54. Filling-Abnormality (So-Called Vasospasm) following Rupture of Intracranial Aneurysm: Its Classification and Relation between different Patterns and their Prognosis

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136 cases of intracranial aneurysms have been treated in our department by the end of July, 1967. The angiographic films were available for reexamination in the 109 cases, which have been used in this presentation.

Filling-abnormality (so-called vasospasm) has been found in 62 cases (38.5%). There is no average age difference between two groups (Table 1). As for relation between presence of filling-abnormality and its prognosis, little significant relation could be found in an internal carotid and a middle cerebral aneurysms, but a high mortality rate (62.5%) has been demonstrated in the group of filling-abnormality of an anterior communicating aneurysm (Table 2). 80 per cent of filling-abnormality have been found in the films taken within 3 weeks after the last subarachnoid hemorrhage (Table 3), and bloody or xanthochromic CSF has been found in 28 out of 40 cases of filling-abnormality (Table 4). Not rarely, a pre-operative filling-abnormality remained after the craniotomy, in some case the filling-

Table 1. Relation Between Sites of Aneurysm and Presence of Vasospasm, and Age Distribution

	Spasm		Age	
	(+)	(-)	Spasm (+)	Spasm (-)
Int. Carotid A.	14	30	46.4	46.3
Ant. Communicat. A.	16	20	44	44.5
Middle Cereb. A.	10	15	40.3	40.7
Vertebrobasilar & Post. Cereb. A.	1	1	—	—
Multiple Cereb. A.	1	1	—	—

Table 2. Relation Between Postoperative Prognosis and Presence of Vasospasm

		Int. C. A.	Ant. Com. A.	Mid. C. A.
Spasm (+)	Recovered	14	6	9
	Died	0	10	1
Spasm (-)	Recovered	26	14	13
	Died	4	6	2

Table 3. Interval Between Last Hemorrhage and Presence of Vasospasm

	Spasm (+)	Spasm (-)
-48 hrs.	5	2
2- 7 days.	12	7
8-14	6	4
2- 3 wks.	13	3
3- 4	—	3
1- 6 mos.	9	37
6-	1	11

Table 4. CSF. Examination in the Presence of Vasospasm

	Bloody	Xanthochrom.	Clear
Int. Carotid A.	1	3	8
Ant. Communicat. A.	9	6	1
Middle Cereb. A.	4	3	3
Totals	15	12	12

Table 5. Presence of Vasospasm before and after Operation

	Preop.	Postop.
Ant. Cereb. A.	1	1
Middle Cereb. A.	4	6
Int. Carotid A.	1	4

Table 6. Classification of Filling-Abnormality in Carotid Angiography of Intracranial Aneurysm

Types	Description
Diffuse Nar.	Smooth contour; more than 2 cm.
Tapering	Smooth contour; tapered distally
Local Nar.	
Nodular	Localized indentation
Segmental	Smooth contour; less than 2 cm.
Irregular Nar.	Rough contour; diffuse or local
Central Sparing	Filling spared in the center of the vessel

abnormality appeared only after the craniotomy (Table 5). Tendency of recurrent hemorrhage could be revealed more markedly in the absence of filling-abnormality than the presence of filling-abnormality.

Present investigation was undertaken to classify the filling-abnormality into several different patterns and to get information about the prognosis of the different patterns, and, if possible, the probable etiology of the filling-abnormality.

Table 7. Relation Between Prognosis and Types of Vasospasm

	Died	Improved	Cured	Totals
Tapering (C2)	5	12	8	25
Diffuse				
A1, A1-2, A2				
A2-3, A1M1C1	10	5	0	15
others	1	3	4	8
				23
Segmental				
A1-2, A2, A3	2	2	0	4
others	1	4	0	5
				9
Nodular				
M1-2, M2	2	1	3	6
others	0	0	2	2
				8
Irregular				
A1M1, A1M1C1				
A1C1, M1	0	4	2	6
others	0	2	0	2
				8
Cent. Sparing (M2 or A2)	1	1	—	2

Filling-abnormality has been classified into 6 types; diffuse, local (segmental and nodular), irregular narrowings, tapering and central sparing (Table 6). Diffuse narrowing has been shown to occur predominantly in anterior communicating aneurysms, especially in the proximal part of the anterior cerebral artery including the aneurysm. The prognosis in this pattern has been very poor, for 7 out of the 8 cases of filling-abnormality in proximal part of the anterior cerebral artery died. Tapering has been shown in intracranial part of the internal carotid artery almost exclusively. The incidence of this type of narrowing has been remarkably frequent in the middle cerebral aneurysm but did not seem to influence the prognosis. Local, either segmental or nodular narrowings may occur without any predominant tendency in any part of the aneurysm and have no definite relation to the prognosis. The average age of patients with irregular narrowing and central sparing has been about 10 years higher than that of other groups. Although there has been no fatality, few patients with irregular narrowing was in the cured group (Table 7).

Using the cat's basilar artery vasospasm has been experimentally produced by mechanical and chemical (serotonin and fresh whole blood) stimuli and by bleeding from a small branch of a basilar artery. The most marked vasospasm occurred after bleeding from the branch. Vasospasm has been more pronounced after pouring fresh whole blood than after 0.1% serotonin solution. From these experimental results one could logically assume that serotonin must be one of the factors producing vasospasm but that there is another factor or factors in the fresh whole blood other than the serotonin in the platelets. Further, another factor or factors

in the process of hemostasis must be considered responsible for vasospasm, for the most severe vasospasm is produced by bleeding.

As for the neurogenic factor in vasospasm the autonomic nervous innervation of the cerebral vessels have been the subject of different opinions based upon experimentation since the end of the last century. The demonstration of sympathetic nerves on the cerebral vessels has been shown by the use of noradrenaline fluorescence. (Falk and Hillarp). The main cerebral vessels, especially those of the circle of Willis are innervated consistently and densely by sympathetic nerves, but the pial vessels have little innervation. Complete blockade of the sympathetic chain at the level of the superior cervical ganglion has resulted in complete disappearance of noradrenaline on the main ipsilateral cerebral vessel.

55. Statistical Survey of Cerebral Aneurysm

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We have experienced 184 cases with 214 aneurysms in the last 5 years. The location of the aneurysm is as follow: 88 for the internal carotid, 50; the anterior communicating artery, 18; the anterior cerebral artery, 49; the middle cerebral artery, 4; the posterior cerebral artery, 6; the basilar artery, 1; the posterior cerebellar artery and 1 for the vertebral artery.

The multiple aneurysm is disclosed in 13% of our series.

Surgical procedure was performed in 93 cases and 10 expired postoperatively. Operation was not carried out in 91 patients and 25 out of them died of subarachnoid hemorrhage. Operative techniques performed are as follows: Clipping in 35 (4 died), Trapping, 2 (none), Coating with EDH adhesive, 24 (none),