Embryogenetic theory of the vessel network of the lower limbs

The theory of the angioguiding nerves

Anatomical variations according to embryo’s development

A) ABNORMAL DEVELOPMENT OF AXIAL VENOUS PLEXUS

1. The variations of the venous axis at the popliteal level. The biradicular origin of the popliteal exists in this form in 56% of normal cases. In practice, variations come down to two broad possibilities: the single collector, sometimes made up of several different embryological segments, resulting in a hybrid vessel and an aberrant course, either axial, satellite to the sciatic nerve, or profunda femoris, satellite to the shaft of the femur. Doubling (bifid or by bifurcation) opens up an additional channel, either parallel or divergent, which considerably modifies the conditions of venous return. A lesion affecting one branch only, e.g. a solitary thrombus, may have no clinical manifestations and marking of collectors during imaging.

2. The variations of the venous axis at the thigh level are also interesting. According to the development of the three axes, we can observe:

I. normal small venous arcades of the sciatic nerve and deep femoral and femoral veins joining in the upper or lower part of the popliteal fossa;
II. a huge trunk called sciatic vein or ‘persistent sciatic vein’ connected to the deep femoral vein, which could be the main venous axis of the thigh, if the femoral vein is hypoplastic;

III. the same disposal, of course, could be seen with the arterial axis, known as the ‘persistent sciatic artery’.

B) ABNORMAL DEVELOPMENT OF PRE-AXIAL VENOUS PLEXUS

1. The variations of GSV trunk
   I. Duplicity of saphenous trunk
      • Global (duplex GSV)
      • Segmental (bifid trunk of GSV)
   II. atresia / hypoplasia
   III. interruption (termination in perforating vein)
   IV. plexiform saphenous network

2. The variations of collateral veins of GSV
   I. High Termination (GSV trunk of thigh) of:
      • Anterior intersaphenous vein
      • Posterior intersaphenous vein (Leonardo v.)
   II. Isolated termination of femoral anterior saphenous v. in femoral vein (true Accessory Saphenous Vein)

3. The variations of Femoral vein atresia / hypoplasia

C) ABNORMAL DEVELOPMENT OF POST-AXIAL VENOUS PLEXUS

1. The variations of SSV trunk
   I. The termination types of the SSV: First of all, the presence of an arch (or French ‘crosse’) is not constant in a normal population (70%). The arch is more frequent in varicose patients because it is often responsible for the pathological reflux in this area. The reflux coming from higher points, popliteal or deep femoral vein, is scarcely feeding the superficial network. Using a practical and surgical classification, there are five possible termination types for the SSV according to the presence (A and B) or the absence (C, D and E) of SPJ.
   a. Type A: Normal SPJ located less than 5 cm above the popliteal crease (83%)
      • J Type A1: isolated termination in popliteal vein (62%)
      • J Type A2: termination in medial gastrocnemial vein “common trunk” (21%)
   b. Type B: High SPJ, equal or more than 5 cm above the crease (6%)
   c. Type C: No SPJ, SSV continued through the Giacomini vein (5%)
   d. Type D: No SPJ, short termination at the leg level (1%)
   e. Type E: No SPJ, plexiform deep termination in the thigh muscles (5%).
   II. The ‘deep extension’ of SSV: Named axial extension because it is located dorsally, near the tibial nerve (axial nerve of the embryo). It could join an axial arcade (or sciatic nerve arcade), which is located ventrally to the sciatic nerve.
III. The ‘dorsal extension’ of SSV: Also named post-axial or cranial extension of the SSV (postaxial nerve of the embryo), it is located more superficially, but below the muscular fascia, companion of the femoral posterior cutaneous nerve. It often perforates the fascia at various levels and extends with the Giacomini vein (subcutaneous vein) to join GSV.

IV. Global or Segmental proximal atresia of SSV trunk (continuity with sural vein)

V. Plexiform saphenous network

2. The variations of collateral veins of SSV
   I. Intersaphenous Communicating vein (absence)
   II. Achillean tributary