ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN — POLONIA
VOL. LI, 13 SECTIO D 1996

Katedra i Klinika Neurologii Akademii Medycznej w Lublinie
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The Comparison of Usefulness of Computer Tomography and Angiography in Diagnostics of Intracranial Vascular Anomalies

Ocena przydatności angiografii i tomografii komputerowej w rozpoznawaniu wewnątrzczaszkowych anomalii naczyniowych

We evaluated 84 patients with SAH to compare the clinical usefulness of CT and cerebral angiography in diagnostics of intracranial vascular anomalies as a source of SAH. Angiography was more effective in detection of aneurysms (in 67.9% cases), also multiple aneurysms. Both methods showed angiomas equally well (in 100%). The agreement in the aneurysms localisation was only 17%. The effectiveness of subtentorial aneurysms detection was poor in both methods (especially in CT). The most common localisation of aneurysms were: the middle cerebral artery, communicating anterior artery, internal carotid artery, anterior artery.

INTRODUCTION

Subarachnoid hemorrhagia is described as a sudden bleeding into the space between the arachnoid and the pia matter. This condition creates immediate threat for patients health and life. The mortality rate within the first six weeks is about 50% and is a result of the first or recurrent bleeding (8).

The most common cause of the non-traumatic bleeding into the subarachnoid space is the rupture of the intracranial aneurysm or arteriovenous malformation. Other rare reasons are atherosclerotically changed vessels, hemorrhagic diseases, tumor with hemorrhage, trauma (4). In 10—15% no visible reasons for bleeding could be found (2, 11).

The early diagnosis of the cause and the bleeding site is of a great importance for further therapy.

More than 90% of all intracranial aneurysms are of the so-called saccular ("berry") type. They are found in approximately 5% of the general population in either sex, especially between the 30th and 50th year of life (5, 7). They are mainly localised at bifurcations in the anterior portion of the Willis circle (75—90% cases) and on its major branches (internal carotid, anterior and middle cerebral artery) (3). Aneurysms-located in the posterior fossa region are very rare (3). In 20% cases there are multiple aneurysms (5, 7).

Other types of aneurysms include: fusiform atherosclerotic aneurysm, mycotic (caused by the infected embolus) aneurysm (1, 5), traumatic aneurysm.

Small percentage of SAH accidents are caused by angiomas. In 60—80% they are arteriovenous malformations (3) quite frequently located in the subtentorial space. They cause recurrent subarachnoid hemorrhages, but the prognosis is better than in the case of aneurysm rupture. The overall mortality in angiomas is about 10% (5).

In SAH diagnosis the following procedures are routinely used:

1. Cerebrospinal fluid examination — the subarachnoid bleeding was observed by the findings of bloody fluid (4) or CSF xantochromia. This method is useful only to differentiate SAH from other cases.

2. Computer tomography — cranial CT usually shows the blood in the subarachnoid space (except very small bleeding when the results of the examination may be negative) (6). It is also helpful in detection and localisation of intracerebral aneurysms and vascular malformations when iodine-based contrast is used (10, 13, 14).

3. Angiography — this method consists of giving the contrast to carotid or vertebral arteries. It may well localise the exact site of the bleeding, the size of anomaly etc., it is considered the best method for intracranial aneurysm and angiomas detection (13).

The purpose of our work was to compare the usefulness of computer tomography and angiography in diagnostics and localisation of intracranial aneurysm and vascular malformations.

PATIENTS AND METHODS

The subject of this study were 84 patients with SAH (43 male and 41 female) diagnosed at Neurology Clinic of the Medical Academy in Lublin between January 1990 and February 1996. The age of the patients ranged from 21 to 69 years (mean 46.08 ± 10.14). All patients underwent CT and angiography of cerebral arteries. Most of the data originate from the retrospective study.

Diagnosis of SAH was based on: the examination of CSF only (hemorrhagic syndrome in CSF) — 45 patients (54%), CT only (blood in CSF spaces) — 22 patients (26%), the examination of CSF as well as CT — 17 patients (20%).

Four-vessel angiography was performed in all the cases (84). Most of them underwent conventional angiography; DSA was performed in 18 cases only. In 5 cases (6%) angiospasm was observed during angiography (in all the cases it was conventional angiography). All patients were investigated with third-generation CT-SOMATOM DRH with picturesque matrix 512/512 in standard layer 8 mm (or in case of need 4 mm). In 54 patients (64%) intravenous contrast media (75% Uropoline) was administered during CT; in 30 cases (36%) CT was performed without contrast media.

RESULTS

Neither CT nor angiography showed vessel anomaly in 17 patients (20%), in 8 of them CT was performed without contrast media and in 1 case angiospasm was observed during angiography.

The presence of aneurysm was visible either in CT or angiography in 43 cases (51%). Both CT and angiography showed aneurysm in 25 patients (30%) and angioma in 3 ones (4%) (of these in 1 case the angioma was localised in the posterior cranial fossa).

CT as well as cerebral angiography showed the same aneurysm in 14 patients (17%), of these in 1 case there was probability of another aneurysm in CT and in 5 cases other aneurysms were exposed by angiography. In 10 cases (12%) both CT and angiography detected aneurysms but they were located on different mother vessels.

In 31 patients (37%) CT did not show any aneurysm (of these in 17 cases CT was performed without contrast media), while cerebral angiography did.

In 5 cases (6%) CT showed aneurysm but angiography did not confirm it; vasospasm was visualised in 1 case.

We noted 2 cases (3%) of aneurysm detection by CT without contast media; of these in 1 case localisation of the anomaly was confirmed by angiography and in 1 case localisation was different.

Cerebral angiography detected 72 aneurysms (in 57 patients), and CT showed 33 aneurysms (in 31 patients). Aneurysm location ascertained on the ground of cerebral angiography and CT was respectively: middle cerebral artery — 27 (37.5%) and 15 (45.5%) — of these 9 aneurysms were visible both in angiography and CT, anterior artery — 4 (5.6%) and 1 (3%) — of these 1 aneurysm was visible both in angiography and CT, communicating anterior artery — 18 (25%) and 11 (33.3%) — of these 8 aneurysms were visible both in angiography and CT, communicating artery posterior — 4 (5.6%) and 2 (6.1%), internal carotid artery — 10 (13.9%) and 0, basilar artery — 6 (8.3%) and 1 (3%), posterior cerebral artery — 0 and 3 (9.1%) and vertebral artery — 3 (4.1%) and 0.

DISCUSSION

In our study the frequency of aneurysms occurrence as a source of SAH was 81% and angioma occurrence — 4%; these data are consistent with the data from the reference (3).

Cerebral angiography seems to be more accurate in aneurysms detection (aneurysms were found in 67.9% patients) than CT (36.9%). It is also more precise in the detection of multiple aneurysms. CT as well as angiography were equally effective in angioma exposing.

The agreement between CT and angiography as regards aneurysms localisation was only 17%, whereas in angiomas localisation — 100%. It seems important to notice that poorer accuracy of CT in aneurysms detection showed in our study is connected with the fact that in more than 1/3 cases (36%) CT was performed without contrast media. CT without contrast media detected aneurysms in 3% cases only; of these in 1.5% it was consistent with angiography. The other reason for the worse detection of aneurysms in CT may be their size. According to the references, CT shows well only the aneurysms larger than 3—5 mm (5, 12, 15). In our study, aneurysms size in cerebral angiography was disregarded because of the lack of the evaluation of these parameters in most of angiographic searches made in our patients. Taking the spread of CT scans layer into account and the fact that the most common are saccular aneurysms (with salk), it seems to be true that CT shows only the aneurysm of suitable size (3, 5).

In our study we noticed a relatively large percentage of diagnostic negative searches (20%). According to references in 10% cases the primary source of haemorrhagia in unknown (2, 5, 11). It may be caused by vasopasm (in our study in 1 case) or by obturation of the aneurysm by cloth (5, 7). Another reason for the failure in the detection of the SAH source are the difficulties in diagnostics of subtentorial vascular anomaly. According to Ogasawara et al., repeated angiography showed the aneurysm in 32 cases with primary studies being negative; of these 75% had the aneurysm in the vertebro-basiliar system (9). In our study once performed angiography detected only 9 aneurysms (12.5%) localised in this region. Considering the slight possibility of illustrating subtentorial arteries by CT, this search seems to have still less value in the detection of aneurysms localised in this region. Our study confirms that none of 4 aneurysms detected by CT subtentorially was visualized in angiography. In our observation

Table 1

Localisation of aneurysms	Showed in CT	Showed both in CT and cerebral angiography	Showed in cerebral angiography
Middle cerebral artery	15	9	27
Anterior artery	1	1	4
Communicating anterior artery	11	8	18
Communicating posterior artery	2	—	4
Internal carotid artery	0	—	10
Basilar artery	1	—	6
Posterior cerebral artery	3	—	0
Vertebral artery	0	—	3

the most common localisation of aneurysms are: middle cerebral artery, communicating anterior artery, internal carotid artery, anterior artery (Tab. 1).

In the diagnostics of SAH, CT serves as a method detecting the blood in CSF spaces — it is important in these cases when lumbar puncture cannot be performed. CT with contrast media may also be treated as a screening test for the detection of mainly large and supratentorial aneurysms, being inferior to angiography in the diagnostics of SAH bleeding source.

CONCLUSIONS

1. The most frequent and probable cause (more than 80% reasons) for spontaneous (nontraumatic) primary subarachnoid hemorrhage is the bleeding caused by vascular anomaly. Aneurysms are chiefly localised in the middle and anterior cerebral arteries, which seems to be in discord with the literature data where aneurysms are usually placed on the run of the anterior cerebral artery and are a little less frequent than in the middle site.
2. Aneurysms located in the internal carotid artery and vertebral arteries are less accessible for computer tomography.
3. Usefulness of angiography and CT is similar as far as the detection of vascular malformations is concerned.
4. DSA gives only 5.5% diagnostic negative cases, when in conventional angiography in more than 25% cases no intracranial vascular lesions could be found.
5. The arterial spasm was not observed in the group of DSA.

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Otrz. 1996.04.16

STRESZCZENIE

W celu porównania klinicznej przydatności angiografii mózgowej i badania KT w diagnostyce anomalii naczyniowych wewnątrzczaszkowych oceniliśmy 84 chorych z rozpoznanym krwawieniem podpajęczynówkowym. Angiografia okazała się bardziej skuteczna w wykrywaniu tętniaków (w 67,9% przypadków), również tętniaków mnogich. Wykrywalność tętniaków przy użyciu KT była znacznie niższa (36,9%) i dotyczyła głównie badania KT z użyciem środka cieniującego. Oba badania w jednakowym stopniu okazały się skuteczne w ujawnianiu i lokalizacji naczyniaków (100%). Zgodność co do lokalizacji tętniaków w obu badaniach wynosiła tylko 17%. Skuteczność wykrywania tętniaków podnamiotowych w obu metodach była niewielka (mniejsza w KT). Tętniaki najczęściej zlokalizowane były na t. środkowej mózgu, t. łączącej przedniej, t. szyjnej wewnętrznej i t. przedniej mózgu.