Spinal vessels

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Embryologically, the vascular system of the spine and the surface of the spinal cord develops in a segmental pattern. They are fed by each segmental arteries given off from the dorsal aorta and drain into the posterior cardinal vein through each segmental veins. These basic structures are relatively preserved in the spine, dura matter, nerve roots and paraspinal muscles in adults. Although segmental arteries persist as intercostal and lumbar arteries originated from the descending aorta in the majority of thoracolumbar region, the pattern of segmental supply changes in the cervical and lumbosacral regions. Longitudinal anastomosis and/or rearrangement of segmental arteries develop ascending cervical arteries, vertebral arteries and deep cervical arteries in the cervical region, and sacral arteries and iliolumbar arteries in the lumbosacral region. These segmental arteries give off somatic branch (ventral and dorsal), prelaminar artery and dorsal branch supplying to the spine, and radiculomeningeal artery to the dura matter and nerve roots in the spinal canal (Fig.1). The superficial arteries of the spinal cord include two systems, the anterior spinal artery and the vasa corona. The anterior spinal artery runs the entire length of the spinal cord longitudinally in the midline. It is fed by radiculomedullary arteries at various segmental levels. The radiculomedullary artery arising from the segmental artery runs with the anterior nerve root to join the anterior spinal artery. At most spinal levels, the anterior spinal artery gives off sulcal (central) arteries which supply to the anterior two-thirds of spinal cord in a centrifugal pattern. The vasa corona is pial plexus of the surface of the spinal cord. It is fed by radiculopial arteries at various segmental levels. Most of radiculopial artery runs with the posterior nerve root to join the vasa corona on the posterolateral surface of spinal cord. Longitudinal anastomoses of the vasa corona on bilateral posterolateral surface of the spinal cord are posterior spinal arteries. Radial perforating branches from the vasa corona supply the spinal cord in a centripetal pattern (Fig.2).

The intrinsic venous drainage of the spinal cord is characterized as a radially symmetric pattern. Sulcal (central) veins and radial (peripheral) veins drain into the extrinsic (superficial)

venous system. The extrinsic venous system consists of the coronal venous plexus and several longitudinal veins. The anterior spinal vein is located deep to the anterior spinal artery in the anterior median fissure and runs the entire length of the spinal cord. The posterior (posteromedian and/or posterolateral) spinal vein is longitudinal anastomosis of the coronal venous plexus. The anterior and posterior spinal veins receive the sulcal veins directly and the coronal venous plexus, and drain into the epidural venous plexus (internal vertebral venous plexus) though radiculomedullary veins and bridging veins. Both radiculomedullary veins and bridging veins have the role to drain the extrinsic venous system. The former exit to the epidural venous plexus at the level of intervertebral foramia along the nerve roots, while the latter exit at the level between the intervertebral foramia (Fig.3). The epidural venous plexus plays a role in draining not only the spinal cord but also the spine. It is connected with the paraspinal venous plexus (external vertebral venous plexus) by the intervertebral veins at intervertebral foramina. Finally, they drain into various extraspinal longitudinal veins including the vertebral veins, azygos system and ascending lumbar veins (Fig.4).

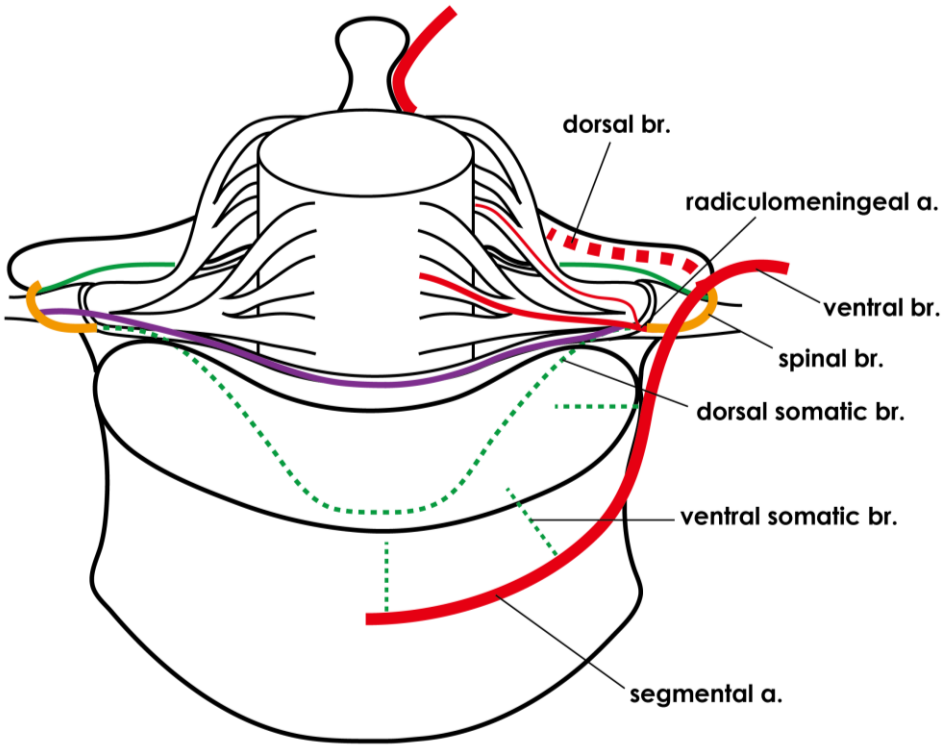

Figure 1: Schema of arterial anatomy of the spine.
The vertebral body is supplied by ventral somatic branch arising from main trunk of the segmental artery and dorsal somatic branch from spinal branch of the segmental artery. And lamina is supplied by dorsal branch of the segmental artery and prelaminar artery arising from spinal branch of it. In addition, spinal branch gives off radiculomeningeal artery supplying the dura matter and the nerve roots.

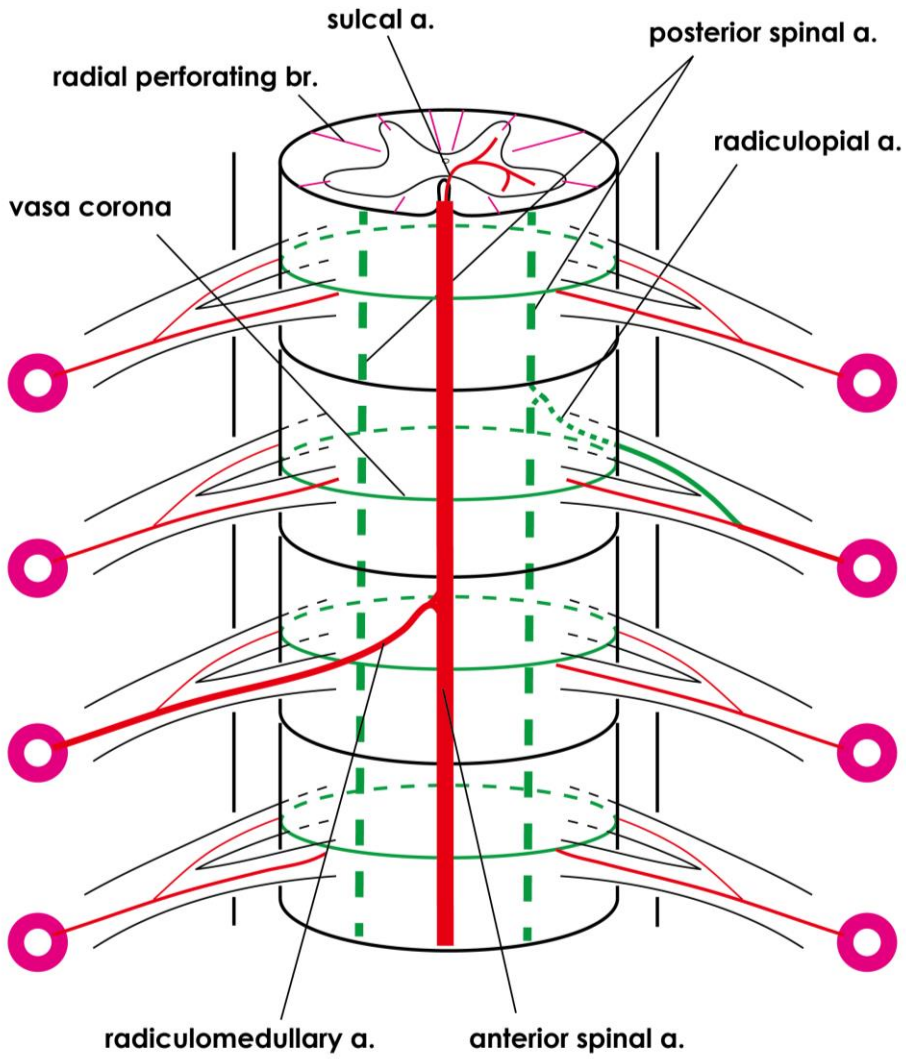

Figure 2: Schema of arterial anatomy of the spinal cord.
The radiculomedullary artery runs with the anterior nerve root and connects to the anterior spinal artery. On the other hand, most of the radiculopial arteries run with the posterior nerve root and connect to the posterior spinal arteries, which are developed by longitudinal anastomosis of the vasa corona. The blood supply of the spinal cord is contributed by the sulcal artery in a centrifugal pattern and radial perforating branch in a centripetal pattern.

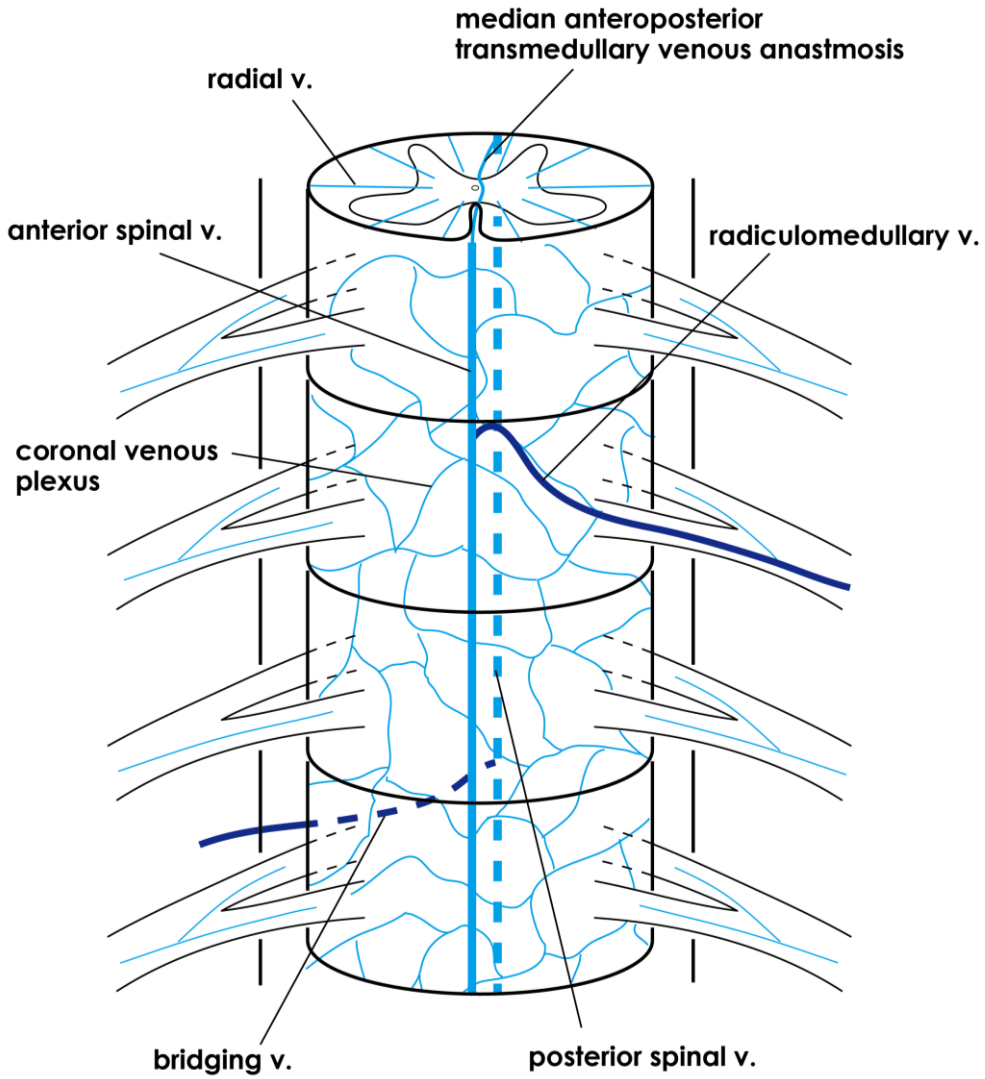

Figure 3: Schema of venous anatomy of the spinal cord.
The intrinsic venous system of the spinal cord is radially and symmetrically arranged with axial anastomosis. The sulcal and radial veins connects to the extrinsic venous system, which consists of anterior and posterior spinal veins, the coronal venous plexus. The anterior and posterior spinal veins are the longitudinal venous axes which are interconnected by the coronal venous plexus and transmedullary venous anastomosis. The extrinsic venous system of the spinal cord drains into the epidural venous plexus through the radiculomedullary vein and the bridging vein.

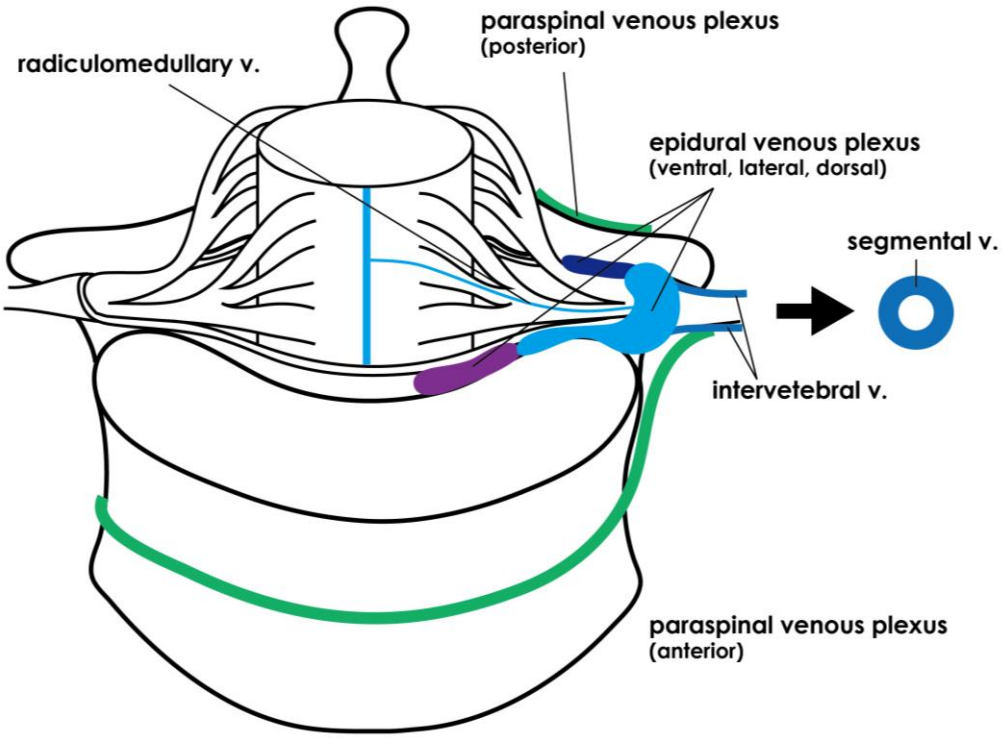

Figure 4: Schema of venous anatomy of the spine.
The epidural venous plexus plays a role in draining not only the spinal cord but also the spine. The epidural venous plexus and the paraspinal venous plexus communicate with one another via the intervertebral vein, which drains into the segmental vein.