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Clinical Course of Spontaneous Gangliothalamic Hemorrhage in the Acute Period
— Who Requires Surgical Removal? —

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We analyzed the clinical courses of 93 consecutive patients with gangliothalmic hemorrhage for the first three weeks after the ictus and investigated the factors affecting the clinical course and the final outcome. The clinical status was assessed daily using the Glasgow Coma Score (GCS) and patients were divided into two groups according to the clinical course; Group I included those who improved and Group II consisted of patients who deteriorated. There were 44 patients (47.3%) in Group I and 49 patients (52.7%) in group II. Each group was subdivided into the conservative group and the surgical group. In Group I only eight patients (18.2%) received surgery while twenty-five patients (51.0%) received surgery in Group II. Clinical features and computed tomography characteristics of these four groups were compared. Our results suggested that the surgery is rarely required for patients 1) whose GCS values are 12 or more without deterioration; 2) with hematomas smaller than 3cm in diameter or 20ml in volume; 3) with midline shifts of less than 3mm, and 4) whose subtypes of the hematomas are P1, P2a, T1, T2a, and T2b. For proper comparison of the results of medical and surgical treatment, the patient population should include the patients 1) who became deteriorated progressively regardless of initial GCS values; 2) whose GCS values are below 12; 3) with hematomas larger than at least 3cm in diameter or 20ml in volume; 4) with midline shift of more than 3mm, and 5) whose subtypes of the hematoma are P2b or GT.

Key Words: *Gangliothalamic hematoma, Hospital course, Method of treatment, Subtypes*

INTRODUCTION

There is still great controversy concerning the surgical treatment of spontaneous intracerebral hemorrhage(SICH) (Heir et al., 1977, Kaneko et al., 1983, Kanno et al., 1984, Matsumoto et al., 1984, Mary et al., 1983, Paillas et al., 1973). Some reported that the result of surgical treatment was not significantly better than that of conservative treatment(Douglas et al., 1982, Kim et al., 1988, McKissock et al., 1961, Waga et al., 1986), while others reported the opposite results(Doh et al., 1989, Oh et al., 1988, Kaneko et al., 1977, Kim et al., 1990, Matsumto et al., 1984, Mosdal et al., 1986, Shin et al., 1988, Tedes Chi et al., 1975, Volpin et al., 1984). The results of recent surgical treatment seem to be better than those of

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the 1970s(Oh et al., 1988, Shin et al., 1988, Tedeschi et al., 1975, Volpin et al., 1984). However, to evaluate the efficacy of a certain therapeutic methods, the result of such therapy should be better than the natural outcome. Recently, the mortality rate of SICH has been much reduced(Furlan et al., 1978, Hier et al., 1976, Luyendijk., 1972). In this reduction of the mortality rate, the enhanced diagnostic ability of small, tiny SICHs by computed tomography(CT) should be considered(Heleweg-Larsen et al., 1984, Hier et al., 1976). Who requires surgical evacuation? Naturally, not all lesions demonstrated in the CT need to be surgically removed. in general, any mass lesion causing deterioration needs to be removed(Kase et al., 1982, Modal et al., 1986, Volpin et al., 1984). However, a lesion with stable, fixed deficits may be left. In this paper, we analyzed clinical course of gangliothalamic hemorrhage(GTH) for the first three weeks after the ictus in the 93 consecutive patients, and investigated the factors affecting the clinical course and final outcome.

MATERIALS AND METHODS

From February 1989 to January 1990, records of 93 consecutive patients of GTH were retrospectively reviewed. Patients who were admitted 24 hours after the ictus were excluded. Most of them were conservatively treated unless there was clinical deterioration or their Glasgow coma score (GCS) (Jennett et al., 1983) was below 10. Conservative treatment consisted of blood pressure regulation(controlled systolic pressure around 160mm Hg), steriods and intermittent mannitol administration. Surgery was performed for 33 patients (35.5%) (Table 1). The most common method of surgery was external ventricular drainage. The clinical status was assesed daily using GCS and classified into three groups according to their initial GCS ; Group A between 13-15, Group B between 9-12 and Group C between 3-8. They were subclassified into nine subgroups as shown in Fig. 1. We described A1, B1 and C1 as improved", "no change" for A2, B2 and C2, and "deteriorated" for A3, B3 and C3. According to the clinical course, the patients were divided into two groups, Group I (patients remained alert or became alert ; A1, B1, C1, and A2) and Group II (patients deteriorated or remained in decreased mentality ; B2, C2, A3, B3, and C3). Each group was subdivided into a conservative group and a surgical group according to the

Table 1. Methods and date of surgical treatment

Date(HD)	BE	EVD/VP	CO	Total
1	9	10	3	22
2-7	1	6	3	10
7〉	1			1
TOTAL	11	16	6	33

HD=hospital day; BE=burr-hole craniectomy; EVD/VP=external ventricular drainage with or without ventriculoperitoneal shunt; CO=craniotomy

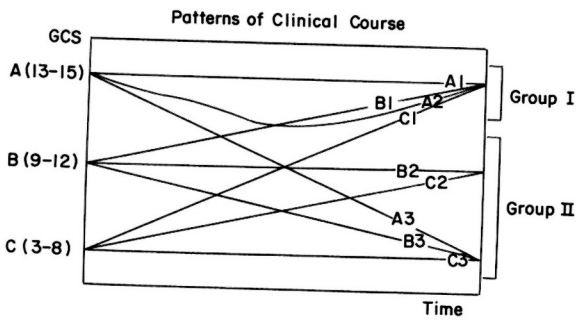

Fig. 1. Patterns of clinical course and groups. A1=continuous good mentality ; A2=transient deterioration, then recovery ; A3=progressive deterioration ; B1 =progressive improvement ; B2=continuous decrease in mentality ; B3=further deterioration ; C1=improvement to GCS 13−15 ; C2=improvement to GCS 9 −12 ; C3=no improvement ; Group I includes A1, B1, C1, and A2 ; Group II includes B2, C2, A3, B3, and C3.

Table 2. Classification of gangliothalamic hemorrhage*

Type	Description
P1	Hematoma is localized in the putamen or expands in a ball-like fashion with its center remaining at site of origin. The actual diameter of the hematoma is less than 3cm
P2a	The actual diameter of the hematoma is more than 3cm. The hematoma extends forwards and backwards; the posterior limb of the internal capsule is partially involved
P2b	The internal capsule is totally distroyed, the hematoma spreads upwards through the corona radiata into the centrum semiovale, and then through the isthmus of the temporal lobe to produce a large mass in the posterior temporal white matter, or rupture into the ventricular system
T1	Hematona is localized in the thalamus or expands in a small ovoid hematoma with its center remaining at the site of origin
T2a	Hematoma enlarges laterally, spreads against and into the internal capsule
T2b	Hematoma spreads infero-medially into the subthalamus and midbrain
GT	The massive hematoma involves the adjacent structures, and most ventricular systems, particularly the third ventricle is obstructed

* classified according to Kitamura et al (Kitamura et al., 1980) with minor modifications

Table 3. Patterns of hospital course

GCS	Improved*		No change*		Deteriorated*		Total		
	C	S	C	S	C	S	C	S	T(%)
13-15	19	0	10	2	2	1	31	3	34(36.6)
9-12	7	2	6	3	2	5	15	10	25(26.9)
3-8	0	4	4	6	10	10	14	20	34(36.6)
TOTAL#	32		31		30		60	33	93(100)

* see Fig. 1 and text; C=conservative; S=surgical; T=total; #totals of both C and S.

methods of treatment. Clinical features and CT characteristics of these four groups were compared. Subtypes of the GTH were classified according to Kitamura et al (Kitamura et al., 1980) with minor modifications(Table 2). P3 and T3 were classified into GT because the origin of hematoma was obscure in some massive gangliothalamic hemorrhages. The size of the hematoma was measured by two parameters, the largest diameter and estimated volume. The volume was estimated using the formula, $\pi/6 \times ABC$ (A=largest diameter; B=width; C=height). Hematoma within the ventricular system was not measured. Specific statistical tests included the Chi-square test, Fisher's exact probability test, and the Student's t-test. Significance was attributed to a p value of < 0.05.

RESULT

Patterns of the clinical course

Of 93 patients, 30 (32.3%) deteriorated. Deterioration(A3, B3, and C3) was most common in patients whose GCS on admi-

Table 4. Clinical features

Clinical features	Group I		Group II		Statistics			
	C	S	C	S	C:S(I)	C:S(II)	I:II(C)	I:II(S)
Total	36	8	24	25				
Age								
mean	59.3	56.8	60.8	57.5	NS*	NS*	NS#	NS*
SD	10.4	6.1	13.4	13.1				
range	42-87	46-72	39-85	26-84				
M:F ratio	14:22	5:3	6:18	14:11	NS+	NS+	NS+	NS*
GCS								
mean	13.7	9.3	7.5	7.7	P<0.01*	NS*	P<0.01*	NS*
SD	1.6	3.0	3.2	2.9				
range	10-15	6-14	3-14	4-15				
Hypertension								
(+)	20	5	19	15	NS+	NS#	NS#	NS+
(−)	16	3	5	10				

C=conservative; S=surgical; C:S(I)=comparison between C and S in Group I; C:S(II)=comparison between C and S in Group II; I:II(C)=comparison between Groups I and II in conservatively treated patients; I:II(S)=comparison between Groups I and II in surgically treated patients; SD=standard deviation; NS=not significant; * t-test; # chi-square test; + Fisher's test

Table 5. Subtypes of gangliothalamic hemorrhage and treatment

Subtypes+	Group I			Group II			Total		
	C	S	T(%)*	C	S	T(%)*	C(%)*	S(%)*	T(%)#
P1/P2a	14	2	16(72.7)	4	2	6(27.3)	18(81.8)	4(18.2)	22(23.7)
P2b	2	1	3(37.5)	1	4	5(62.5)	3(37.5)	(5.62.5)	8(8.6)
T1/T2a	11	0	11(100)	0	0	0(0.0)	11(100)	0(0.0)	11(11.8)
T2b	13	0	13(86.7)	0	2	2(13.3)	13(86.7)	2(13.3)	15(21.5)
GT	0	2	5(14.3)	11	12	30(85.7)	11(40.0)	14(60.0)	35(37.6)
others	1	0	1(50.0)	0	1	1(50.0)	1(50.0)	1(50.0)	2(2.2)
total	36	844		24	25	49	60(64.5)	33(35.5)	93(100)

+ classified according to Kitamura et al with minor modifications; * percentage in row; # percentage in column

ssion was 3-8. Of 34 patients with GCS 13-15, only three (8.8%) deteriorated(Table 3). There were 44 patients (47.3%) in Group I and 49 patients (52.7%) in Group II.

Clinical features

The clinical features of each group are summarized in Table 4. Age, sex ratio, and history of hypertension were not significantly different between the groups. The mean value of GCS on admission of Group I was significantly higher than that of Group II in the conservative group. However, in the surgical group, the mean value of the GCS was not significantly different between Groups I and II. In Group I, the mean value of GCS of the surgical group was significantly lower

able 6. CT characteristics

Clinical features	Group Ⅰ		Group Ⅱ		Statistics			
	C	S	C	S	C:S(Ⅰ)	C:S(Ⅱ)	Ⅰ:Ⅱ(C)	Ⅰ:Ⅱ(S)
Total	36	8	24	25				
Diameter(㎜)								
mean	29.1	54.5	45.4	50.7	P〈0.01*	NS*	P〈0.01*	NS*
SD	10.3	10.9	18.0	18.6				
range	11-48	31-71	17-80	17-100				
Volume(cc)								
mean	9.0	41.7	44.1	49.5	P〈0.01*	NS*	P〈0.01*	NS*
SD	7.4	15.0	38.4	45.1				
range	1-29	18-62	3-136	3-214				
Midline shift(㎜)								
mean	0.9	5.2	6.7	7.5	P〈0.01*	NS*	P〈0.01*	NS*
SD	1.4	2.0	6.1	4.8				
range	0-6	1-9	0-20	0-20				
IVH								
(+)	13	6	17	23	NS+	NS+	P〈0.01#	NS+
(−)	23	2	7	2				

C=conservative; S=surgical; C:S(Ⅰ)=comparison between C and S in Group Ⅰ; C:S(Ⅱ)=comparison between C and S in Group Ⅱ; Ⅰ:Ⅱ(C)=comparison between Groups Ⅰ and Ⅱ in conservatively treated patients; Ⅰ:Ⅱ(S)=comparison between Groups Ⅰ and Ⅱ in surgically treated patients; SD=standard deviation; NS=not significant; * t-test; # chi-square test; + Fisher's test

than that of the conservative group.

Subtypes and methods of treatment

Subtypes were different in groups Ⅰ and Ⅱ (Table 5). P1/P2a, T1/T2a, and T2b usually belonged to Group Ⅰ, while P2b and GT usually belonged to Group Ⅱ. In Group Ⅰ, eight patients(18.2%) received surgical treatment, while 25 patients (51.0%) underwent surgery in Group Ⅱ. Surgical treatment was usually performed in the P2b and GT.

CT characteristics

CT features of each group are summarized in Table 6. Statistically significant differences were found in the size and volume of the hematoma, the degree of midline shift, and ventricular extension. In Gsoup I, the mean values of the size of hematoma(both the largest diameter and volume) and midline shift of the surgical group were larger than those of the conservative group. In Group Ⅱ, there were no significant differences between the conservative and surgical groups. The mean values of the size of hematoma and midline shift of Group Ⅱ were significantly larger than those of Group Ⅰ in the conservative group. I the surgical group, there were no significant differences between Groups I and Ⅱ. Only in the conservative group, the ventricular extension of the hemorrhage was more common in Group Ⅱ than Group Ⅰ.

Outcome

In the conservatively treated patients, 24 patients (40.0%) belonged to Group Ⅱ(Table 7). In Group Ⅱ, 11 patients (45.8%) expired, and none the others made a good recovery,

Table 7. Outcome in conservatively treated patients

Outcome	3−8		9−12		13−15		total		
	I	II	I	II	I	II	I(%)	II(%)	T(%)
GR	0	0	3	0	16	0	19(52.8)	0(0.0)	19(31.7)
MD	0	1	2	0	8	0	10(27.8)	1(4.2)	11(18.3)
SD	0	3	2	3	2	0	4(11.1)	6(25.0)	10(15.9)
VS	0	0	0	0	0	0	0(0.0)	0(0.0)	0(0.0)
DD	0	7	0	2	0	2	0(0.0)	11(45.8)	11(18.3)
DS	0	3	0	3	3	0	3(8.3)	6(25.0)	9(6.8)
Total	0	14	7	8	29	2	36(100)	24(100)	60(100)

GR=good recovery ; MD=moderate disability ; SD=severe disability ; VS=vegetative state ; DD=death ; DS=self−discharged

Table 8. Outcome in surgically treated patients

Outcome	3−8		9−12		13−15		total		
	I	II	I	II	I	II	I(%)	II(%)	T(%)
GR	1	0	0	0	0	0	1(12.5)	0(0.0)	1(3.0)
MD	2	2	1	0	1	0	4(50.0)	2(8.0)	6(18.2)
SD	1	2	1	2	1	0	3(37.5)	4(16.0)	7(21.2)
VS	0	1	0	1	0	0	0(0.0)	2(8.0)	2(6.1)
DD	0	10	0	3	0	0	0(0.0)	13(52.0)	13(39.4)
DS	0	1	0	2	0	1	0(0.0)	4(16.0)	7(21.2)
Total	4	16	2	8	2	1	8(100)	25(100)	33(100)

GR=good recovery ; MD=moderate disability ; SD=severe disability ; VS=vegetative state ; DD=death ; DS=self−discharged

while there were no deaths in Group I and 19 (52.8%) patients made a good recovery. The overall mortality rate was 18.3% in the conservatively treated patients.

In surgically treated patients, 25 (75.8%) belonged to Group II(Table 8). In Group II, 13 (52.0%) expired, and no one made a good recovery, while, there were no deaths in Group I. The overall mortality rate was 39.4% in the surgically treated patients.

In total, 49 patients(52.7%) belonged to Group to Group II. In group II, 24 patients (25.8%) expired, and no one made a good recovery, while there were no deaths in Group I and 20 (21.5%) patients made a good recovery. The overall mortality rate was 25.8 %.

DISCUSSION

In the era before CT scanning, the mortality rate of unoperated SICH was reported to be as high as 65%-85%(Luyendijk., 1972). Recently, the reported mortality rate for SICH has declined to around 30% because, with the routine use of the CT scan, many small hemorrhages have been detected(Furlan et al., 1978, Heleweg-Larsen et al., 1984, Hier et al., 1976). A small lesion with stable, fixed deficits tends to have a much more benign course and outcome(kase et al 1982), Naturally, those small lesions do not need to be

surgically removed(kase et al., 1982, Tsementzis et al., 1985). There is general agreement that the results of surgical treatment for the cerebellar and lobar hemorrhages is superior to conservative treatment(kase et al., 1982, Mayr et al., 1983, Tsementzis et al., 1985). For the GTH, even though they constitute the major part of SICH, it is not firmly established that surgical treatment is better or not(Heir et al., 1977, kaneko et al., 1983, kanno et al., 1984, Matsumoto et al., 1984, Mary et al., 1983, Paillas et al., 1973). The indications for surgery are still controversial, especially for the GTH(Heir et al., 1977, kaneko et al., 1983, kanno et al., 1984, Matsumoto et al., 1984, Mary et al., 1983, Paillas et al., 1973). Besides the timing of the surgical treatment(Doh et al., 1990, Kaneko et al., 1977, Kim et al., 1988, Kim et al., 1990, Matsumoto et al., 1984, Mckissock et al., 1961, Paillas et al., 1973, Shin et al., 1988, Tedeschi et al., 1975), methods(Doh et al., 1989, Kim et al., 1988, Kim et al., 1990, M tsumoto et al., 1984, Paillas et al., 1973, Shin et al., 1988 Tsementzis et al., 1985), and the results of surgery(Helweg-Larsen et al., 1984, Kanno et al., 1984, Mckissock et al., 1961, Mosdal et al 1986, Shin et al., 1988, Waga et al., 1986), there are still no established indications for surgical treatment(Heir et al., 1977, Kaneko et al., 1983, Kanno et al., 1984, Matsumoto et al., 1984, Mary et al., 1983, Paillas et al., 1973). There are several reasons such as 1) lack of adequate and comparable data in conservative and surgical therapy from the same institution, 2) difficulty in homogenizing the patient population, 3) lack of a uniform grading system, and 4) lack of a proper classification of SICH(kanno et al., 1984, Paillas et al., 1973). In any event, prior to comparing the efficacy of different therapeutic methods, a proper selection of the patient population seems to be necessary for comparison. There is no room for surgery for small hemorrhages having a benign course and outcome(Tsementzis et al., 1985). It is impossible to prove the efficacy of surgery in those cases. There should be some room for both medical and surgical treatment(Tsementzis et al., 1985). In general, surgery is needed for patients who cannot improve by medical therapy(Helweg-Larsen et al., 1984, Kase et al., 1982, Oh et al., 1988, Paillas et al., 1973, Tsementzis et al., 1985). The patients who received conservative treatment and belonged to Group I in this study may not require surgical treatment. Conversely, surgery could be considered for the patients who belonged to Group II or received surgical treatment.

Age, sex ratio, and history of hypertension were not significantly different between the groups. The mean value of GCS on admission of Group I was significantly higher than that of Group II in the conservative group. The mean value of the GCS was 12.1-15 (mean:13.7, SD:1.6) in Group I. Thus, the patients whose GCS value were 12 or more could be managed conservatively. Conversely, surgery should be reserved for the patients whose GCS values were less than 12, unless they deteriorated progressively.

Subtypes were different in Groups I and II. P1/P2a, T1/T2a and T2b usually belonged to Group I, while P2b and GT usually belonged to Group II. Thus, patients could be conservatively managed in P1, T1, P2a, T2a and T2b unless there is a progressive deterioration. Surgical treatment should be considered in the P2b and GT.

Statistically significant differences were found in the size and volume of the hematoma, the degree of midline shift, and ventricular extension of the hematoma. In the conservative group, the mean value of the largest diameter of Group I was 18.8-39.4mm (mean:29.1, SD:10.3), while that of Group II was 27.4-63.4mm (mean:45.4, SD:18.0). The mean value of the volume in the former group was 1.6-16.4ml (9.0, SD:7.4), and that of the latter group was 5.7-82.5ml (mean:44.1, SD:38.4). Many authors agree that the crucial size is 3cm in diameter(Mayr et al., 1983, Tsementzis et al., 1985). They recommend surgical removal if the patient is showing signs of increasing neurologic deficit or a decreasing state of consciousness in spite of medical therapy(Kase et al., 1982, Mosdal et al., 1986, Tsementzis et al., 1985). In this study, patients with the hematomas of size 3 to 4cm in diameter, the initial treatment

could be medical. But if the hematomas are larger than 4cm, surgical treatment should be considered eventhough there is no obvious deterioration. As a matter of course, CT findings alone would not dictate surgical intervention. However, the patients with hematomas larger than 4cm in diameter have a tendency to detériorate or to remain in coma. The GCS values of these patients are usually below 12, and the hematomas are more than 20 to 30ml in volume. Although Helweg-Larsen et al(Helweg-Larsen et al., 1984) have reported that the crucial size was 50ml with a mortality of 90% for hematomas larger than that, and 10% for hematomas smaller than that in 53 conservativery treated patients, it does not mean that surgery is useless for the patients with hematomas larger than 50ml (Helweg-Larsen et al., 1984). In the conservative group, the degree of midline shift of Group I was 0-2. 3mm (mean:0.9, SD:1.4) and that of Group II was 0.6-12.8mm (mean:6.7, SD:6.1). The midline shift represents the mass effect of the hematoma. Surgical removal could reduce the mass effect. Thus, surgery seems to be benificial for patients with midline shift of more than 3mm.

CONCLUSION

We analyzed hospital course of GTH for the first three weeks after the ictus and investigated the factors affecting the clinical course and final outcome in 93 consecutive patients. There were 44 patients(47.3%) in Group I and 49 patients(52.7%) in Group II. In Group I, only eight patients(18.2%) received surgery, while 25 patients(51.0%) received surgery in Group II. Since surgery is needed for patients who cannot be helped by medical therapy, patients who received surgical treatment. Conversely, surgery could be considered for patients who belonged to Group II or received surgical treatment. Our inverstgation of the clinical course suggests that surgery is rarely required for patients 1) whose GCS values are 12 or more without deterioration; 2) with hematomas smaller tnan 3cm in diameter or 20ml in volume; 3) with midline shift of less than 3mm; and 4) whose subtypes of the hematoma are P1, P2a, T1, P2a, and T2b. Thus, for a proper comparison of the result of medical and surgical treatment the patient population should include patients 1) who deteriorated progressively regardless of the initial GCS value; 2) whose GCS values are below 12; 3) with hematomas larger than at least 3cm in diameter or 20ml in volume; 4) with midline shift of more than 3mm; and 5) whose subtypes of the hematoma are P2b or GT.

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