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Arteriovenous angiomas in pictures of digital subtractional angiography (DSA)

Arteriovenous angioma is a syndrome of displastic plexiform tightly packed, abnormal vascular canals. It is supplied by afferent arterial vessels forming a central network, the so-called nidus, and wide venous draining vessels. Deficient vascular walls can form in the network of the angioma aneurismal widenings when normal capillaries are absent. The nucleus may be plexiform or mixed with an element of fistulas (10, 13).

Angiography is a technique of choice, though diagnostics is usually started with CT, MRI giving suspicion of malformation. In selected cases angiography can be combined with embolisation.

The aim of the study is to present different forms of arteriovenous angiomas in the picture of digital subtractional angiography, which is a selective examination of major cerebral vessels and a superselective one of vessels supplying the lesion.

MATERIAL AND METHODS

The material comprises 16 arteriovenous angiomas found in the group of 591 angiographies of cerebral arteries done in the Laboratory of Vascular Examinations of the Department of Imaging Diagnostics, District Specialist Hospital no 1 in Rzeszów.

From the access through the femoral artery both carotid arteries and vertebral artery were catheterized (panangiography). The external carotid artery was shadowed in the posteroarterial angioma of the posterior cranial fossa and in peripheral parts of cerebral hemispheres when blood supply from spinal dura mater was suspected.

Both sides were examined, because in 30% of cases of arteriovenous angiomas they showed supply from the opposite side.

RESULTS

In angiographic examination visualization of three elements was assessed:

1. Supplying arterial vessels widened with abnormal course (Fig. 1a). Because of the possibility of more than one arterial trunk panangiography was always performed. CT examination showed an angiomal loop (Fig. 1c).

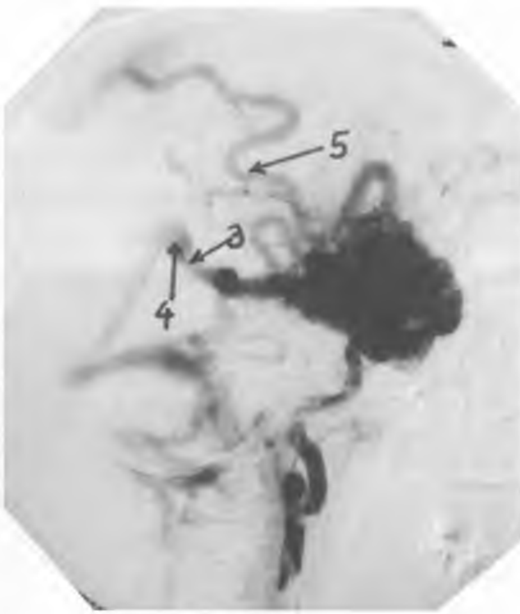

Fig. 1a. Angioma of the left cerebral hemisphere supplied from the left cerebral medial artery. A deep vein running to the major cerebral vein takes part in the outflow. In its terminal part visible narrowing (3) – suspicion of thrombosis – and varicose widening of the lumen (4)

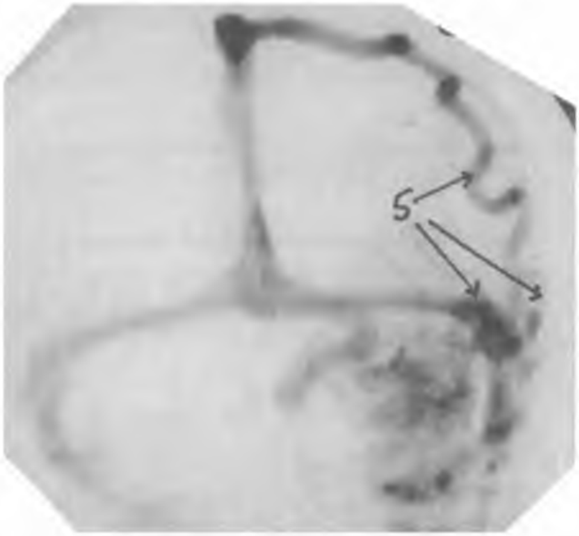

Fig. 1b. Routes of outflow through superficial veins to the sinuses (5); catheterized left internal carotid artery: venous stage (6), arterial stage (D)

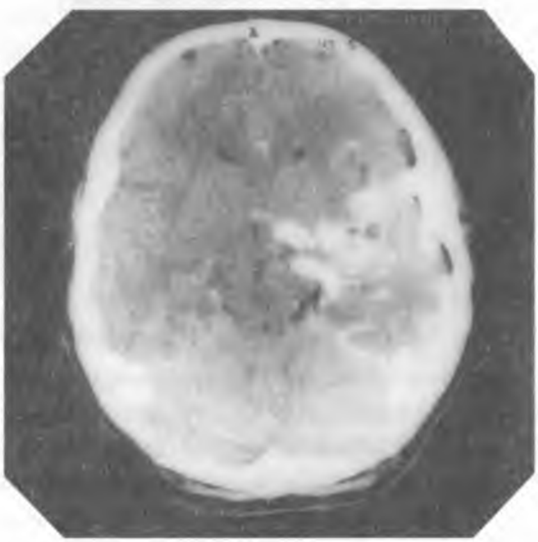

Fig. 1c. CT – after contrast administration – intensely hypodensic band-shaped structures

2. Nucleus of angioma (nidus) forming tightly packed mass of vessels and cavities difficult to trace (Fig. 2a). Contrast CT examination showed a hyperdensic angiomal mass (Fig. 2b). Apart from spots and small lakes of the contrast the nucleus may also be

Fig. 2a. Angioma of the right cerebral hemisphere supplied from a branch of right medial cerebral artery (1), outflow through superficial veins (2); nidus (3). Catheterized right internal carotid artery; early arterial stage (B)

Fig. 2b. CT – after contrast administration – intensified structures of the angioma – nidus (3)

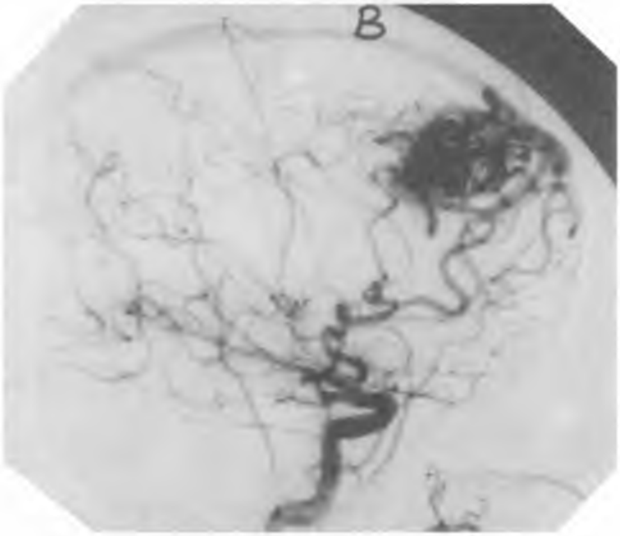

Fig. 3a. Arteriovenous angioma of the left cerebral hemisphere with intracerebral haematoma (1). Angiography (B) – structures of the angioma and displacements on the right side of anterior cerebral arteries

Fig. 3b. CT – haematoma area (1) adjacent to an intensifying agglomerate of band-shaped hyperdensic structures – elements of angioma (3) with the effect of mass caused by the haematoma

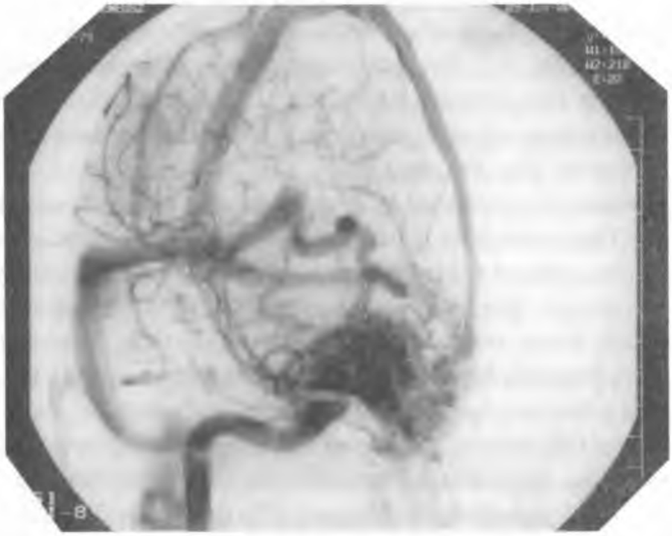

Fig. 4a. Arteriovenous angioma of the right cerebral hemisphere of the frontal part. Catheterized right internal carotid artery, late arterial stage (C)

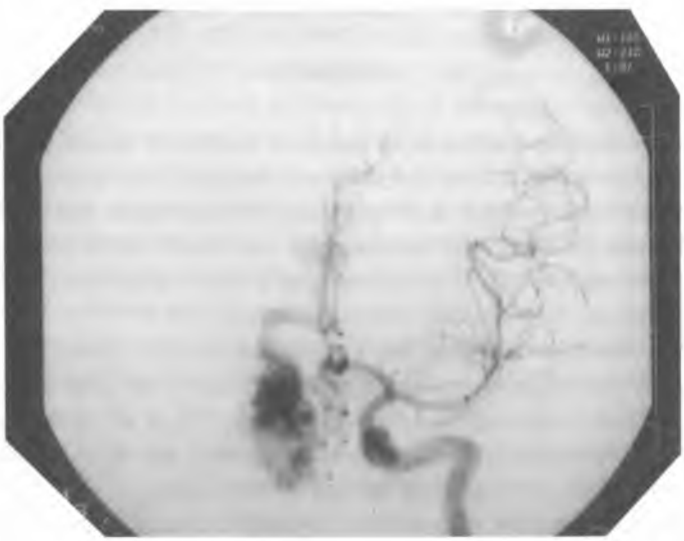

Fig. 4b. Catheterised left internal carotid artery (2), 'sucking' action, the angioma is contrasted through the anterior linking artery

formed by single loops of irregularly coursing and widened vessels. Sucking action of the angioma is revealed (Fig. 4b). The nucleus can contain aneurismal widenings of vessels, pseudoaneurisms, an area of liquid haematoma communicating with vessels of the malformation (Fig. 3a). As a rule it is possible to trace afferent arteries and efferent veins from angiomal nucleus (Fig. 1b).

3. Efferent vessels are constituted by draining veins appearing already at early arterial stages (Fig. 4a). This results from the presence of arteriovenous fistulas and lack of capillaries. Fistulas are widened twisted vessels with segmental varicose widenings. Outflow can take place through deep and superficial veins (Fig. 1b). In efferent deep vains anomalies of their lumen are revealed. Contrast CT sections showed angiomal loops when the nucleus formed a hyperdensic focus of different sizes (Fig. 3a). In 4 cases of haematoma mass effect was found (Fig. 3b).

MRI in SE or GRE examination formed a conglomerate of hyper-and hypointensive garland-like structures. In 3 cases it showed foci of extravasated blood and in 2 cases – ischaemic areas. MRA separated supplying and efferent vessels. 3D TOF technique was used for arteries and 2D TOF or PC for veins. Symptoms of "stealing" blood by joining anterior or posterior arteries or sucking effect were found in 11 arteriovenous angiomas.

Clinical picture was made up by: subarachnoid bleedings (6 cases), intracerebral haematomas (7 cases), epileptic seizures (3 cases).

DISCUSSION

Arteriovenous angioma consists in an abnormal junction of vessels without the presence of capillary network. DSA is the basic examination in the assessment of arterial supply and venous outflow as well as the possibility of embolisation. MRI and CT as non--invasive techniques are done first. Screening CT can reveal foci of extravasated blood, calcifications, local atrophy (7). If a malformation is big irregular areas of band-shaped, garland-like structures corresponding with vascular loops occur.

Functionally arteriovenous angiomas are characterized by intensified blood flow, which can lead to stealing syndrome and ischaemic changes in the close or distant regions of the brain. Arteriovenous angiomas constitute about 13% of all intracranial angiomas (9). They are the commonest among symptomatic angiomas and affect equally both sexes. The peak of symptoms occurs between the age of 20-40 years.

Congenital anomalies grow with age due to complications. Smaller arteriovenous angiomas bleed more frequently. From the point of view of the source of supply they are divided into: parenchymal of pia mater – 75%, dura mater – 10%, mixed with supply from both these sources – 15% (6, 3). Bleeding in arteriovenous angiomas usually comes from a thin-wall draining vein which is widened, sometimes varicosely changed with clots in the lumen (4).

Aneurisms can be localized in the nest usually at the initial segments of afferent arteries, the so-called aneurisms from a big flow or on a distant vessel unconnected haemodynamically with arteriovenous angioma (11). The mass effect and oedema around malformation may occur in the presence of a haematoma giving a picture of displaced, tense vessels. In differentiating with a tumour contrast CT is helpful as well as MRI which shows especially the sustained bleeding (12). In about 50% patients bleeding occurs (in 50% – subarachnoid, in 23% – intracerebral, in 16% – ventricopetal, in 31% – mixed, mainly in parenchymal vessels), epileptic seizures in 25-30%, headaches in 9%, especially in vessels of dura mater. Focal neurological defects caused by ischaemia occur less frequently (10).

Arteriovenous angiomas occur in 3% patients with subarachnoid patients and in 1% patients with stroke. Mortality rate after the first bleeding is 10% and is lower than in aneurisms, which is accounted for by venous source of bleeding (4, 7). By using a superselective technique embolisation of afferent vessels is performed (13). In 30% patients a subsequent total resection of an arteriovenous angioma becomes possible. In 20% of cases embolisation through catheter causes obliteration (8). The greatest chances are given by arteriovenous angiomas with the diameter up to 3.5 cm.

Arteriovenous angiomas in the group of angiographically mute ones constitute 44% though sometimes irregular arteries get contrasted late and show a slow flow. They are the so-called stagnating vessels sometimes observed after the removal of malformation or after radiotherapy (7, 4, 10). CT and MRI usually shows then symptoms of earlier hemorrhages, which may result in non-visualising in DSA picture.

A deep venous drainage can lead to thrombosis of the straight sinus, Galen's vein or internal cerebral veins. It is caused by high-flow angiopathy, in which thickened endothelium narrows the lumen and may lead to complete impatency like irregular duplications thinning of the elastic internal membrane, invasion of endothelium through the mesenchymal cells. Impatency of the straight sinus is common in high flow arteriovenous angiomas. Widening of veins may lead to the formation of the so-called "aneurysm of Galen's vein" or similar formations which can show calcification of walls (2, 5). Narrowings in afferent arteries occur in about 20% of cases and are also connected with hypertrophy of endothelium resulting from intensified blood flow (1).

CONCLUSIONS

1. DSA in recognizing arteriovenous angiomas is a technique of choice. It is essential to identify supplying and efferent vessels in planning embolisation.

2. CT and MRI are important in determining the cause of bleeding, the structure of arteriovenous angioma and indications for DSA.

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SUMMARY

The value of digital subtractional angiography (DSA) was presented in the material of 16 arteriovenous angiomas found in the group of 591 angiographies of cerebral arteries. Visualisation of arterial supplying vessels, vascular mass, nucleus and draining vessels was analyzed. Angiograms were correlated with CT contrast sections to reconstruct coexisting intracerebral and subarachnoid hemorrhages. The degree of visualization of mass effect in the two examinations was compared. There was emphasized the role of angiographic demonstration of the sucking effect of angiomas in the so-called stealing syndromes.

Naczyniaki tętniczo-żylne w obrazach cyfrowej angiografii subtrakcyjnej (DSA)

W materiale 16 naczyniaków tętniczo-żylnych stwierdzanych w grupie 591 angiografii tętnic mózgowych przedstawiono wartość cyfrowej angiografii subtrakcyjnej. Analizowano uwidocznienie tętniczych naczyń zaopatrujących, masy naczyniowej, jądra i żył drenujących. Angiogramy korelowano z przekrojami kontrastowymi TK, odtwarzając współistniejące krwawienie śródmózgowe i podpajęczynówkowe. Porównano stopień uwidocznienia efektu masy w obu badaniach. Podkreślano wartość angiograficznego wykazania działania ssącego naczyniaków w tzw. zespołach podkradania.