Dilatation of Virchow-Robin Perivascular Spaces

Abstract

The dilation of Virchow and Robin spaces (Figure 1) is a benign pathology. In most cases, patients are asymptomatic. A contrast enhancement of Virchow and Robin spaces can be found in many pathologies. Virchow and Robin spaces dilations less than 2mm appear at any age. Expansions of more than 2mm are much more frequent in elderly subjects.

The spaces of Virchow and Robin or perivascular spaces are spaces surrounding the perforating blood vessels (arteries, arterioles, veins and venules) that enter the brain. The spaces of Virchow and Robin are spaces of varying sizes, filled with interstitial fluid (also called interstitium, a liquid that fills the space between blood capillaries and cells). They are covered by the intima pia which is the avascular layer of the pia mater (one of the three membranes constituting the meninges) and that accompanies the penetration of the perforating arteries in the cerebral parenchyma.

The pathophysiology of dilation of Virchow and Robin spaces is poorly understood. Several causes are considered, including: increased vascular permeability, interstitial fluid drainage anomaly, parenchymal atrophy, or Virchow and Robin spaces fibrosis and obstruction. The prevalence and size of dilated Virchow and Robin spaces increase with age, but the pathological value of space dilation remains uncertain.

Virchow and Robin spaces are becoming more visible in imaging thanks to the continuous improvement of spatial resolution. Virchow-Robin perivascular spaces dilatations are frequent entities and are increasingly encountered because of advances in neuroimaging.

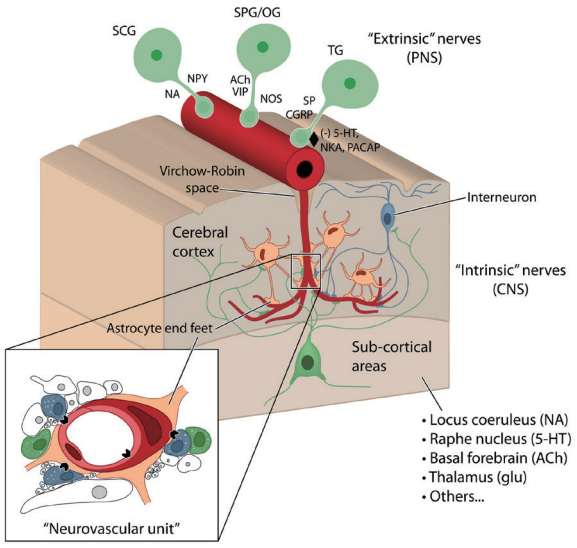

Figure 1

Complication

- Hydrocephalus

Possible treatments

- Only giant dilatations require close monitoring and treatment
- Ventriculocisternostomy (surgical treatment performed using an endoscope, an optical tube that can be introduced into the cerebral ventricles)
- A fenestration gesture (opening breakthrough of the Virchow-Robin perivascular spaces dilation can be associated if necessary).

In Vitrea

The viewer on enterprise platform provides good visualization and analysis of Virchow and Robin spaces dilatations from an isotropic FSE T2 sequence acquired in the three planes as well as the visualization of hydrocephalus (Figure 2). The MPR (Multi-Planar Reconstruction) and MIP (Maximum Intensity Projection) tools, also provided by this module, are particularly suitable for viewing and analyzing images.

Thanks to diffusion tensor maps (DTI), it is possible to reconstruct and visualize the bundles of nerve fibers and thus analyze the repercussion on the latter of the different dilations, especially at the mesencephalon (Figure 3).

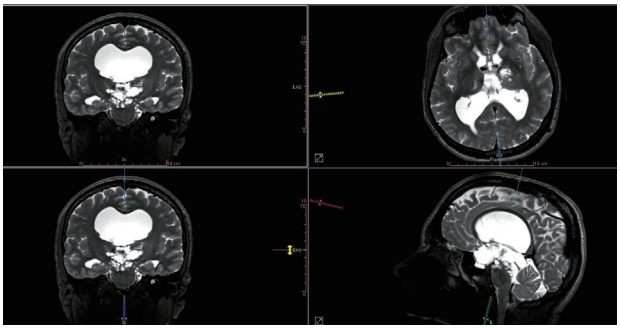

Figure 2

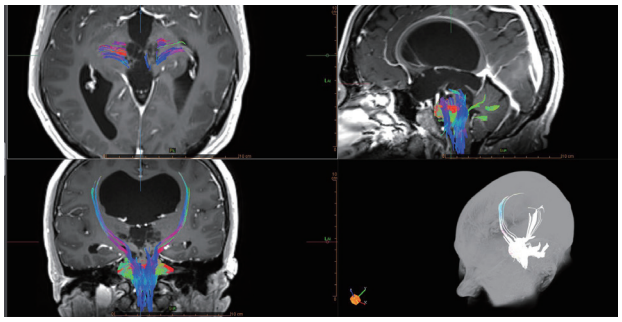

Figure 3

Cerebral perfusion applications with rapid computation of corrected rBV, Tmax and diffusion (ADC) maps can detect any potential dilation in cerebral vasculature (Figure 4).

A follow-up module facilitates the simultaneous visualization of the different examinations carried out as part of patient follow-up.

Addition

The enhancement of perivascular spaces is always pathological. It could occur in three major etiological contexts: vascularity (involvement of the vascular wall) ; infection (infectious meningitis, chronic perivascular infection like neurosyphilis...) ; tumor (intravascular lymphoma, glioblastoma, metastasis...).

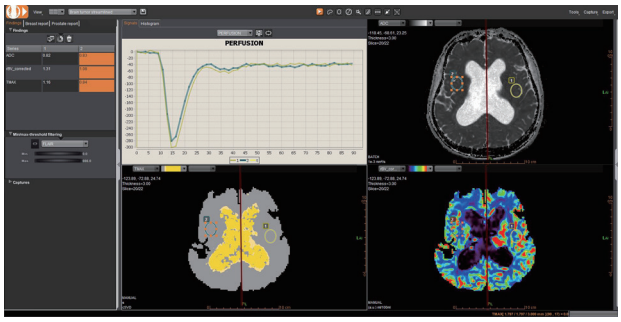

Figure 4

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