Parenchymal CNS hemorrhage: What the Clinician Wants

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Parenchymal CNS hemorrhage (intracerebral hemorrhage, ICH) is a common and devastating condition making up about 15% of all strokes. The overall incidence of ICH is 25 per 100.000 person-years and the reported case fatality after one year is 55%. The modifiable risk factors are hypertension, smoking, excessive alcohol use and cocaine use. Previous ischemic stroke is an independent risk factor for ICH, so controlling diabetes and obesity and maintaining a healthy lifestyle with good exercise and sleep habits are other reasonable preventive strategies. Antiplatelets, anticoagulants and statins can increase the risk of ICH and the magnitude of such effect may be related to the underlying etiology.

Neuroimaging is the most important diagnostic approach to determine the cause of the ICH, and such assessment has important consequences for both immediate and long-term management. In the hyperacute phase, computerized tomography (CT) and magnetic resonance imaging (MRI) of the brain help to diagnose ICH, allowing the clinician to distinguish it from ischemic stroke and other types of CNS injury. The location and size of the hemorrhage, presence of ventricular extension and other pathologies also directly influence immediate treatment decisions such as surgical evacuation. These factors are very important in prognostication and the presence of "spot sign" on CT Angiogram (CTA) source images can also help identify patients at high risk of hemorrhage expansion.

About 80% of all ICH is related to small vessel disease (SVD), and should be distinguished from underlying gross pathologies (mainly malignancies, hemorrhagic conversion of infarcts, aneurysms, arteriovenous malformations, arteriovenous fistulas and dural venous thrombosis) by means of parenchymal (MRI) and vascular (CTA or MRA) brain imaging. In select cases, conventional angiogram, still the gold standard test for detection of many gross vascular pathologies, should be performed. If any of these pathologies is diagnosed using appropriate workup, they need to be treated promptly by respective subspecialists using surgery, endovascular interventions, radiotherapy and medications.

Hypertensive SVD and cerebral amyloid angiopathy (CAA) are by far the most common SVD types that result in ICH. SVD-related ICH diagnosis requires one to rule out potential alternative etiologies discussed in the paragraph above using appropriate imaging. Hypertensive ICH (HTN-ICH) is related to hypertensive degenerative changes (arteriolosclerosis) near the bifurcation of small penetrating arteries, hemorrhage in these patients is typically located in deep parts of the brain (putamen, head of caudate, thalamus, pons, cerebellum). Intracerebral hemorrhage

in the cortico-subcortical regions of the brain, called “lobar” ICH constitutes about one third of all brain bleeds, the incidence significantly increasing with age. In most of these cases, CAA, characterized by the accumulation of Amyloid-β protein within the arterial media and adventitia, will lead to vessel fragility, rupture, and formation of macroscopic or microscopic hematomas. Based on the Boston Criteria, multiple macro- and/or micro-hemorrhages (on CT or MRI) restricted to lobar, cortical, or cortico-subcortical regions in patients aged 55 or older are diagnosed as “probable CAA”. A single lobar ICH in the same setting qualifies as “possible CAA”, as long as there is no evidence for other etiology. These clinical-radiological criteria have shown high specificity for the probable category in a pathological validation study and addition of superficial siderosis as another imaging marker has further increased their sensitivity. The annual risk of recurrence of deep HTN-ICH is about 2% whereas such risk is close to 10% for CAA-HTN. The presence of CAA pathology interacts significantly with some medications (anticoagulants and possibly with statins and antiplatelets) resulting in a higher recurrence risk if these drugs are used. It therefore is very important to be able to distinguish the type of SVD underlying ICH, in order to tailor preventive strategies in elderly patients who also have concomitant ischemic vascular risk.

Over the past few years, novel neuroimaging markers of SVD that can help diagnose different SVD-types and predict the risk of hemorrhagic versus ischemic cerebral damage have been identified. Other than the well-known pathologies such as ICH, lacunar infarcts, and other strokes, these neuroimaging markers include cerebral microbleeds, superficial siderosis, microinfarcts, white matter disease, and enlarged perivascular spaces. This talk will include a detailed discussion on the detection of these neuroimaging findings as well as their impact on stratification of ICH-risk and therefore management decisions.