Dos and Don'ts of Venous Accidents Around the Vein of Galen

Venous anatomy around the vein of Galen (VOG) is similar to any other venous regions. The fundamental concept being in the periphery they are small and multiple and as they approach the main vein they are large and single or paired. However, when analyzed with reference to tumors around the pineal region (some of which can be vascular and some others can engulf or push the nearby veins), we coin safe and dangerous zones. Safe maximal resection[1] being the key for pineal region tumors. This article is organized in such a way so as to describe the common anatomy first, followed by special arachnoid anatomy, pial/ependymal veins, and finally how to navigate through these branches while removing pineal region pathology and the common sites of bleed during the operation.

Larger Branches of Vein of Galen

- Internal cerebral vein originates and remains parallel to each other in the small membrane called velum interpositum,[2] join VOG from the front. Velum interpositum is an invagination of pia and present anterior to the pineal gland on the superior aspect of the third ventricle
- The basal vein is single on either side can join either the distal internal cerebral vein or VOG
- Inferior sagittal sinus joins VOG from above
- Posterior mesencephalic vein collects blood from anastomosis around mesencephalon such as the anastomotic lateral mesencephalic vein and many anastomotic veins exists around the brainstem and cerebellum[3-5]
- Precentral cerebellar vein joins VOG from below.

Anastomotic Veins

Cerebrum has cortex and medulla. Anything under the cortex is medulla. For the purpose of drainage, medulla has superficial medullary veins (subcortical veins draining 1–2 cm deep-draining to pial veins) and deep medullary veins (deep white matter and central nuclei draining to internal cerebral vein).

Transcerebral anastomotic vein (Kaplan) and transanastomotic vein (Schlesinger 1939, Hassler 1966) get additional names to veins that run across the cerebrum and meet the subependymal veins.[6]

Arachnoid Sleeves Around Veins

If we imagine arachnoid sleeve[7] to be like a dural sleeve (of an existing nerve root from spinal dura) around all the joining veins to the VOG, then there will be little anastomosis between them. In other words, the arachnoid can be opaque and careful dissection is a must. The farther away from the trunk one traces, the veins are obviously thinner and branches out. For example, posterior mesencephalic vein drains the anastomotic ring around brainstem.

Pial Vessels

Professor Rhoton says many veins are closely attached to the brain/pia while many arteries are a relatively free.[8] This could be one of the reasons why venous bleed is more common than arterial territory bleed/infarct during operative procedures.

Ependymal Veins

In addition, Gaab and Schroeder[9] say during endoscopy ependymal veins commonly bleed.

Two types of venous bleed occur during endoscopy. First one is the small bleed which is common and stop spontaneously and managed simply with continuous irrigation. The second one is the major bleed which will need bipolar coagulation.[9]

Pineal Pathology

Preoperative, intraoperative, and postoperative bleeds are common, especially in vascular tumors.

Veins that can be Sacrificed

Classical teaching says tentorial bridging veins are usually sacrificed after coagulating, to get a safe direct access under the tent way before reaching the pineal region. Furthermore, inferior sagittal sinus can be sacrificed to facilitate falx retraction, in the occipital interhemispheric approach.[10]

Only after meticulous arachnoid dissection around the pineal region,[11] especially the VOG can the precentral cerebellar vein be sacrificed.[1] This is because the joining of the precentral to the VOG can vary and can look very similar before arachnoid dissection[1] (in the infratentorial approach).

However, for the veins around the pineal region sacrificing one vein is only doubtfully acceptable.[10] And finally, never sacrifice more than one vein.

Conclusion

The closer you get to the VOG, the more the chance of sacrificing an independent vein and thereby increasing the risk of causing a large area infarct. On the contrary, if you make a hole[1] in the big veins, pressure with gelfoam/surgicel will control the bleeding and seal the hole, without causing major blocks to venous drainage of any territory. Therefore, identify the VOG before sacrificing anything.

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Conflicts of interest

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