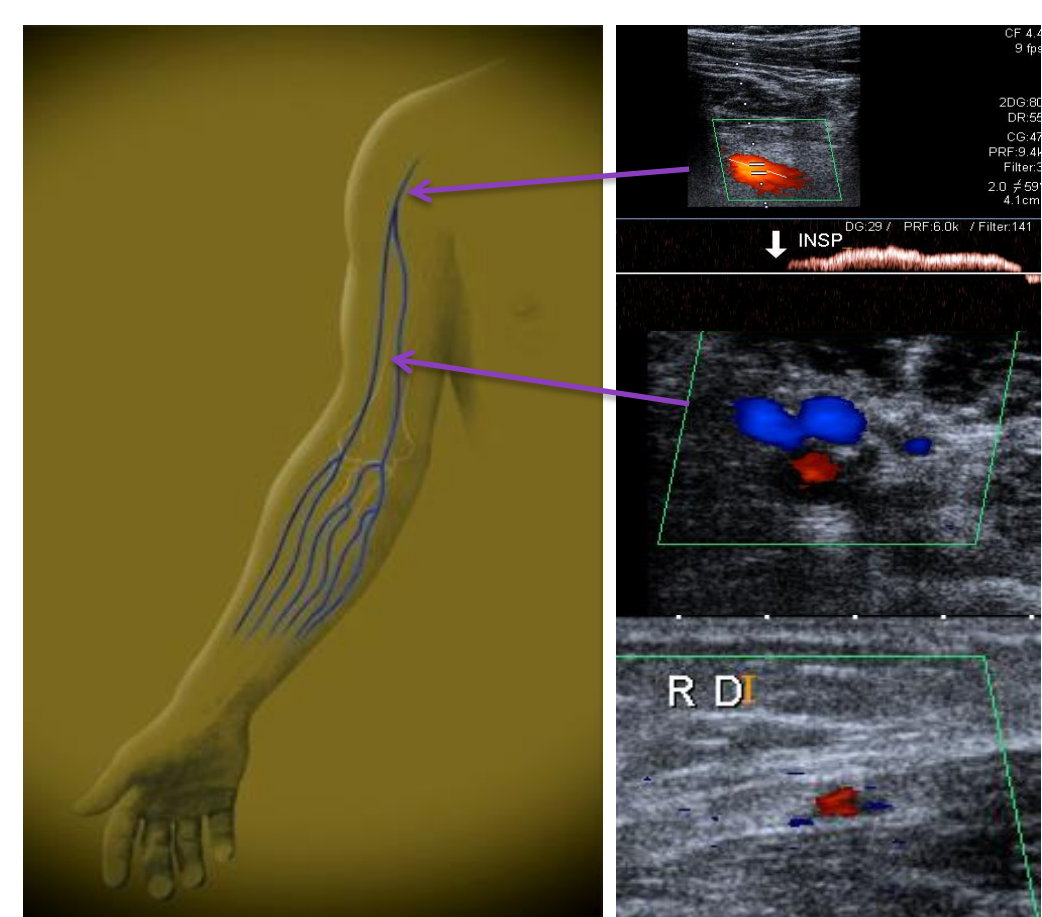
In order to achieve this goal, it is fundamental to know normal anatomy. However there is a huge normal variability in upper arm arteries and veins, seldom mentioned in textbooks.

With this presentation we intend to build "a roadmap to build the vascular map", exemplifying when possible with images obtained in a retrospective analysis of our last two years activity.

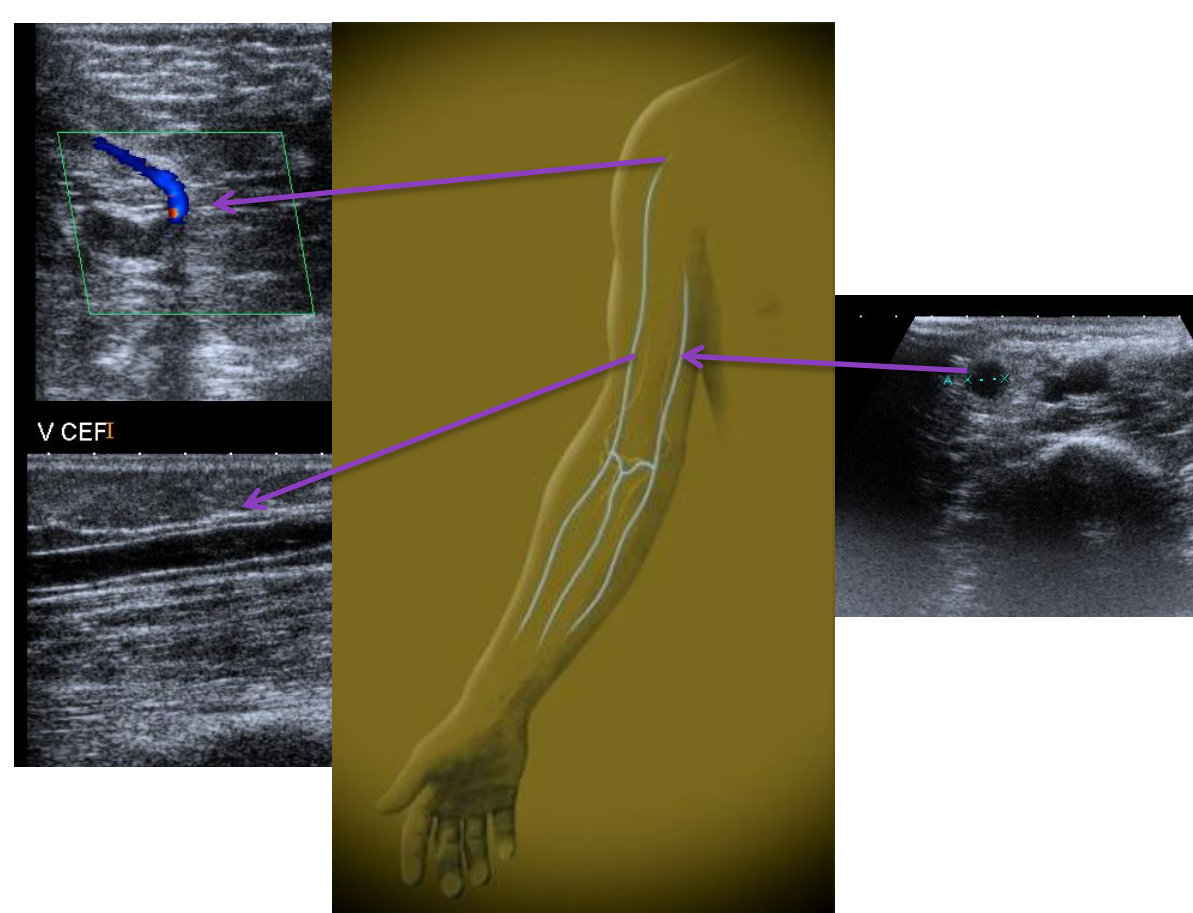
Classical



Normal brachial artery division
Normal flow waveform.

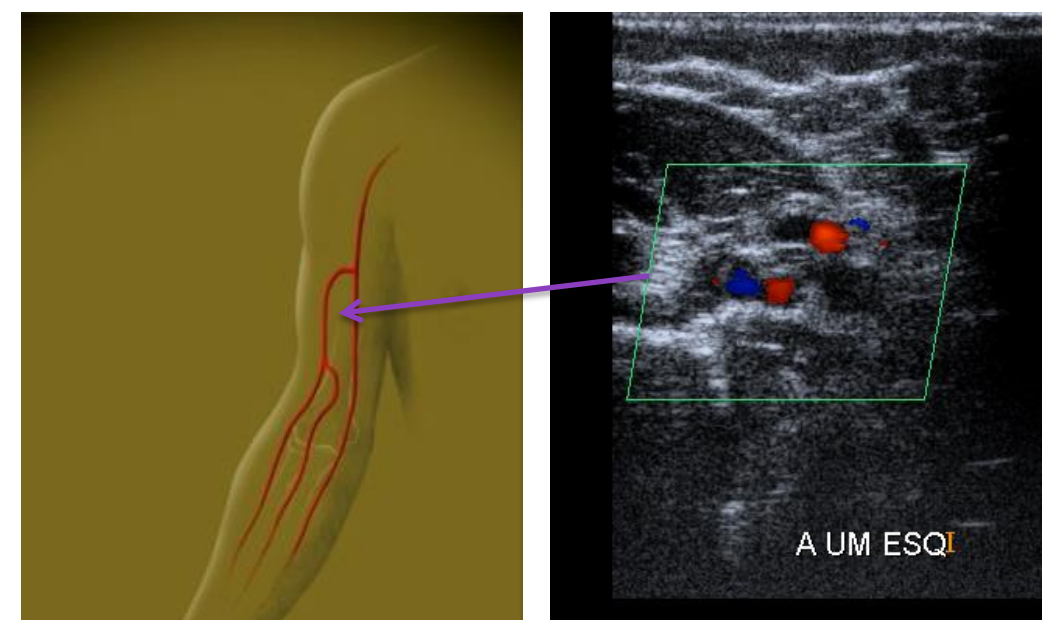


Normal subclavian vein. Normal paired deep veins accompanying the arm and forearm arteries



The basilic is the largest superficial vein in the arm, also known as royal vein. The classical cephalic-axillary confluent is at the highest portion of the delto-pectoral groove, the fosseta of Morhenheim or sub-clavicular fosseta of Gerdy

arteries

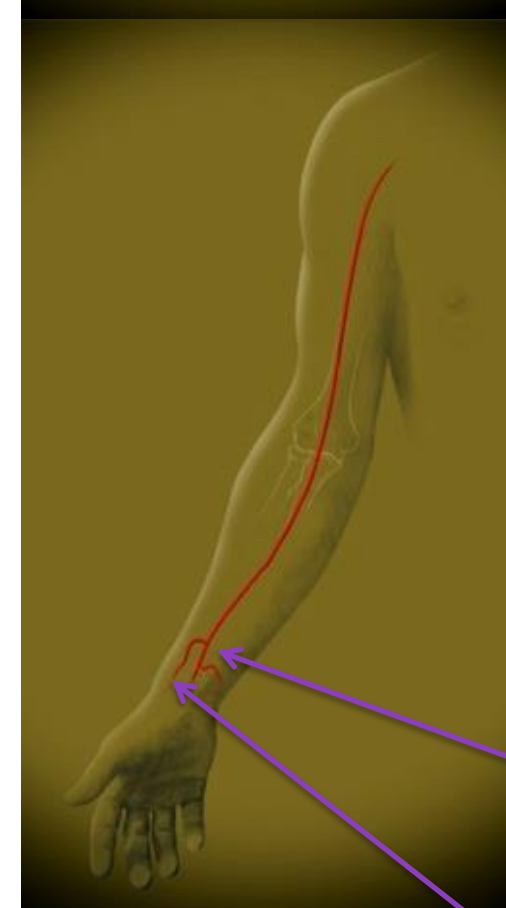
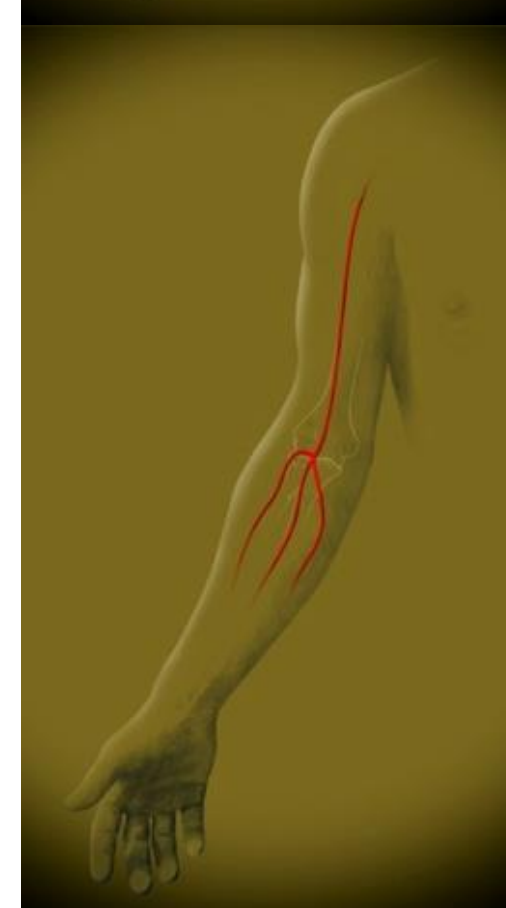
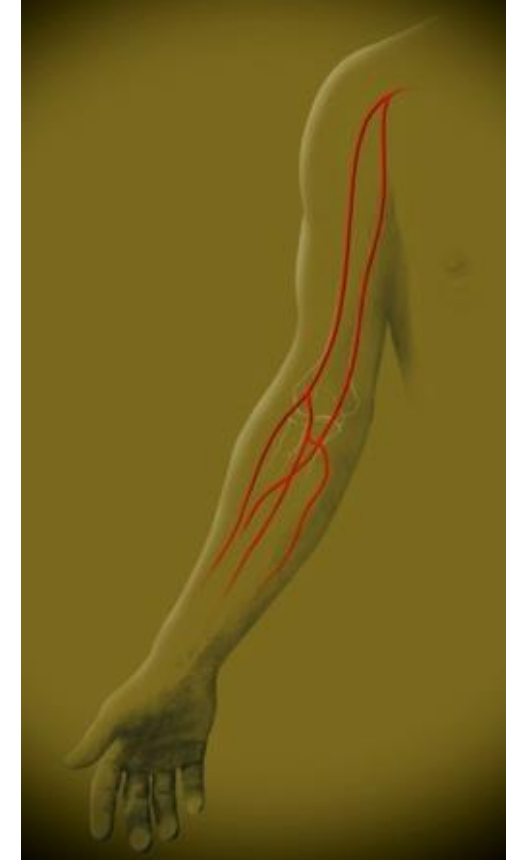


High bifurcation of the brachial artery, in the upper arm.

High origin may be a cause of slow access maturation.

Three different patterns:

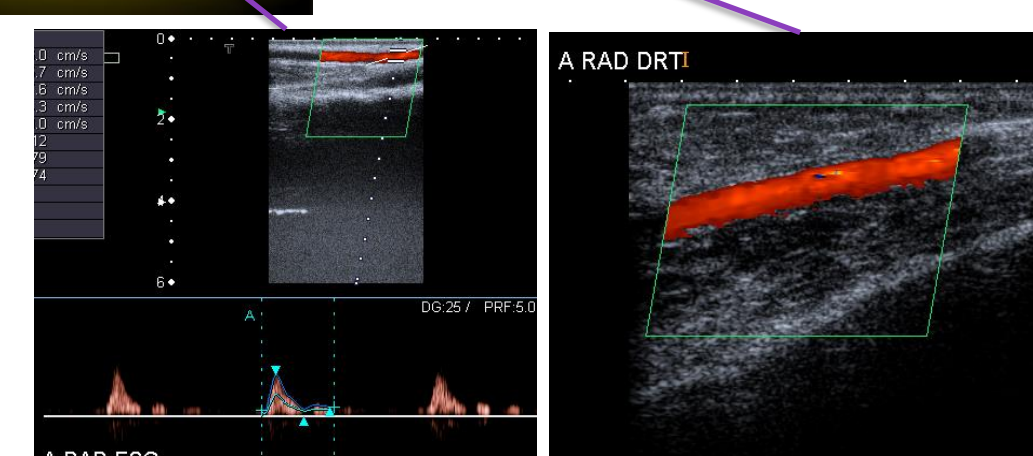
- 1) The interosseous artery arises from the radial;
- 2) The interosseous arises from the brachial and the radial and ulnar arise from a common trunk;
- 3) An aberrant radial artery arises from the axillary;



Abnormal trifurcation of the brachial artery at the elbow level

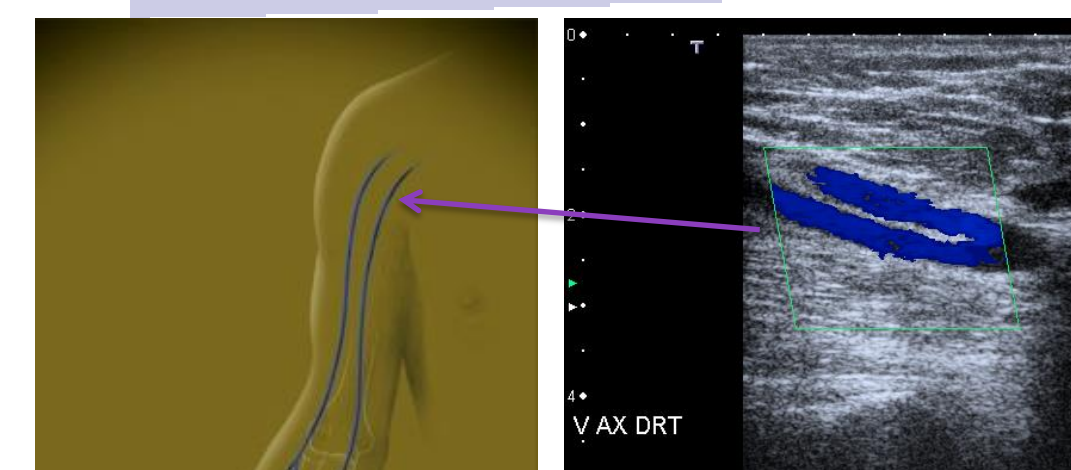
Low division of the brachial artery.

The radial and ulnar arteries can also have variable sizes or be absent.

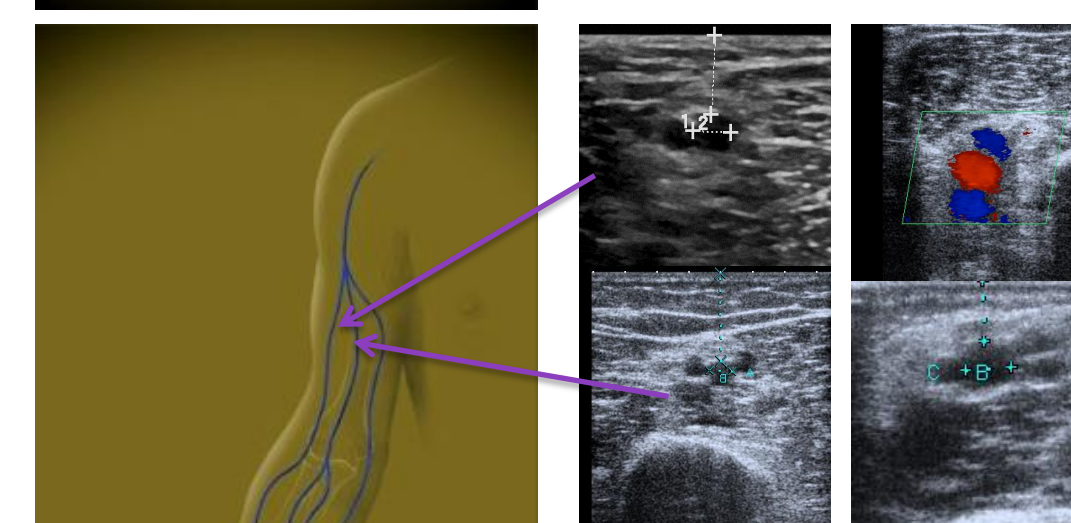


Different sizes of the radial artery in two different patients

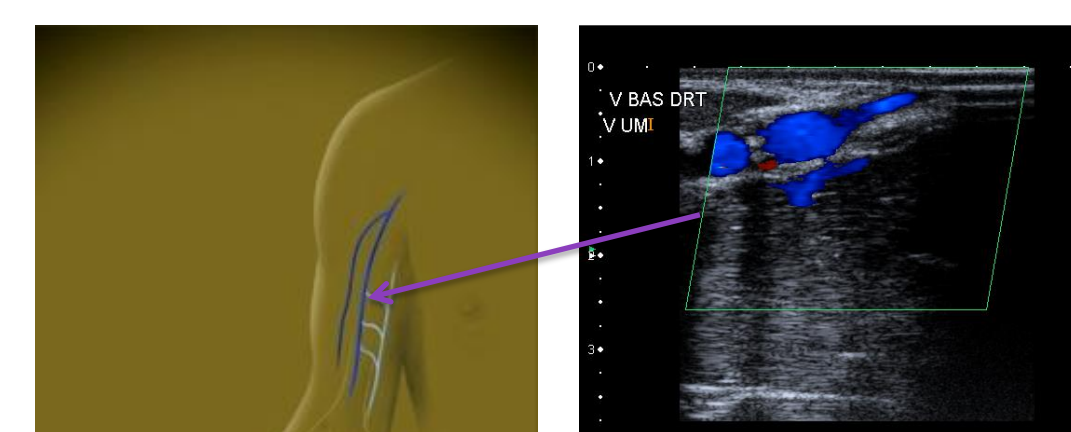
Deep veins



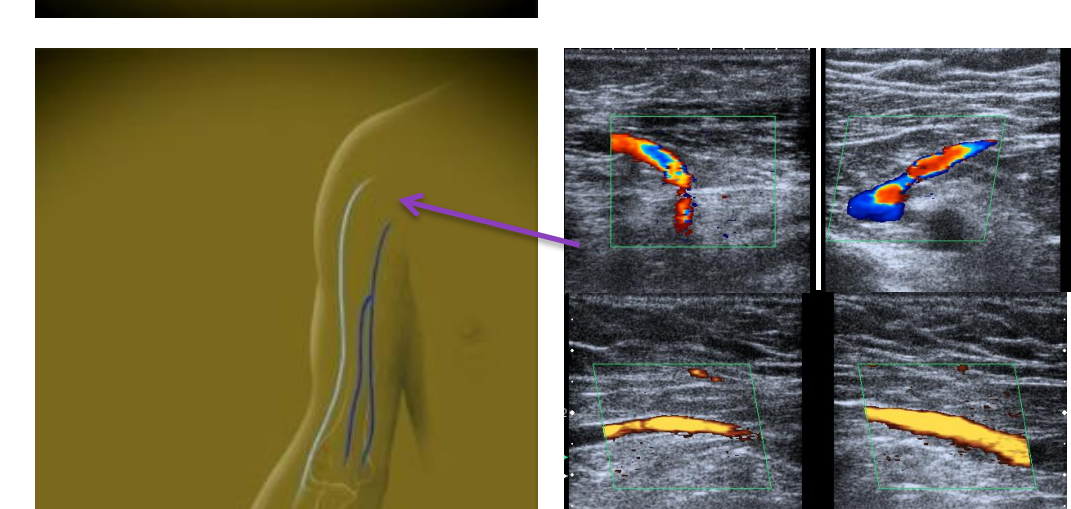
Paired axillary veins



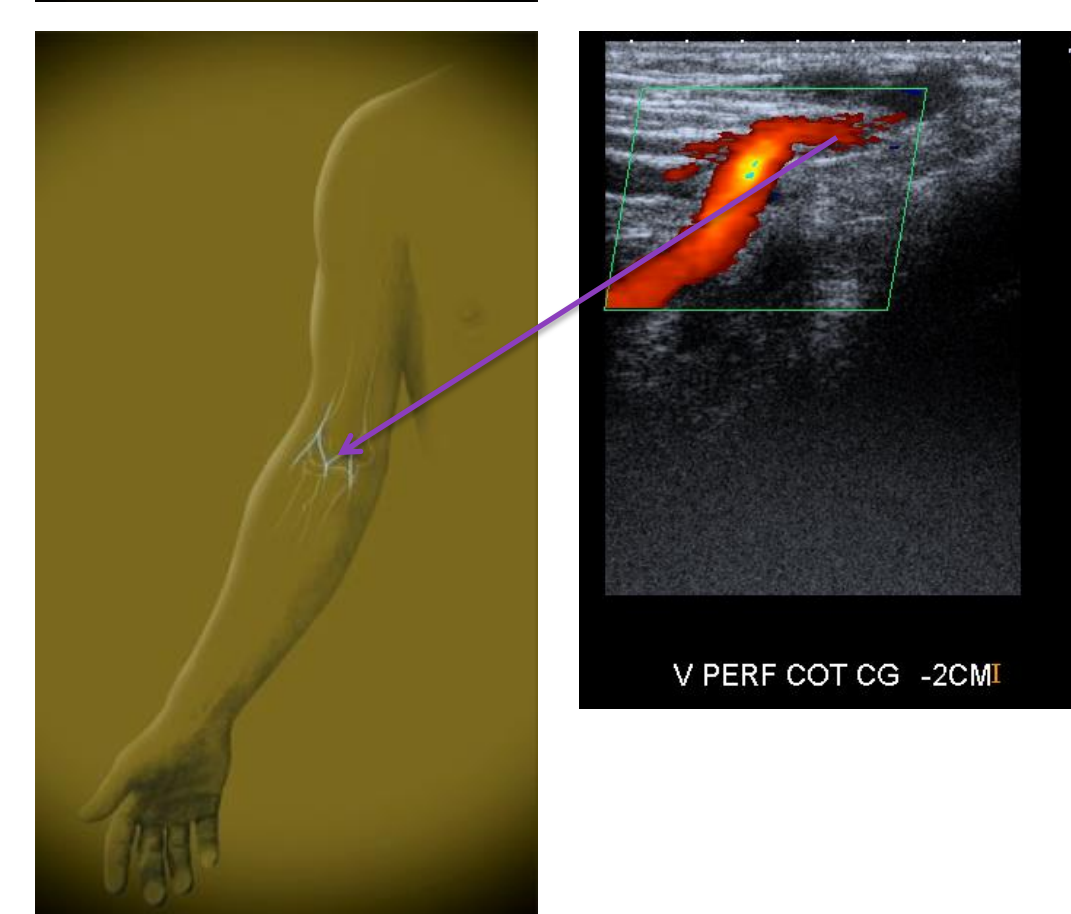
Brachial veins: Variability in the number (1 to 3) and disposition around the brachial artery



Basilic-brachial confluent - at variable levels in the upper arm



There is high variability in the classically cephalic-axillary confluent



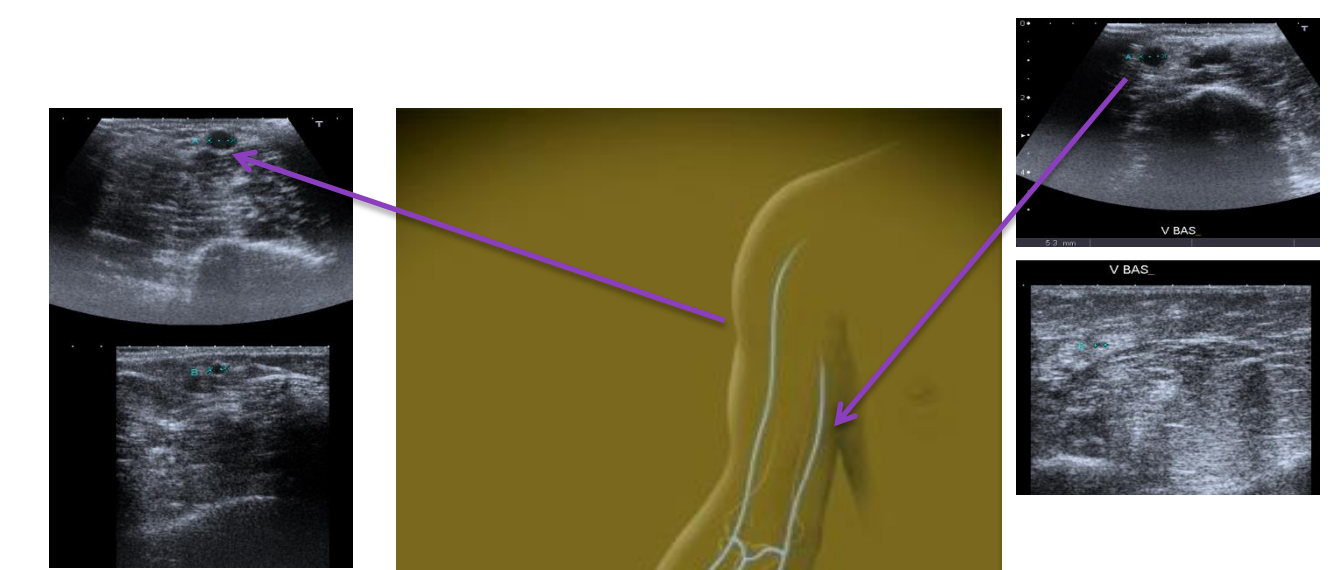
Communicating vein of the elbow. Classically described at the "M" tip, but seen at various levels.

We also noted on doppler examination that the direction of the flow in this vein is almost allways from the deep system to the superficial system. This is the opposit of what is described in textbooks .

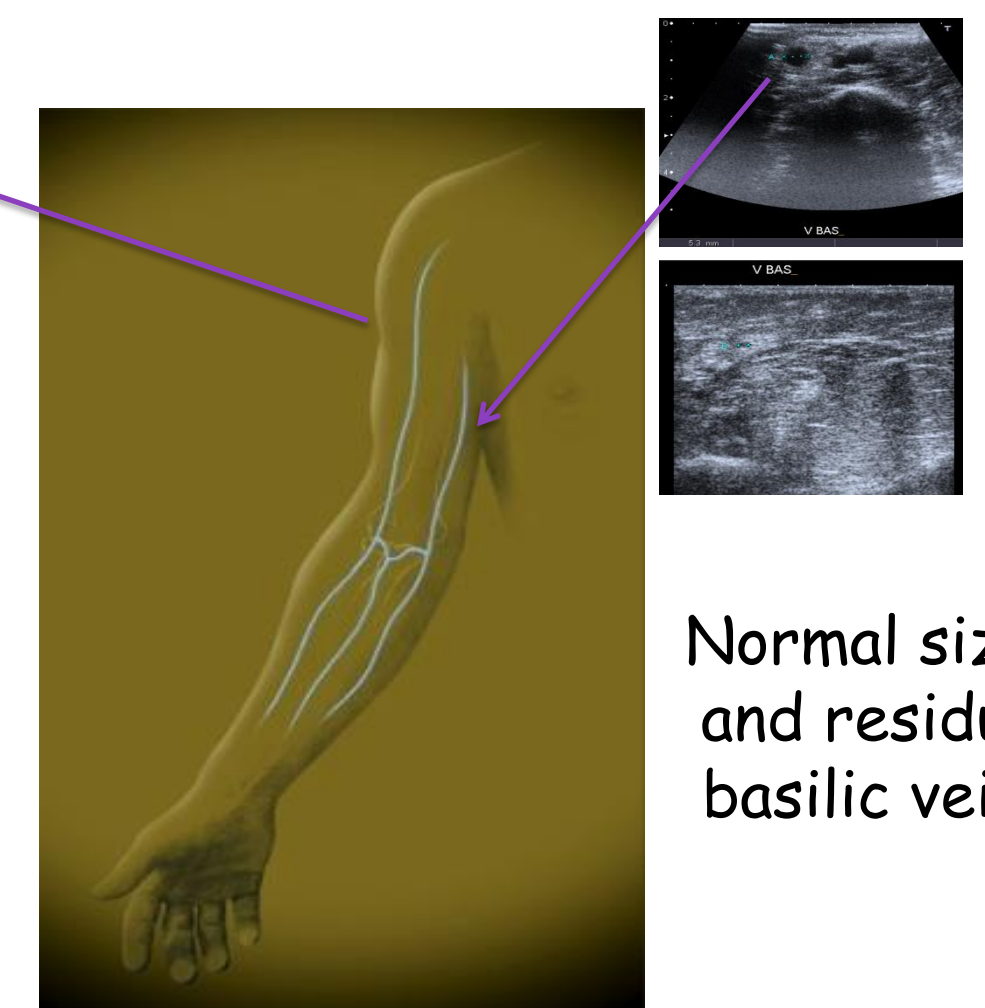
Anatomic variants

Superficial veins

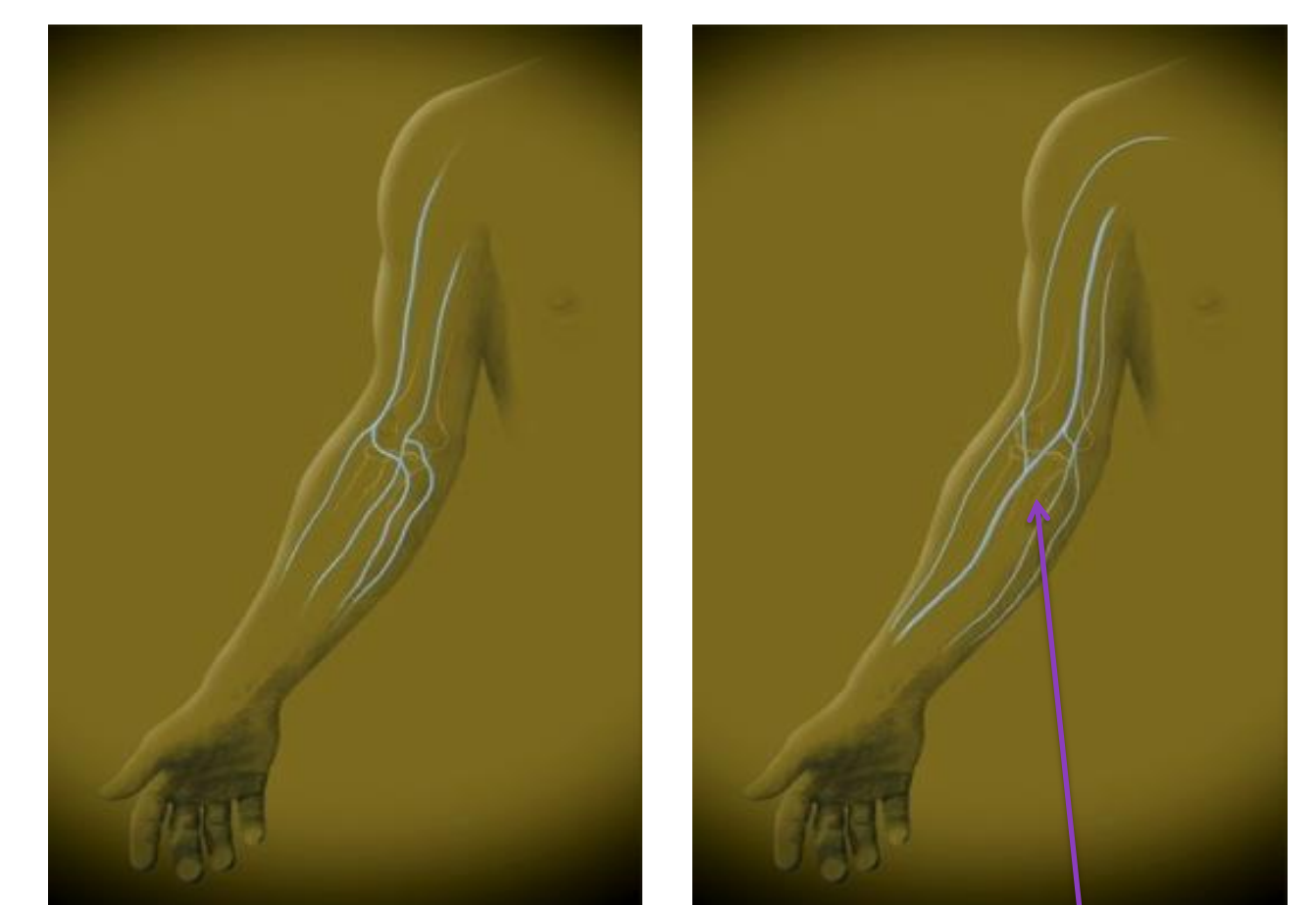
The superficial vein system is the most variable. We represent only some possible patterns. It is important to recognize accessory basilic and cephalic veins and variable vein diameters.



Normal sized and residual cephalic veins



Normal sized and residual basilic veins



The "Y" type

The "W" type. Note the accessory basilic vein

Results and conclusions

60 DU were performed, all by the same specialized in AV access radiologist. We registered 38 anatomically normal DU, and 22 (36.7%) with vascular anatomic variants. 3 arterial variants were found - 1 absence of radial artery, 1 absence of the cubital artery and 1 subcutaneous radial artery - 3 deep venous system variants were found - 2 cases of duplication of the axillary vein and one case of anterior positioning regarding to umeral artery of the external umeral vein - 17 superficial venous system variants were found: 3 regarding to basilica vein (absent in two cases and atrophic in another) and 12 cases regarding to cephalic vein (absent or atrophic in 12 cases; 2 cases in which the cephalic vein was subcutaneous in the forearm and arm and one case in which cephalic vein communicates with the deep system above the elbow.

Conclusions: The number of anatomic variants accounts for 36,7% in our study, mainly regarding to the cephalic vein (54.5% of all variants) frequently used in for native primary AV access. The knowledge of these anatomical features allows the creation of the best possible and successful AV access. Thus reinforcing the importance of preoperative vascular mapping by a specialized radiologist .

References:

- Paturet G. 1951. Traité d'anatomie humaine, tome II. Masson edituers. Librairie de l'academie de medicine, Paris, pp 435-440.
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