Intraoperative Intracranial Aneurysm Rupture

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Abstract

119 patients with surgically treated intracranial aneurysm between December 18, 1984 and October 1997 were analyzed resulting in nine patients with intraoperative aneurysm rupture. These nine cases formed the basis of this study. The incidence of intraoperative aneurysm rupture was 7.6 per cent. The mortality was 33.3 per cent. In our institution, maneuvers used to control profuse hemorrhage include induced hypotension, suction dissection, and temporary clips at the parent vessels. Some controversies exist regarding the effect of timing of surgery on intraoperative aneurysm rupture and ischemic consequence from induced hypotension. The argument is whether early surgery, within 72 hours, increases the incidence of intraoperative aneurysm rupture.

Key word : Intracranial Aneurysm, Intraoperative Rupture

Dott first documented intraoperative aneurysm rupture in 1931 with his report of the first direct surgical approach to intracranial aneurysm. He controlled profuse hemorrhage by using a tamponade with a piece of muscle. The ruptured aneurysm was secured by wrapping it with a thin muscle strip. His patient recovered from an uneventful postoperative course and lived for a long time(1). Intraoperative aneurysmal rupture is a catastrophe, which may be obviated by an experienced neurosurgeon with immediate appropriate action. Little information about the incidence, technique of management, and effect on outcome can be drawn from the literature(2). The sporadic reports were out of proportion with its importance. This report aimed to add the incidence of intraoperative aneurysmal rupture into the literature and relay the experience of how to control this catastrophic event when faced with it.

MATERIAL AND METHOD

We analyzed 119 patients with surgically treated aneurysms between December 18, 1984 and October 1997. The medical records and operative

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notes of all cases were analyzed which resulted in 9 cases with intraoperative aneurysm rupture. These 9 cases formed the basis of this study. The patients presented with both subarachnoid hemorrhage (SAH) and mass effect. The traumatic aneurysms presented with massive epistaxis. The patients with SAH were diagnosed by either CT scan and lumbar puncture or both. The patients presented with SAH were classified by Hunt and Hess scale[3]. Nimodipine was given orally at the time of diagnosis of SAH. The patients with intracranial aneurysms were definitely diagnosed by four-vessel angiography. All of our cases with intracranial aneurysms were operated on by microneurosurgical technique.

We divided intraoperative rupture into 3 stages: predissection, actual dissection of the aneurysm, and aneurysm clipping[2,4,5]. Predissection is defined as an aneurysmal rupture that occurred during the early period of induction of anaesthesia, dural opening and initial brain retraction. The rupture may be the result of change in transmural pressure gradient, shearing forces on the aneurysm, and blood pressure liability. Actual dissection means that aneurysm rupture occurred during microsurgical dissection to expose its neck. Blunt dissection often produces a more serious hemorrhage than sharp dissection. Aneurysm rupture can occur during aneurysmal clipping from inadequate exposure and/or poor technical clip application. In our institution, control of the hemorrhage is done in sequence by lowering systolic blood pressure to 80-90 mm. Hg, two suckers are used to clear the operative field, and application of temporary clips at proximal and distal parent vessels. Tamponade with cottonoid or muscle piece is seldom used because it will obscure the operative field and prevent further progression.

The outcome assessment followed Glasgow Outcome Scale (GOS) which composed of good recovery (GR), moderate disability(MD), severe disability(SD), persistent vegetative state (PVS), and death (D)[6]. GR and MD are favorable outcomes and the remainder are unfavorable outcomes.

RESULTS

Data from 119 patients with surgically treated aneurysms were collected from December 18, 1984 and formed the intracranial aneurysm data bank. The aneurysms were all supratentorial. The mean age of these 119 patients was 54 years. The incidence of intraoperative aneurysm rupture in our series was 7.6 per cent (9/119 patients). Preoperative grades were 1 in 1 case, 2 in 5 cases, and 3 in 3 cases. The aneurysm site which ruptured intraoperatively was PCoA (4 patients), ACoA (3 patients), and ICA (2 patient). One patient (no. 8) had multiple aneurysms (ACoA and PCoA) but intraoperative ruptured aneurysm was ACoA. Intraoperative aneurysm rupture occurred at predissection in 1 case, actual dissection in 3 cases, and clipping in 5 cases. The mean follow-up period in 6 cases was 11.2 months. Favorable and unfavorable outcome was 44.4 per cent (4/9 cases) and 55.6 per cent (5/9 cases) respectively. The mortality was 33.3 per cent (3/9 cases). The details of all 9 cases are summarized in Table 1.

Tables 1. Detail of patients with intraoperative aneurysm rupture are summarized.

Case No.	Age	Sex	Preop. Grade	Aneurysm Site	Ruptured Stage	Timing (days)@	FU (months)	Results+
1	69	F	2	ACoA	Clipping	11	0	D
2	47	F	2	ACoA	Predissect	15	0	D
3	62	F	3	PCoA-L	Dissect	15	13	MD
4	48	M	1	PCoA-L	Clipping	4	12	GR
5	63	M	2	ICA-L	Clipping	9	19	MD
6	47	F	3	ICA-R	Clipping	15	9	GR
7	46	F	2	PCoA-R	Dissect	30	8	SD
8	64	F	3	ACoA, PCoA-R	Clipping	6	6	SD
9	70	M	2	PCoA-R	Dissect	1	0	D

@ Timing is the interval between first episode of SAH and surgery.
+ GR = good recovery, MD = moderate disability, SD = severe disability, D = death
ACoA = anterior communicating artery, PCoA = posterior communicating artery, ICA = internal carotid artery

Table 2. The incidence and mortality of intraoperative aneurysm rupture from the reports in the literatures were reviewed and shown.

	Incidence	Mortality
Cooperative study (1981)[7]	18% (40/228 cases)	37.5%
Kassell et al (1981)[8]	26%	N/A
Yasargil (1984) (AcoA only)[9]	24% (90/371 cases)	3.3%
Batjer & Samson (1986)[4]	19% (58/307 operation)	16%
Giannotta et al (1991)[10]	14.8%	19.5% (8/41 cases)
Schramm & Cedzich (1993)[11]	27.5% (61/222 cases)	6.6%

N/A = not available

DISCUSSION

Our study may differ in a few points from the reported series in the literature. The incidence of intraoperative rupture was between 18 and 27.5 per cent (per case, per operation, or per aneurysm). These catastrophic events occurred with the mortality of 3.3- 37.5 per cent[4,7-11](as shown in Table 2). The incidence of intraoperative rupture in our study was only 7.6 per cent and the mortality was 33.3 per cent. Our low incidence of intraoperative rupture may be from our case number limitation and the use of microneurosurgical techniques and modern anaesthetic methods.

Batjer and Samson found that intraoperative aneurysm rupture could be divided into 3 stages: predissection, actual dissection and clipping[2]. In their study, intraoperative aneurysm rupture occurred 48 per cent in the period of dissection, 45 per cent in clip application, and 7 per cent in predissection. In our surgical series, the majority occurred in the stage of clipping (5 cases) and during the period of dissection (3 cases). The stage of dissection and clipping was interconnecting. If the dissection was not complete, clip application would be performed with a high risk of rupture.

Whether timing of surgery influenced the incidence of intraoperative aneurysm rupture or not, is controversial. Kassell et al reported the indifference between the incidence in the early (operated on within 72 hours after SAH) and late surgery group[8]. But Schramm and Cedzich found that an early surgery group has a significantly higher incidence of intraoperative aneurysm rupture than in the late surgery group (40.2 *vs* 20.7 %)[11]. Only one case (case no 9), in our report series, was operated on 1 day after the first episode of SAH with the result of death. The others were operated on more than 72 hours after the first episode of SAH. The long interval between the first episode of SAH and the day of surgery, in our series, was from delayed transfer from surrounding hospitals, angiographic appearance of generalized vasospasm, and presenting with a poor grade (grade IV or V).

There are many maneuvers used to control profuse hemorrhage from intraoperative aneurysm rupture including suction dissection, coagulation of the aneurysmal rent, clip application to the distal sac, severe induced hypotension, and temporary arterial occlusion[2]. We preferred to begin with the technique of suction dissection because it brought the operative field into sight. More than one suction tube was necessary. If we could control the hemorrhage and the aneurysm was already exposed before rupture, the aneurysm would be clipped. When the aneurysm was not fully exposed and needed further dissection, we used a temporary occlusion at the parent vessels.

Currently, severe induced hypotension to reduce intramural pressure gradient during intraoperative aneurysmal rupture is a controversial topic. Many studies support this maneuver, while others do not[8,10-12]. Giannotta et al reported the same outcome using tamponade and temporary clips without hypotension. But tamponade and temporary clips with hypotension resulted in decreased favorable outcome[10]. Batjer and Samson suggested that the technique of severe induced hypotension should be avoided to prevent the effect of ischemic consequence[2].

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เส้นเลือดโป่งภายในกะโหลกศีรษะแตกขณะผ่าตัด

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คณะผู้วิจัยได้ทำการศึกษาผู้ป่วยเส้นเลือดโป่งภายในกะโหลกศีรษะ 119 รายที่ทำผ่าตัดรักษาในโรงพยาบาลสงขลานครินทร์ ระหว่างวันที่ 18 ธันวาคม พ.ศ. 2527 ถึงตุลาคม พ.ศ. 2540 พบผู้ป่วยที่มีเส้นเลือดโป่งแตกขณะผ่าตัด 9 ราย หรือคิดเป็นร้อยละ 7.6 ของผู้ป่วยทั้งหมด และมีอัตราตายสูงถึงร้อยละ 33.3 ในสถาบันของผู้วิจัยมีวิธีการควบคุมการตกเลือดที่รุนแรงจากเหตุนี้ด้วยการลดความดันโลหิตของผู้ป่วยลง, ในขณะเดียวกันก็ดูดเลือดออกจากบริเวณที่ผ่าตัดเพื่อให้สามารถทำผ่าตัดต่อไปได้, และการใช้คลิ้ปหนีบชั่วคราวที่หลอดเลือดซึ่งไปเลี้ยงตัวเส้นเลือดโป่ง ยังมีข้อขัดแย้งเกี่ยวกับการทำผ่าตัดโดยเร็วหลังการตกเลือดว่าจะทำให้เส้นเลือดโป่งแตกเพิ่มขึ้นในขณะผ่าตัดหรือไม่ และการลดความดันโลหิตลงในขณะเส้นเลือดโป่งแตกอาจจะทำให้เกิดผลเสียมากกว่าผลดี

คำสำคัญ : เส้นเลือดโป่งภายในกะโหลกศีรษะ, แตกขณะผ่าตัด

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