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 deltopectoral groove, the fossa of Morhenheim or subclavicular fossa 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

Normal sized and residual cephalic veins

Paired axillary veins

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

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

Deep veins

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

There is high variability in the classically cephalic -axillary confluent

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 ulnar artery of the external ulnar 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 anatomical 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. Thus reinforcing the importance of preoperative vascular mapping by a specialized radiologist.

Superficial veins

Normal sized and residual basilic veins

The "Y" type. Note the accessory basilic vein

Anatomic variants