Statistic study regarding the correlation of ischemic stroke etiologic diagnosis with the computer-tomographic imaging of initial scans

ANDREEA FLEANCU, GABRIELA SECHEL
LORENA DIMA, CĂLIN FLEANCU
Transilvania University of Brasov, ROMANIA
fleancumed@yahoo.com

Abstract: The study has the purpose of making a statistic analysis the concordance between the etiologic diagnosis of ischemic stroke (embolic or thrombotic) and the initial computer-tomographic scans. Material and method: 1544 patients with acute ischemic stroke have been examined through CT immediately after the debut of neurological symptoms. By correlating with the etiologic factors the following have been discovered: 366 cases of embolic stroke, 772 cases of thrombotic stroke, 133 cases that could not be etiologically characterized. Conclusions: a repartition of stroke on etiologic types cannot be made using the initial CT scans.

Key Words: CT scan, statistic, ischemic stroke, cerebral embolism, cerebral thrombosis

1. Introduction

Thrombotic cerebral infarction:

The thrombotic arterial infarction appears when the arterial lumen is significantly narrowed and the blood clots that form there occlude the artery [2].

The CT signs suggestive for thrombotic infarction are made of a hypo dense area, which strictly respects a well-defined arterial territory [6]. A consecrated, but inconstant sign is the spontaneous contrast at the level of the incriminated artery, meaning thrombosis at this level [4].

On contrast examination there is either a peripheral contrast area, giriform, at cerebral cortex level, which has the meaning of the development of collateral circulation (luxury perfusion), or an inhomogeneous contrast capture, which represents the rupture of the hemato-encephalic barrier – hemorrhagic transformation (this can be pointed out at native exam) [5].

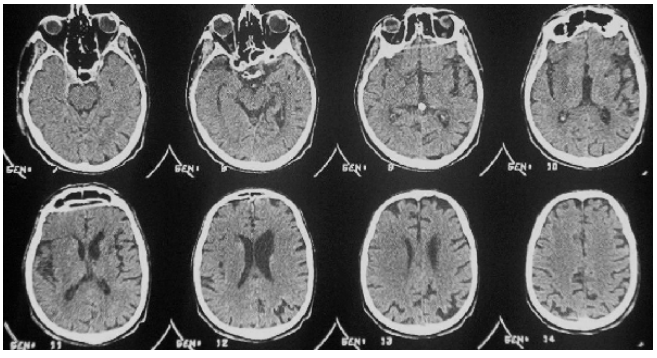


Fig. 1.C.I., male, 71 years
The initial CT examination (done at 7 hours from debut) doesn't point out any recent tomo-densitometric modifications. A discrete hypo density area is observed at the level of the right lenticular nucleus; also the erase of the insulae and the temporal gyrations, which could be considered signs of ischemia.

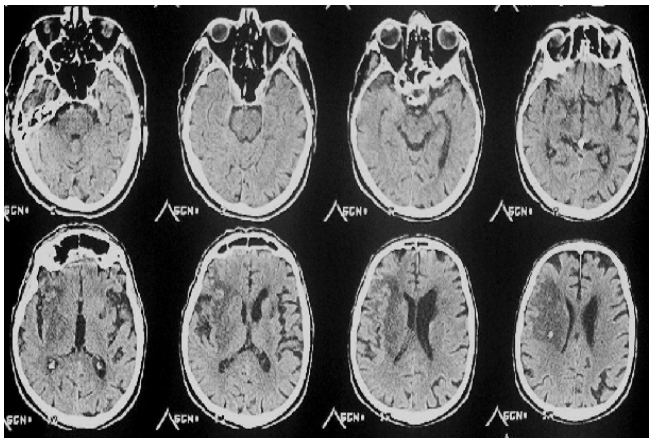


Fig. 2. The same patient
Control CT (done after 10 days) – a wide hypo dense area can be seen, having vascular-ischemic character, capsulo-nuclear and right fronto-temporal, inhomogeneous, through the installation of luxury perfusion, and an infracentimetric hemorrhagic area, in the frontal posterior paraventricular area. The imprinting of the lateral ventricle and the movement of the ventricular system to the left

Embolic cerebral infarction

The location and the evolution of the embolic infarction differ from the one of the thrombotic infarction. The embolic particles follow the intracranial cerebral circulation, often causing multiple peripheral infarctions in different major arterial territories [1].

Regarding the CT aspect of embolic infarctions, most of the time cardiac in nature, many hypo dense images can be seen, being relatively small in dimension, having the same age (which differentiates them from lacuna-rism), spread in territories that are irrigated by different cerebral arteries [7]. The CT examination may point out the presence of discrete spontaneously hyper dense area

(hemorrhagic transformation) in the middle of a hypo dense area, if the parietal lesion had occurred and the overcoming of the hemato-encephalic barrier has been done, or spontaneously hyper dense giriform areas, situated at the periphery of the hypo density (luxury perfusion) if the collaterals have suffered a pelagic vasodilatation [9].

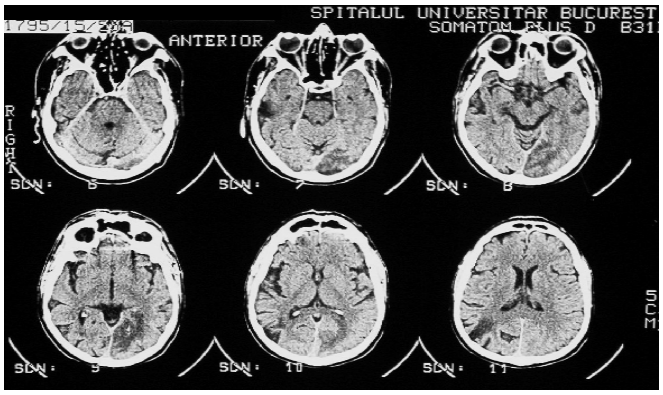
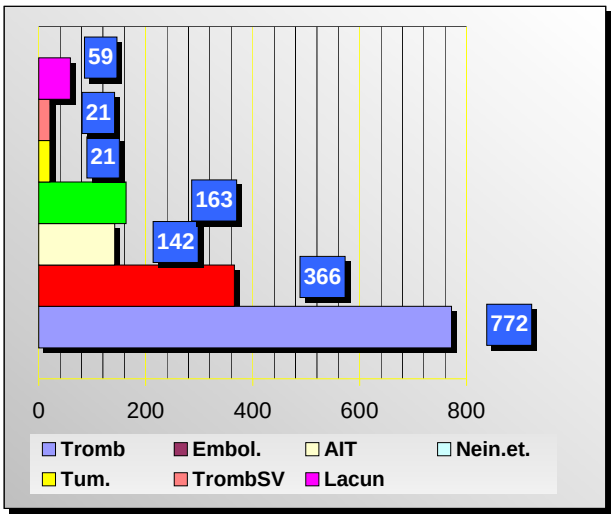


Fig. 3. D.R., male, 76 y.o.

Initial CT (done at 12 hours from debut) shows many hypo densities with ischemic aspect and different ages:

Relatively recent left occipital, with cortical reperfusion aspect

Sechelary in the MCA-PCA junction territory and right temporal cortico-subcortical



Graphic 1: The frequency of etiologic types of ischemic stroke in the study group

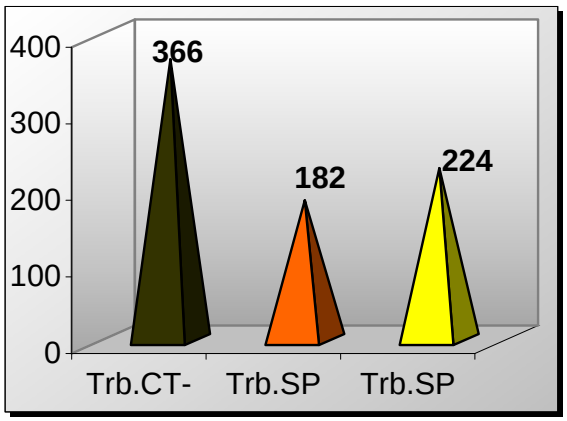
2. Results

1. the correlation between etiologic types of ischemic stroke and the imagistic diagnosis of initial scans

1544 cases with acute ischemic stroke have been taken into study. Through the correlation with the etiologic factors and by the association with other investigations, a repartition of ischemic stroke has been done by etiologic types, the repartition being the following:

2. The correlation between the etiologic type (established through the existence of associated risk factors) and the results of the initial CT scan

The 366 cases presumed to be embolic stroke were correlated with the initial CT scan results in the following way (see graphic 2):



Graphic 2: the frequency of thrombotic stroke cases based on CT diagnosis

- 81 cases presented with negative initial CT scan
- 162 cases presented with precocious signs suggestive for acute ischemic stroke after the initial CT examination, from with:
  - The deletion of gyrations – 20 cases
  - Hypo density in the basal nuclei – 19 cases (all associated with the deletion of the gyration)
  - Spontaneous contrast in the MCA – 123 cases (from which 101 cases have been associated with hypo density areas extended to a vascular territory, inconclusive aspect for embolic stroke)
- 224 cases presented with positive initial CT scans:
  - 102 cases – conclusive aspect for ischemic embolic stroke (multiple small hypo densities, approximately the same age, disseminated into many vascular territories)
  - 122 cases – inconclusive aspect (widespread hypo dense area extended through a vascular territory, conclusive aspect for thrombotic ischemic stroke)

The 772 cases presumed to be thrombotic stoke have correlated with the initial CT exam in the following way:

- 366 cases presented with negative initial CT scan
- 182 cases presenter precocious sign suggestive for acute ischemic stroke at the initial CT examination, from which:

- Hypo density in the basal nuclei – 20 cases (all associated with the deletion of the gyration)
- Spontaneous contrast in MCA – 121 cases (from which 57 were associated with hypo density areas extended to a vascular territory, conclusive aspect for thrombotic stroke)
- The deletion of gyration – 19 cases (all associated with hypo density in the basal nuclei)
- The insulae lobe sign – 20 cases

- 224 cases presented with positive initial CT scan, from which:
  - 61 cases – inconclusive aspect for thrombotic ischemic stroke (multiple small hypo densities, approximately the same age, spread on many vascular territories)
  - 163 cases conclusive aspect for ischemic thrombotic stroke (hypo density area spread to a vascular territory) (See graphic 3)
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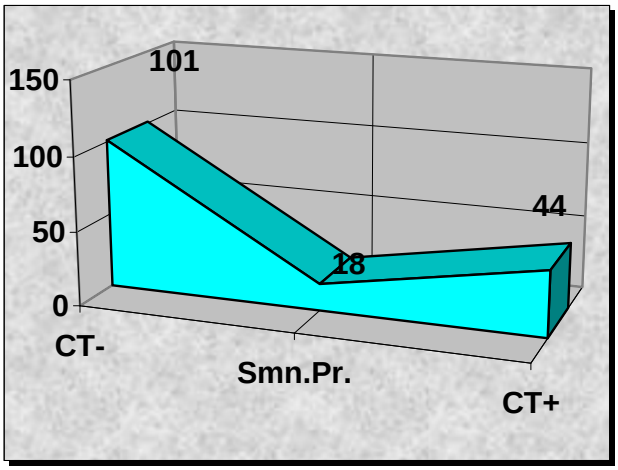

Graphic 3: The frequency of stroke unclassified by etiology after the CT exam

The 163 cases of ischemic stroke uncategorized by aetiology were correlated with the results of the initial CT scan in the following way:

- 101 cases presented with negative initial CT scan
- 18 cases presented with precocious signs suggestive for acute ischemic stroke after the initial CT examination
- 44 cases presented with positive initial CT scans, from which:
- No case has presented a conclusive aspect for embolic ischemic stroke (multiple small hip densities, approximately the same age, spread in many vascular territories – conclusive aspect for embolic ischemic stroke)
- 44 cases (all) presented with conclusive aspect for thrombotic ischemic stroke (a hypo dense area extended on a vascular territory)

Conclusions

- a very small number of presumably embolic ischemic stroke associate with negative initial CT exam.

  We can also point out that regarding the positive initial CT scans in presumably embolic ischemic stroke, they show almost equal percentile between conclusive images for thrombotic and embolic stroke. This statistic conclusion brings to light the fact that the initial CT scan cannot offer an etiologic diagnosis in acute ischemic stroke
- a much larger number of negative initial CT examinations have been shown in presumably thrombotic ischemic stroke.
- precocious CT signs have covered the whole diagnostic area, but again the spontaneous contrast in MCA has overlapped that positive CT scans in a large number of cases [8]
- the images from the positive initial CT scans have been conclusive and suggestive for thrombosis in a larger number than in the case of cerebral embolism.

In the case of the ischemic strokes that couldn't be classified by aetiology, most of the initial CT exams have been negative, and only in a small number of cases they have shown a parenchimatous hypo density suggestive for thrombotic ischemic stroke (3).

Statistic interpretation

The small number of patients that have been imagistic reinvestigated (in order to confirm the initial CT), as well as the insufficient data regarding the debut time through initial CT, has lead to the impossibility to mathematically correlate the diagnosis of the first scan with the time variable.

We have calculate the probability if a sure diagnosis after the first CT in stroke, indifferent of the etiologic type. The results have been the following:

- embolic stroke: p=1/6(16.66%) so q (counter probability) = 5/6 (83.44%)
- thrombotic stroke: p=1/5 (20%) so q = 80%

This means the in the case of our study, the probability of a certain diagnosis of thrombotic or embolic stroke with the initial CT examination is less than 50% (compound probability = 45%).

It can be observed after the analysis of first examination CT diagnosis that there are signs of certitude for stroke type, but also inconclusive signs

(more characteristic for the other etiologic type). So, we raise again the hypothesis: initial CT can confirm with certainty the type of ischemic stroke. We mention that the variables used are cases of precocious signs. The obtained result is: the probability to confirm the hypothesis is very small (10%).

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