Morphological and functional anatomical aspects of the Internal Vertebral Venous Plexus (IVVP)

SCHALLIER Hans, DO *; PROVYN Steven, DO; VAN DUN Patrick, DO

Purpose

Reviewing the literature on the vascular anatomy of the spinal canal, it appeared that the morphologic characteristics of the internal vertebral venous plexus (IVVP) are often limited. This experimental study is taking a survey of the anterior part of the IVVP (AIVVP) and its possible relations with other vascular systems.

Relevance

A revision of the specific morphological characteristics and relations of the IVVP with other vascular systems is important to understand the dynamic functional role of this structure. It also contributes to a better understanding of its role in the pathogenesis of radix- and medulla compression.

Methods

In order to visualize the AIVVP, eleven spines were dissected after injection with Biodur™ E20 epoxy resin and Biodur™ E2 hardner products anterior into the vertebral body. This technique excludes a great part of peripheral vascular problems. Another motivation for this method is the fact that the thin vascular wall of small vessels tears up easily by injection of a fluid with a high viscosity. The dissection took place twenty-four hours after injection with Biodur™. Afterwards microscopic investigations were carried out (Zeiss Op-Mi6).

Results

The morphological pattern of the AIVVP seemed to be very constant with that proposed in literature: it comprises two longitudinal veins which are situated anterolateral in the spinal canal and form the lateral part of the AIVVP. On each vertebral level a branch of these longitudinal veins converges medially, forming a dense venous network. In this way a typical butterfly pattern is visualized. More caudal the volume of the AIVVP increases progressively, with a pronounced volume on the L4-L5 level and an abrupt decline in the sacral region. Microscopic study of the medial part of the butterfly pattern of the AIVVP indicates that this plexus is formed by a network of different veins which is surrounded by the peridural membrane. A striking continuity is seen between the basivertebral veins and the medial part of the AIVVP. In this way intra-osseous pathology (e.g. tumor) can result in an asymmetric butterfly pattern. Further visualization shows direct anastomoses with the Vv. Intervertebralis and also with the Azygos and the vena cava superior. Continuity has been determined between the IVVP and vena cava inferior via the Vv. Lumbales and the Vv. Iliacae communis. The vessels are valveless. During dissection several anatomical variations of vascular structures were found which underlines that the anastomoses we found are individually different and not absolute.

Conclusions

Due to these valveless veins, intrathoracal and intra-abdominal pressure changes have an influence on the direction of the vascular flow. In this manner the IVVP plays its role as an alternative vascular pathway with obstruction phenomena (e.g. pregnancy). Decreased dynamics of venolymphatic circulation at the intervertebral foramen could very well cause an expansion of the IVVP which in turn could lead to a compression of the dural sac or nerve root, causing its well known symptomatology.
The bidirectional flow also allows a haemodynamic shift providing a physiological protection of the dural sac during postural changes (called the safety cushion effect).
Fundamental anatomical knowledge of the IVVP seems to be imperative for further research concerning the functionality of this vascular system.

Keywords: IVVP, internal vertebral venous plexus, dura mater, spinal canal

***contact: Hans SCHALLIER D.O. (CORPP), Koninginnelaan 73, B-8400 OOSTENDE, +32(0)59709363, hans.schallier@telenet.be**