SPECT for idiopathic normal pressure hydrocephalus diagnosis

Thirty subjects with idiopathic normal pressure hydrocephalus (iNPH) underwent both CBF SPECT and MRI. After normalization, voxel-wise two-sample t tests between patients and 11 normal controls were conducted to compare the regional alteration in the gray matter density and regional cerebral blood flow (rCBF).

The rCBF reduction and the gray matter decrease were seen in almost similar regions surrounding sylvian fissure, the left parietotemporal region and frontal lobes, whereas they did not find rCBF increase at the top of the high convexity, where the increase of the gray matter density was the highest ($p < 0.05$).

This study of Takahashi et al. from Tatsuno, Hyogo, Osaka, Kyoto, Tokyo, Japan, showed regional associations and dissociations between the relative gray matter density and rCBF in patients with iNPH [1].

On SPECT, patients with iNPH often show hyperperfusion of the high-convexity area. Ohmichi et al. tested 2 hypotheses regarding the SPECT finding: 1) it is relative hyperperfusion reflecting the increased gray matter density of the convexity, and 2) it is useful for the diagnosis of iNPH. The authors termed the SPECT finding the convexity apparent hyperperfusion (CAPPAH) sign. METHODS Two clinical studies were conducted. In study 1, SPECT was performed for 20 patients suspected of having iNPH, and regional cerebral blood flow (rCBF) of the high-convexity area was examined using quantitative analysis. Clinical differences between patients with the CAPPAH sign (CAP) and those without it (NCAP) were also compared. In study 2, the CAPPAH sign was retrospectively assessed in 30 patients with iNPH and 19 healthy controls using SPECT images and 3D stereotactic surface projection.

In study 1, rCBF of the high-convexity area of the CAP group was calculated as 35.2-43.7 ml/min/100 g, which is not higher than normal values of rCBF determined by SPECT. The NCAP group showed lower cognitive function and weaker responses to the removal of CSF than the CAP group. In study 2, the CAPPAH sign was positive only in patients with iNPH (24/30) and not in controls (sensitivity 80%, specificity 100%). The coincidence rate between tight high convexity on MRI and the CAPPAH sign was very high (28/30).

Patients with iNPH showed hyperperfusion of the high-convexity area on SPECT; however, the presence of the CAPPAH sign did not indicate real hyperperfusion of rCBF in the high-convexity area. The authors speculated that patients with iNPH without the CAPPAH sign, despite showing tight high convexity on MRI, might have comorbidities such as Alzheimer's disease [2].

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Takahashi R, Ishii K, Tokuda T, Nakajima M, Okada T; SINPHONI-2 Investigators. Regional dissociation between the cerebral blood flow and gray matter density alterations in idiopathic normal pressure hydrocephalous: results from SINPHONI-2 study. Neuroradiology. 2018 Sep 30. doi: 10.1007/s00234-018-2106-1. [Epub ahead of print] PubMed PMID: 30269153.
2)
Ohmichi T, Kondo M, Itsukage M, Koizumi H, Matsushima S, Kuriyama N, Ishii K, Mori E, Yamada K,

Mizuno T, Tokuda T. Usefulness of the convexity apparent hyperperfusion sign in (123)I-iodoamphetamine brain perfusion SPECT for the diagnosis of idiopathic normal pressure hydrocephalus. J Neurosurg. 2018 Mar 16:1-8. doi: 10.3171/2017.9.JNS171100. [Epub ahead of print] PubMed PMID: 29547088.