IMAGING ASPECTS IN THE INTRACEREBRAL HEMORRHAGE

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Keywords: *Intracerebral hemorrhage, CT scan, MRI, angiography*

Abstract: *The examinations necessary for the diagnosis and the treatment of the cerebral haemorrhage are CT scan, angio-CT scan, cerebral angiography, RMN. Each one can diagnose an intracerebral hemorrhage but, also it contributes decisively to the diagnosis and treatment algorithm.*

Cuvinte cheie: *hemoragie intracerebrală, C.T. scan, RMN, angiografie*

Rezumat: *Examinările necesare pentru diagnosticul şi tratamentul hemoragiei cerebrale sunt examenul C.T. scan, Angio-CT scan, angiografia cerebrală, RMN. Fiecare poate diagnostica o hemoragie intracerebrală dar şi cauza acesteia, contribuind decisiv la algoritmul de diagnostic şi tratament.*

INTRODUCTION

C.T.scan exam

Because most patients with intracerebral hemorrhage are presented in the emergency department with impaired consciousness, most cases requires a method of investigation that is fast, like computer tomography examination. CT scan is highly sensitive and specific in detecting acute intraparenchymal blood, seen as a hyperdense signal change with Hounsfield units (HU) between 40-60(fig.1), except in those with low hematocrit, when the acute hematoma may seem isodense.

Figure no. 1. T right intracerebral hemorrhage

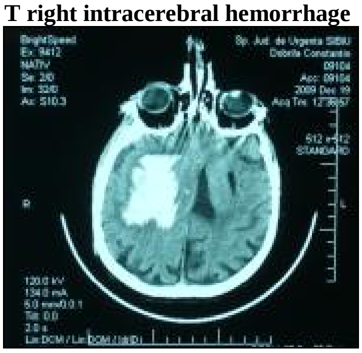
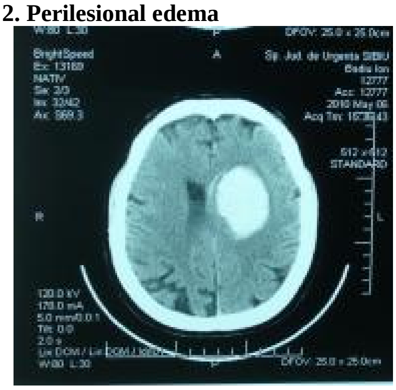


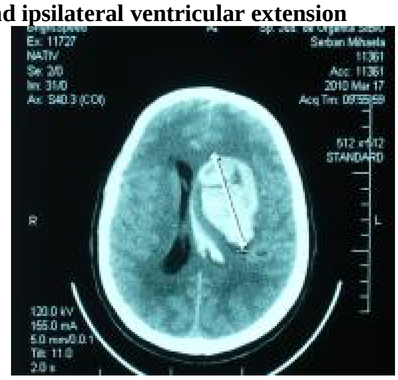
Figure no. 2. Perilesional edema



Perilesional is also observed a thin haloid of low density, which corresponds to the perilesional edema. (Fig.2)

Also during computed tomography examination it can be determined the extension of intracerebral hemorrhage, with the basal ganglions damage and intraventricular extension. (fig3).

Figure no. 3. Intracerebral hemorrhage with basal ganglions damage and ipsilateral ventricular extension



All the CTscan examination can appreciate the midline shift, and could accurately calculate its movement toward the contralateral structures. (fig.4)

Figure no. 4. Mid-line shift

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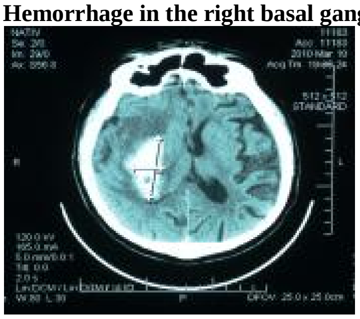
During the CT examination, it may be appreciated by direct measurements, the size of the bleeding in the two planes, longitudinal and transversal. (Fig.5)

Dimensions measured using computed tomography examination, are the maximum size section CT, and the number of sections of one cm, hematoma volume can be calculated according to it and could make a decision for the calculation of the therapeutic decision.Calculation formula for hematoma volume, $V=4\div3x\Pi xABC\div8$, where A, B is the maximum diameter section CT, C is the number of sections 1 cm which can be seen the hematoma. Other simple formula is $V = ABC / 2$.

Figure no. 5. Hemorrhage in the right basal ganglions



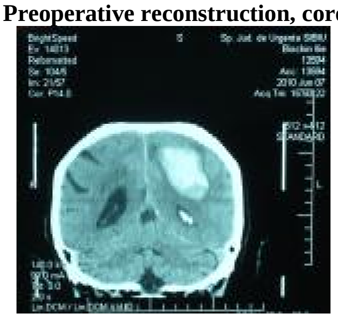
This may obtain the following classification:

a. hematoma volume between 10 to 30 cubic centimeters
b. hematoma volume over 30 cubic centimeters, associated with bad prognosis
c. hematoma volume over 60 cubic centimeters and CGS=8, associated with mortality exceeding 91% .

The 3D reconstruction, using images obtained on the CTscan examination, which allows the neurosurgeon to have an operational strategy by providing a tailored approach fast and directly on the lesion, taking into account the surrounding anatomical landmarks, the ultimate effect of getting rapid recovery of minimal brain lesions .(Fig.6 7).

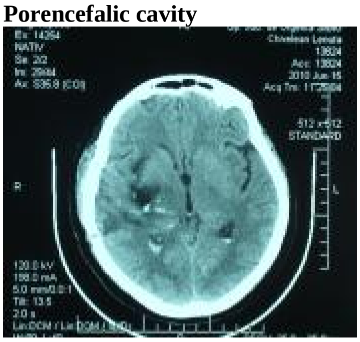
Figure no. 6. Preoperative reconstruction, sagittal plane

Figure no.. 7. Preoperative reconstruction, coronary plan



During the examination should not be neglected the CTscan's possible cause of intracerebral hemorrhage and may be suggested by an associated subarachnoid hemorrhage, where aneurysms, with multiple hemorrhagic areas fronto-temporo-basal or basal, suggesting traumatic nature of the hematoma or fluid levels, suggestive for a coagulopathy (4). In time, changes of hiperdensity hematoma from the periphery to the center so that in 2-3 weeks is so intens,if it is small and if it is big, in about 6-8 weeks.
After 3-4 months remains a hematoma cavity fluid in place. (Fig.8).

Figure no. 8. Porencefalic cavity



Once the inspection required by the development of neurological surgery or routine patient can diagnose and treat any local complications occurred, rebleending, epidural or subdural bleeding, pneumoenccphal, edema.(Fig.9,10,11).

Figure no. 9. Early rebleeding

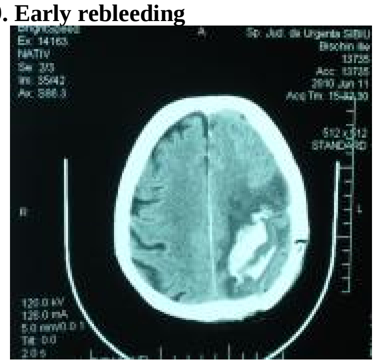
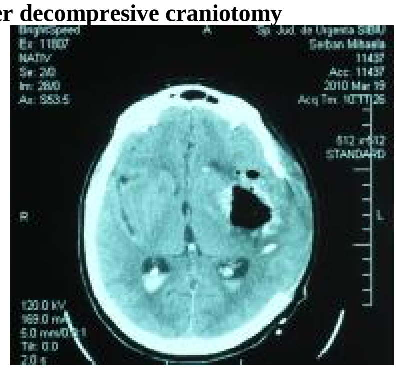


Figure no. 10. 3 weeks late

Figure no. 11. Pneumoencephal postoperatory, edema with fongus after decompresive craniotomy



2. MRI exam

The advantage of using MRI in acute pathology, is increased sensitivity of the examination in early diagnosis of intracerebral bleeding.Imaging of bleeding is variable depending on the length of bleeding, due to changes in the type and distribution of paramagnetic substances in the brain parenchyma.MRI is superior CT scan to reveal higher perihemoragic edema, mass effect, brain shift and parenchymal compression.

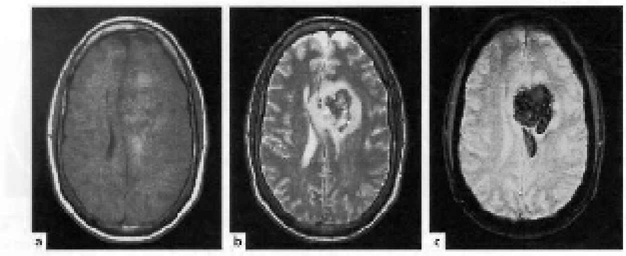
In the initial phase of hemorrhage appears containing OxiHb erythrocyte extravasation, nonparamagnetic substance that turns into DesoxiHb, paramagnetic, but with a closed structure, which allows interaction with the core protons heminic (no effect during T1). By oxidation deoxihb turns into methemoglobin, from periphery to center, deep paramagnetic.Ulterior methb molecule degrades into hemosiderin, paramagnetic molecule concentrated in the cytoplasm of macrophages (2). But if the spatial distribution of paramagnetic substances is heterogeneous, (excluding intracellular), is a susceptibility effect (T2 * effect), which decreases signal on gradient echo sequences or T2 (Table). (2).

Also gradient echo and T2 are too sensitive in detecting bleeding in the ancient sites present in multiple cortical and subcortical patients with lobar hemorrhage, which is very suggestive of CAA (3). Aspect of brain haemorrhage in time can be described as :

1. interval 0-6 hours after onset OxiHB T1 sequence appears in ISO / hyposignal, hypersignal
2. Between 6-72 hours desoxiHb intracellular isosignal appears in the sequence T1, hyposignal
3. In early subacute stage, early 4-7 days DesoxiHb intracellular, center, appears with isosignal, and hyposignal DesoxiHb the periphery appears to hypersignal, hyposignal
4. In tardiv subacute stage, from 1-4 weeks, the center appears hypersignal MetHb, hypersignal, Hemosiderin as a peripheral ring hyposignal
5. Over a month, Hemacrom, center, appears with hypersignal and hemosiderin, the periphery seems hyposignal

In the following images, Fig.12, we can see the appearance of hemorrhage in various stages of the MRI examination

Figure no. 12. a. hypointensity in T1, b. hypointensity înT2, c.hypointensity marked the gradient echo T2



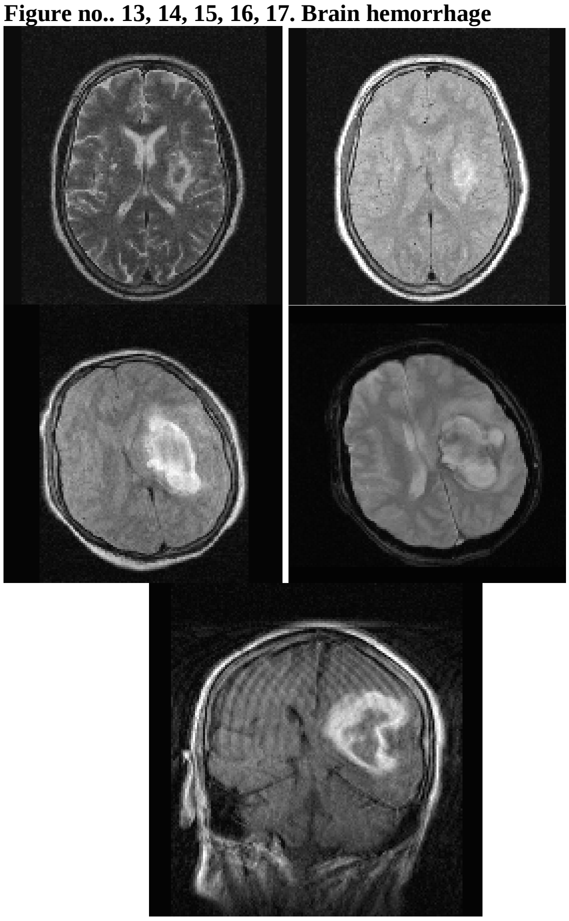
Observe also the hyperintense looking ring around the hematoma which is suggestive for the peripheral edema, and midline shift.

In general appearance MRI examination revealed cerebral haemorrhage in the late stages that can lead to confusion with other aspects of the pathology that is characteristic for MRI imaging for intracerebral hemorrhage, major importance by smear examination CT scan back.

While demonstrating the high sensitivity, the method is not practical in many cases, in acute phase.The studies have demonstrated that MRI examination can be conducted at approximately 20% of patients in coma, the main contraindications are: impaired status of consciousness, hemodynamic instability, and respiratory, vomiting, restlessness, 73% of these patients had ICH (5), also the duration of time necessary to carry out MRI investigation, and difficult conditions for resuscitation measures if rapid worsening of the patient's status during the MRI examination.

The next image, Fig.13,14,15,16, suggests different aspects of brain hemorrhage by MRI examination:

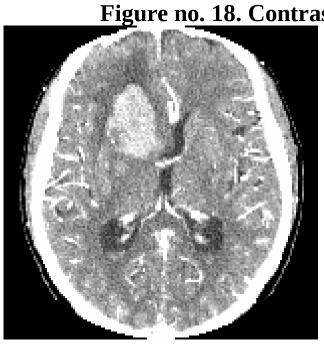
Figure no.. 13, 14, 15, 16, 17. Brain hemorrhage



3. Cerebral angiography.

Consideration is now used only in cases where the CT scan raised suspicion of a ruptured aneurysm, a vascular malformation, subarachnoid hemorrhage, and abnormal calcification, blood interemisferic located in the Sylvian valley or intraventricular bleeding. (1). The cerebral angiography decreases with age, patients over 45 years, who have a history of hypertension, or a bleeding in the putaminale, thalamic or posterior fossa. (7).

Figure no. 18. Contrast Ct scan



Instead the absence of hypertension, young age, atypical locations of the hematoma is a clear indication for angiography examination.It can also be used the angio-CT, angio-MRI, like non-invasive methods. (6). Recent studies have showed that the so-called, marks-spots type, occurring after angio CT., are ditch predictors of hematoma expansion. (8)

Thus in a case involving a suspected cause bleeding which may be a vascular malformation, such as standard examination CTscan proceed to next step by identifying the etiology with C.T.scan,angioC.T exam., by contrast (Fig. 18,).

Figure no. 19. Angio-CT without stenosis, AVM, aneurysm

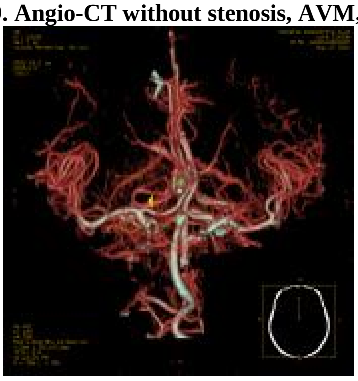


Figure no. 20. Angio C.T.-same case

Figure no. 21. Angio C.T.-F-T intracerebral hemorrhage

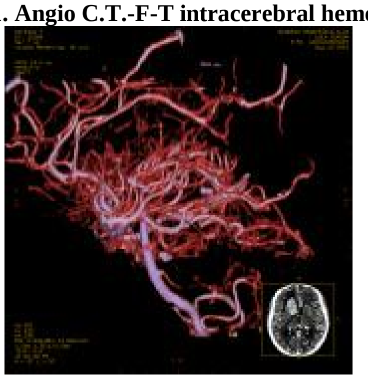
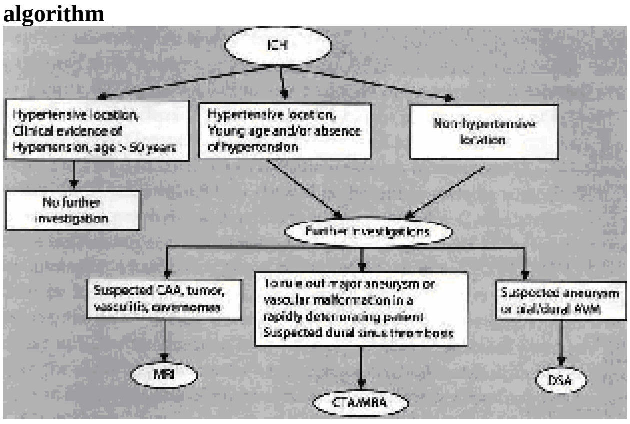


Figure no. 22. Angio C.T.-same case

Thus it came to developing an algorithm for examination, in ICH, the European Society of Stoke (ESO, 2008). (Fig.23), (6).

Figure no. 23. Intracerebral hemorrhage investigation algorithm



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