The ability of the routine head computed tomography in the detection of the non-giant intracranial aneurysms-A reappraisal

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Abstract.

Retrospective review of the routine CT scan of the brain of the patients who were operated for ruptured and unruptured aneurysms. Angiography was performed in every case which was studied. There were 28 ruptured aneurysms and two unruptured aneurysms. The rate of the detection of the ruptured aneurysms by CT scan depended on the size of the aneurysm, the time interval from the onset of the subarachnoid hemorrhage to the time of performing CT scan and the site of the aneurysm. The detection rate was high when the size of the aneurysms were larger than 6 mm, when CT scans was performed after 4 days of onset of subrachnoid hemorrhage and when the aneurysms were at the basilar tip and middle cerebral artery.

key words: CT brain, non giant aneurysms

Introduction

CT has long been the important diagnostic tool in subarachnoid hemorrhage. CT scans without intravenous contrast; blood in the subarachnoid space initially is seen as increased density in the cisterns, sulci and fissures of the brain. It can detect 90% of SAHs within the first 24 hours and by the end of the first week it can still detect more than 50% (1-4). If SAH is obvious on CT more than 1 week following the initial event, rebleeding has probably occurred. Most aneurysms are in the subarachnoid space, when they bleed, they usually cause SAH. The location of blood (particularly parenchymal hemorrhage) following aneurysm rupture often provides useful information regarding aneurysm location (5). Most of the published data reported about the ability of the special CT technique such as thin slices (1.5 mm) (6) and high resolution angio-CT in the detection of the cerebral aneurysms (6-8). Our study was done to reappraise the ability of the routine CT scan in detecting non- giant aneurysms.

SAH = Subarachnoid Hemorrhage

Patients and method

Ninety-six patients were operated for intracranial aneurysms during Janaury 1990 to October 1992, in Ramathibodi Hospital. Complete data including plain and intravenous enhanced CT scan of the brain, angiographic studies and proved surgical reports, were obtained only from 30 patients with 30 aneurysms.

The CT scan were obtained from multiple diagnostic centers, all included scan areas from the foramen magnum to the vertex. The slice thickness varied from 5-10 mm at the posterior fossa and 10 mm at the supratentorial level.

The conventional angiography in all patients were performed by using a cut film biplane technique. In each study, all four major intracranial vessels, were visualized. Anteroposterior, lateral and oblique views were done with carotid injection and AP and lateral views with vertebral injection.

Correlation of the aneurysms detected by CT scan, angiographic studies and surgical findings were retrospectively analysed.

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Results

The patients were 18 males and 12 females. The age ranged from 29 to 76 yrs old. Subarachnoid hemorrhage was present in 28 cases and focal neurological sign without subarachnoid hemorrhage in 2 cases.

From 30 aneurysms, 20aneurysms (66.7%) were retrospectively detected by enhanced CT scan as rounded enhanced area in close proximity to the circle of Willis, with good correlation with angiographic and surgical findings. The size of the aneurysms ranged from 4 to 14 mm and all aneurysms are saccular type. The detection rate of unruptured aneurysms by CT scan was 100% (2 aneurysms)

The size of the aneurysms, the number of the aneurysms and the detection rate by CT scan was shown in Table 1.

The time interval between performing CT scan and the onset of the subarachnoid hemorrhage, number of the aneurysms and the rate of detection by CT scan was shown in Table 2.

The number of the successfully detected aneurysms by CT scan and the site of the aneurysms are shown in Table 3.

The CT detected aneurysms and angiographic demonstration of the aneuryms at internal carotid artery, anterior communicating artery, middle cerebral artery, posterior communicating artery, basilary tip were shown in figures 1-5 respectively and the looping of the anterior cerebral artery misinterpreted by CT scan as an aneurysm was illustrated in figure 6.

Overall incidence of the multiple aneurysms was 1.5% (1 out of 70 cases) by angiographic and surgical findings.

Table 1. The numbers of the detected aneurysms by CT scan, relating to the size of the aneurysms.

Aneurysm's size(mm) measured by Angio + CT	No. of aneurysms by Angio&Surg.	No. detected by CT	
		No.	%
4	3	1	33
5	6	2	33
6	3	2	66
7*	6	6	100
8	3	2	66
9	—	—	—
10	6	4	66
11	1	1	1100
12	—	—	—
13	—	—	—
14	2	2	100

* There was only one aneurysm that was measured 3 mm by angiographic study and 7 mm by CT study, due to spasm of the aneurysm in the presence of subarachnoid hemorrhage; so that the figure 7 mm was used.

Aneurysm's size 4-5 mm, CT detection rate would be 3 in 9 = 33%

6-14 mm, CT detection rate would be 17 in 21 = 85%

Table 2. Number of the detected aneurysms by CT scan relating to the time interval between the CT scan performed and the episode of the subarachnoid hemorrhage

Time interval from SAH episode and CT scan performed (days)	No. of aneurysms by Angio and Surg.	No. detected by CT	
		No.	%
0	3	2	67
1	11	5	46
2	2	1	50
3	2	1	50
4	2	2	100
5	3	2	67
6-9	—	—	—
10	3	3	100
11	—	—	—
12	1	1	100
13	—	—	—
14	1	1	100

Note; time interval day 0-3, CT detection rate would be 9/18 = 50%
4-14, " 9/10 = 90%

Table 3. The number of detected aneurysms by CT scan according to the location of the aneurysms

Location of the aneurysms	No. of aneurysm by Angio & Surg.	Detection by CT scan	
		No.	%
Anterior communicatiing a.	14	9	64
Posterior communicating a.	5	2	40
Internal carotid a.	3	2	66
Middle cerebral a.	6	5	83
Basilary tip	2	2	100

Discussion

The overall detection-rate of the non-giant aneurysms by routine CT scan in our series was 66.7% which was not as low as that mentioned by Ghoshhajra et al (2). The detection rate rised to 81% if the size of the aneurysms were between 6-14 mm, which were the size of the major aneurysms that ruptured (10). The accuracy of high resolution axial CT in the diagnosis of cerebral aneurysms 3 mm and larger has been reported at about 97% (6).

CT could detect 18 aneurysms in 28 cases of subarachnoid hemorrhage in our series (64%). The CT detection rate for the interval of 0-3 days from the SAH episode to the performed CT, would be 50% (9 in 18 aneurysms) and the rate of detection would rise up to 90% after the 4th day (9 in 10 aneurysm), due to the decreased blood attenuation in the subarachnoid space and render the aneurysms to be more obvious. The detection of the aneurysms in the absence of subarachnoid hemorrhage was very successful in our 2 cases. (detection rate = 100%) Delayed CT scanning after the episode of subarachnoid hemorrhage would be another way to detect the ruptured aneurysms.

The highest detection rate of the aneurysms by CT scans was obtained when the aneurysms were at basilary tip and middle cerebral a. which represented 100% and 83% respectively. The detection rate of the aneurysms of other arteries of the circle of Willis detected by CT scan was approximately equal. Ghoshhajra et al (2) reported highter detection rate at anterior and middle cerebral arteries (76%). Because of the close relationship between the aneurysms at the supraclinoid internal carotid artery (ICA), ICA bifurcation and posterior communicating artery, precisely locating the origin of the aneurysm from the ICA complex was impossible by CT alone. Confirmation by angiography or surgical findings was necessary. The aneurysms at the junction of the anterior cerebral artery and the anterior communicating artery were the most frequent ones found to be ruptured, similar to other reports (11).

Looping vessels and non-identical cuts of the plain and post intravenous enhanced studies might give the false positive findings by CT scan.

In conclusion; routine CT scan of the brain could detect 64% of the ruptured aneurysm and 100% of the unruptured aneurysm. The detection rate was high after 4 days from the onset of the subarachnoid hemorrhage due to decreased blood density in the subarachnoid space. The aneurysms at the basilar tip were the easiest ones to be detected, followed by those at the middle cerebral artery. The detection rate would be up to 81% if the size of the ruptured aneurysms were 6 mm or larger.

References

1. Inoui Y, Saiwai S, Miyamato T, et al: Post contrast computed tomography in subarachnoid hemorrhage from rupture aneurysms. J Comput Assist Tomogr 1981; 5: 341-344
2. Ghoshhajra K, Scotti L, Marasco J, et al: CT detection ofintracranial aneurysm in subarachnoid hemorrhage, AJR 1979; 132: 613-616
3. Liliequist B, Lindquist M, Valdimarsson E: Computed tomography and subarachnoid hemorrhage. Neuroradiology 1977; 14: 21-26
4. Lim ST, Sage DJ: Detection of subarachnoid blood clot and other thin flat structures by computed tomography. Radiology 1977; 123: 79-84
5. Silver AJ, Pederson ME, Ganti SR, et al : CT of subarachnoid hemorrhage due to ruptured aneurysm. AJNR 1981; 2: 549-552
6. Schmid U, Steiger HJ, Huber P: Accuracy of high resolution computed Tomography in direct diagnois of cerebral aneurysms. Neuroradiology 1987; 29: 152-159
7. Asari S, Sato T, Sakurai M, et al: Delineation of unruptured cerebral aneurysms by computerized angiotomography. J Neurosurg 1982; 57: 527-534
8. Newell DW, Leroux PD, Dacey RG, et al: CT infusion for the detection of cerebral aneurysms. J Neurosurg 1989; 71: 175-179
9. Nehls DG, Flom RA, Carter LP, Spetzler RF. Multiple intracranial aneurysms: determining the site of rupture. J Neurosurg 1985; 63: 342-348
10. McCormick WF, A Costa-GJ: The size of intracranial saccular aneurysm: An autopsy study. J Neurosurg 1970; 33: 422-427

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Fig. 1a Enhanced CT scan showed enhanced small nodule at the rt margin of the suprasellar cistern-aneurysm of distal rt internal carotid artery.

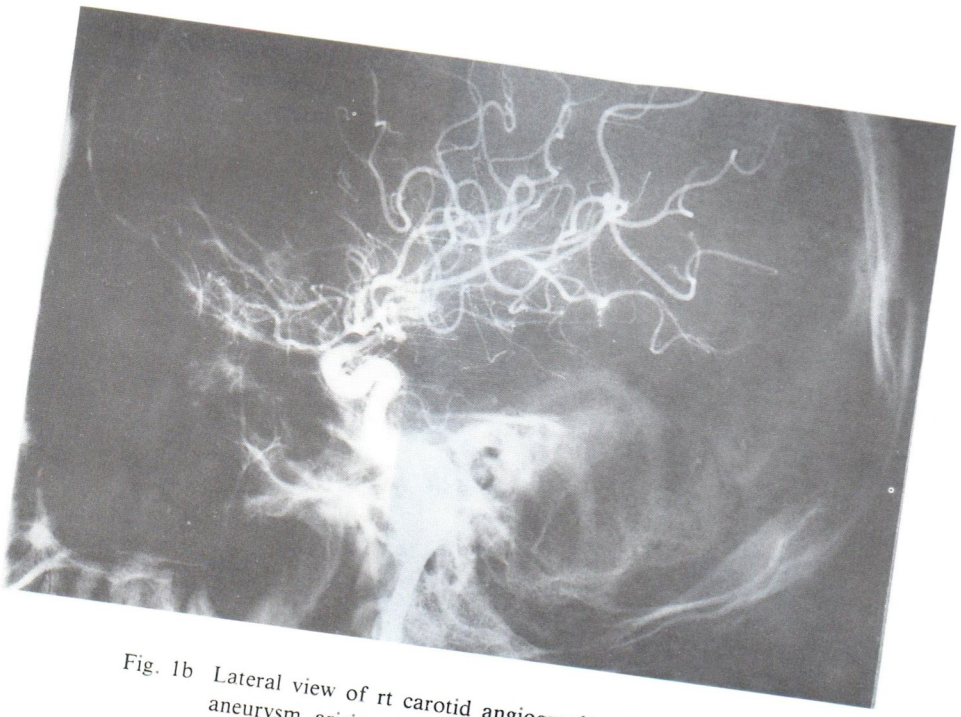

Fig. 1b Lateral view of rt carotid angiography showed small aneurysm arising from posterior part of rt internal carotid a., difficult to differentiate from posterior communicating a. aneurysm.

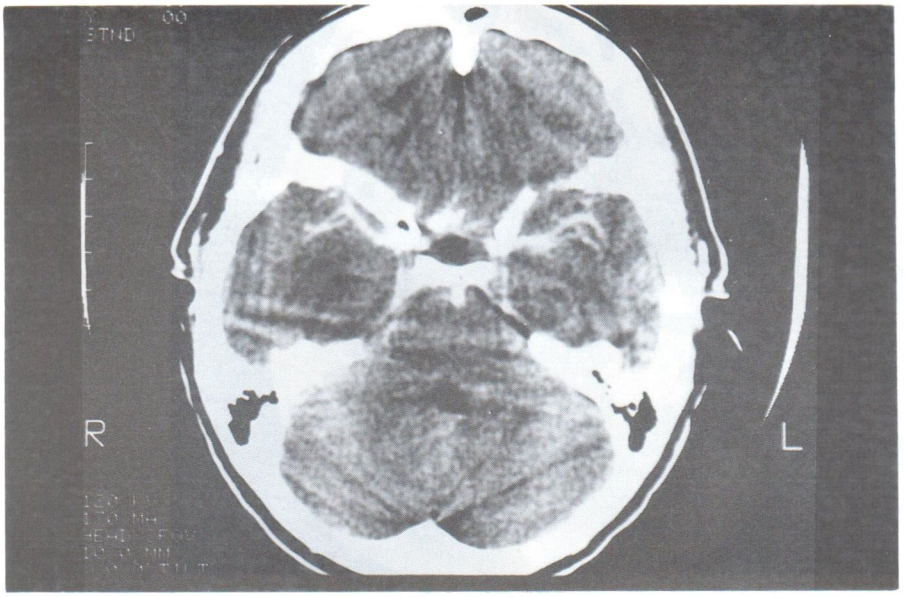

Fig. 2a Enhanced CT scan of the brain at suprasellar area showed enhanced nodule at anterior rt paramedian area of immediate suprasellar region-aneurysm of anterior communicating artery

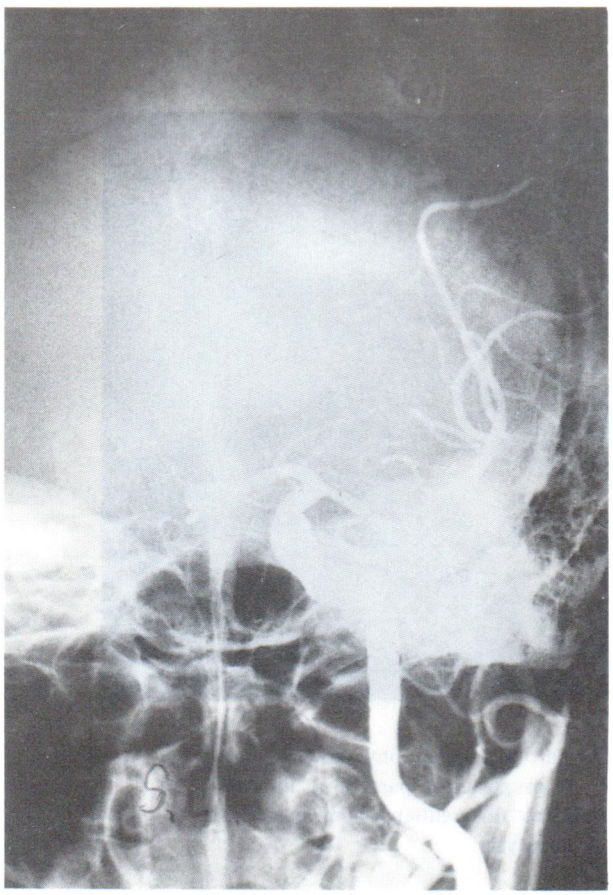

Fig. 2b Left carotid injection showed lobulated aneurysm at anterior communicating artery.

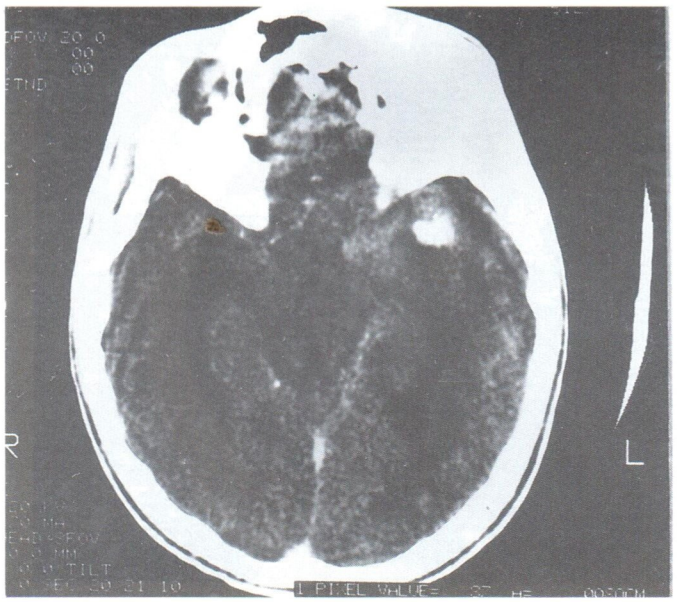

Fig. 3a Enhanced CT scan of the brain showed enhanced nodule at anterior-inferior portion of left temporal fossa-aneurysm of left middle cerebral a.

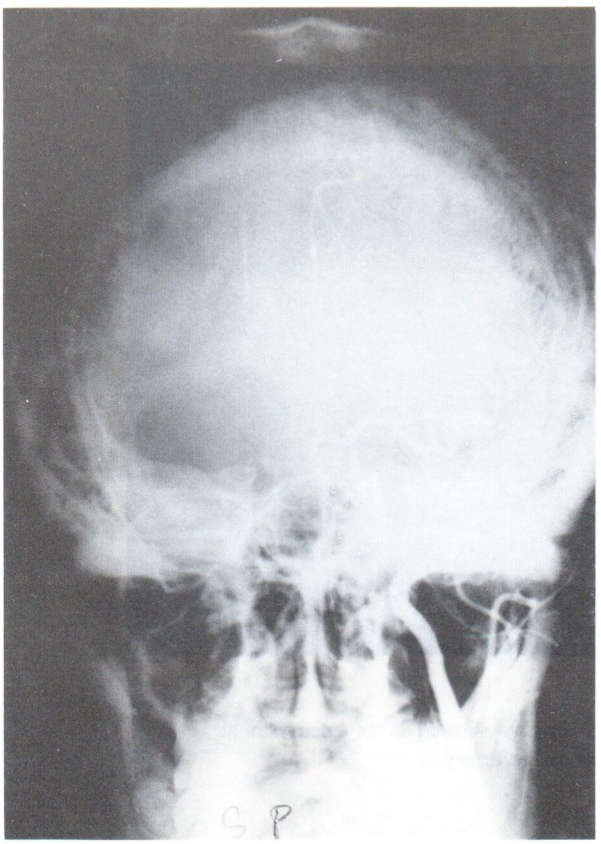

Fig. 3b Left carotid injection showed aneurysm arising from genu of left middle cerebral artery.

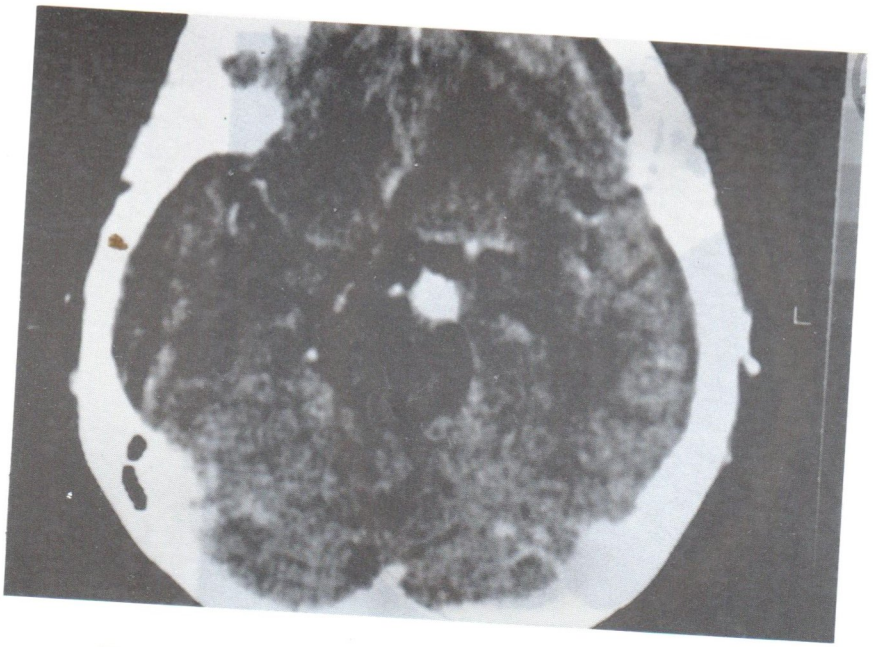

Fig. 4a Enhanced CT scan of the brain showed enhanced nodule at left posterior corner of the suprasellar cistern-aneurysm of posterior communicating artery.

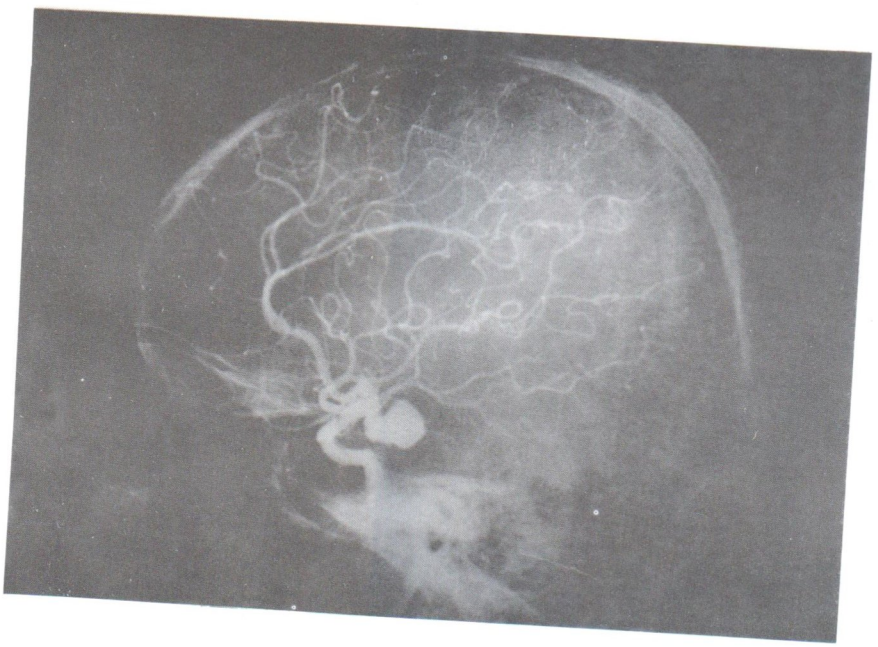

Fig. 4b Left carotid angiography showed large aneurysm at posterior communicating artery.

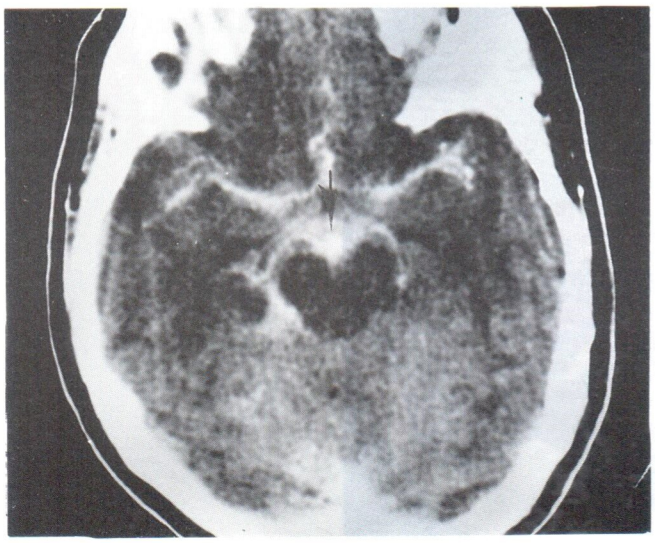

Fig. 5a Plain CT scan of the brain showed subarachnoid blood at suprasellar cistern and rt perimesencephalic cistern-aneurysm of basilar tip.

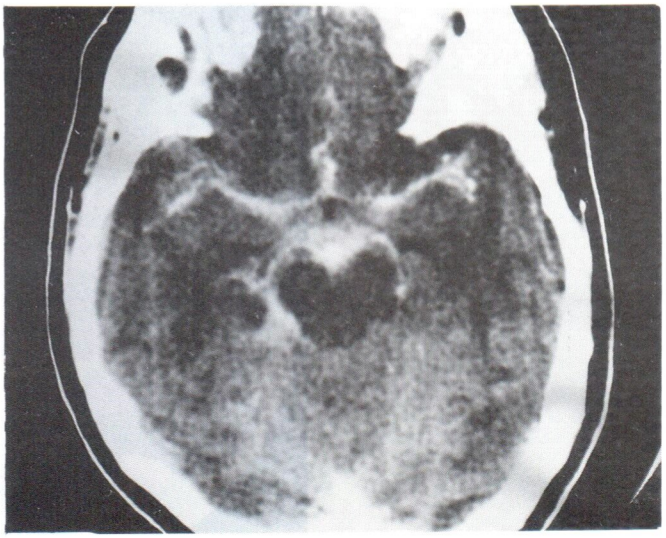

Fig. 5b Enhanced CT scan of the brain showed enhanced nodule at midline of posterior aspect of suprasellar cistern-aneurysm of basilar tip.

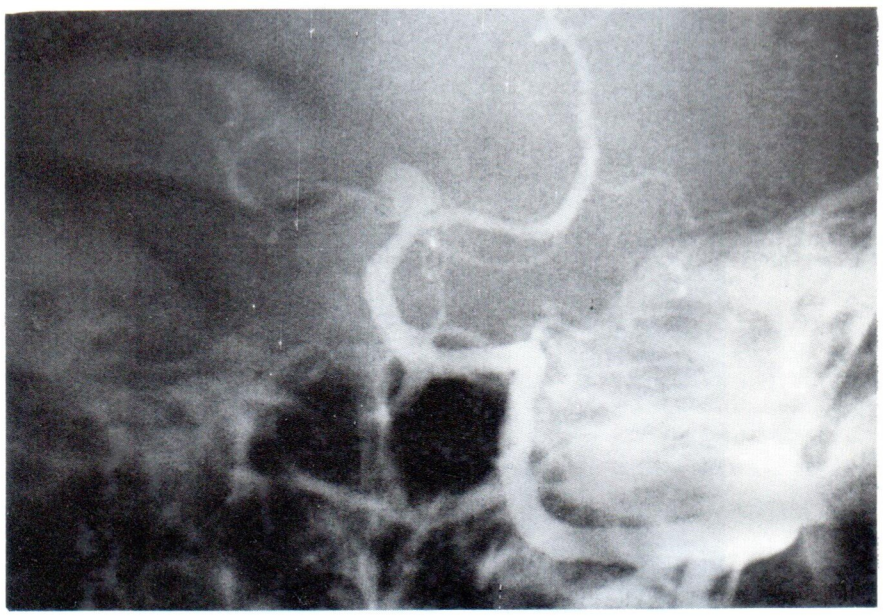

Fig. 5c Left vertebral injection showed lobulated aneurysm at basilar tip.

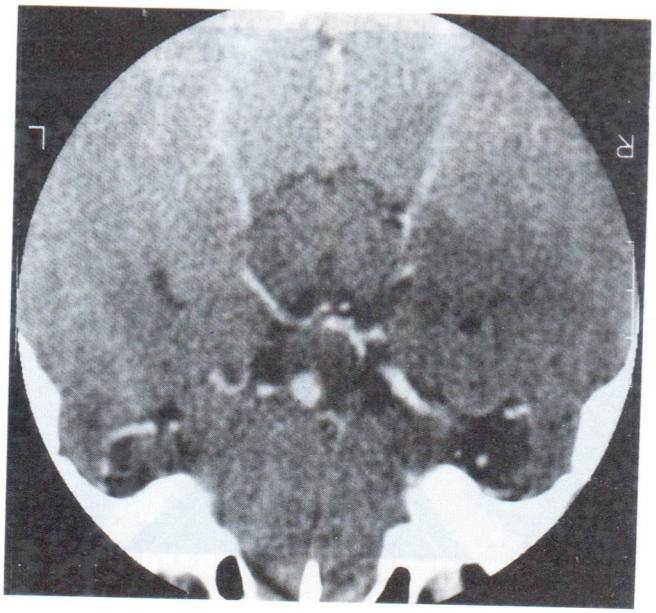

Fig. 6a Enhanced CT scan of the brain showed enhanced small nodule at left paramedian area of the suprasellar cistern-looping of anterior cerebral a.

Fig. 6b Left carotid injection showed looping vessel of lt ACA, simulating aneurysm in CT scan.