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Gastrointestinal Bleeding in Patients with Severe Head Injury, Hypertensive Intracerebral Hemorrhage, and Ruptured Cerebral Aneurysm*)

Takashi YOSHIHARA, Tamotsu KITAOKA, Kenji TOMIHARA, Katsuzo KIYA and Masayuki NOMURA

Department of Neurosurgery, Hiroshima Prefectural Hiroshima Hospital, 1-1-54 Ujina Kanda, Minami-ku, Hiroshima 734, Japan

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ABSTRACT

As a complication in patients with head injury or cerebral stroke, gastrointestinal bleeding is an important problem in neurosurgery.

We reviewed 411 cases of hypertensive intracerebral hemorrhage, ruptured cerebral aneurysm and severe head injury in order to ascertain the pathologic condition of the gastrointestinal bleeding and to introduce an effective method of therapy. In 411 cases, gastrointestinal bleeding was observed in 19 cases (4.6%). Among the cases of hypertensive intracerebral hemorrhage or ruptured cerebral aneurysm, the frequency was high in males. Among the cases of severe head injury, the frequency was high in children. Dogmatyl® had no prophylactic effect for gastrointestinal bleeding. Administration of steroids had no relationship to gastrointestinal bleeding. Of the 19 cases with the gastrointestinal bleeding, laparotomy was performed on 6 cases. Of the 19 cases, 10 cases died. From our review, laparotomy is considered to be the most satisfactory method of therapy.

INTRODUCTION

Castrointestinal bleeding as a complication in patients with severe head injury, hypertensive intracerebral hemorrhage, and subarachnoid hemorrhage is an important problem in neurosurgery. Gastrointestinal bleeding brings rise to hypovolimic shock, aggravates the general physical condition and brain circulation, and leads to a vicious circle. It is therefore important to ascertain the pathologic condition of the gastrointestinal bleeding and introduce an effective method of therapy. A review was therefore made on cases of gastrointestinal bleeding experienced during the last four years.

SUBJECTS AND METHODS

The subjects of the present study were 411 patients who were hospitalized at the Department of Neurosurgery of the Hiroshima Prefectural Hiroshima Hospital during the four year period from the beginning of 1977 to the end of 1980, composed of 119 cases of hypertensive intracerebral hemorrhage, 147 cases of ruptered cerebral aneurysm, and 145 cases of severe head injury (Type 3 and Type 4 of Araki's classification).

Cases with definite hematemesis or bloody discharge were assurmed to have gastrointestinal bleeding. Occult blood in the stool was not used as criterion.

RESULTS

(1) Frequency

Gastrointestinal bleeding was observed in 7 cases (5.9%) in 119 cases of hypertensive intra-

*) 吉原高志，北岡 保，冨原健司，木矢克造，野村雅之：重症頭部外傷，高血圧性脳出血，破裂脳動脈瘤に併発した胃腸出血

cerebral hemorrhage, 7 cases (4.8%) 147 cases of ruptered cerebral aneurysm, and 5 cases (3.4%) in 145 cases of severe head injury for a total of 19 cases (4.6%) out of 411 cases (Table 1).

Table 1. Frequency of GI bleeding

	No. of cases	GI bleeding	Ratio %
HI	145	5	3.4
HIH	119	7	5.9
AN	147	7	4.8
Total	411	19	4.6

(from Jan. '77 to Dec. '80)
HI= Head iniury
HIH= Hypertensive intracerebral hemorrhage
AN= Cerebral aneurysm

(2) Age and sex

In examining the 19 cases with gastrointestinal bleeding, 3 cases (16%) were females with one case being less than 5 of age and two cases being more than 60. The age chiefly ranged from 30 to 70, but of the cases with severe head injury 3 cases were less than 5 (Table 2).

Table 2. Sex and Age of GI bleeding cases

Age	0-5 y	30 y	40 y	50 y	60 y	70 y	Total
HI	3(1)	1		1			5(1)
HIH		1	2	2		2(1)	7(1)
AN		1	3	1	2(1)		7(1)
Total	3(1)	3	5	4	2(1)	2(1)	19(3)

( )= No. of females
HI= Head injury
HIH= Hypertensive intracerebral hemorrhage
AN= Cerebral aneurysm

(3) Presence or absence of gastric ulcer in the past history

History could not be obtained on all cases, but of the 19 cases with gastrointestinal bleeding 4 cases (21%) had a past history of gastric ulcer.

(4) Site of hematoma or aneurysm

Of the cases of hypertensive intracranial hemorrhage there were 4 cases of putaminal hemorrhage with one case localized in the putamen and 3 cases with partial extension into the internal capsule. There was one case each of thalamic hemorrhage, cerebellar hemorrhage, and brain stem hemorrhage. Gastrointestinal bleeding was not observed in any case of subcortical hemorrhage. Of the cases of ruptured cerebral aneurysm, it was located in the internal carotid artery in one case, anterior communicating artery in 3 cases, middle cerebral artery in 2 cases, and basilar artery in one case. Of the cases of severe head injury, one case each of epidural hematoma, subdural hematoma, and intracerebral hematoma were observed

Table 3. The site of HIH and GI bleeding

Site	No. of cases	GI bleeding	Ratio %
Putamen	55	4	7.2
Thalamus	26	1	3.8
Subcortex	13	0	0
Cerebellum	10	1	10.0
Brain stem	15	1	6.7
Total	119	7	5.9

HIH= Hypertensive intracerebral hemorrhage

Table 4. The site of AN and GI bleeding

Site	No. of cases	GI bleeding	Ratio %
IC	45	1	2.2
A-com.	40	3	7.5
MC	34	2	5.9
VB	15	1	6.7
Multiple	13	0	0
Total	147	7	4.8

AN= Cerebral aneurysm
IC= Internal carotid artery
A-com= Anterior communicating artery
MC= Middle cerebral artery
VB= Vertebrobasilar artery system

Table 5. The kind of head injury and GI bleeding

	No. of cases	GI bleeding	Ratio %
Epidural hematoma	35	1	2.9
Subdural hematoma	28	1	3.6
Intracerebral hematoma	9	1	11.7
Cerebral contusion	73	2	2.7
Total	145	5	3.4

Table 6. Dogmatyl® and GI bleeding

	Dogmatyl (−)			Dogmatyl (+) 300 mg/day		
	No. of cases	GI bleeding	Ratio %	No. of cases	GI bleeding	Ratio %
HI	90	4	4.4	53	1	1.8
HIH	53	2	3.8	66	5	7.6
AN	84	2	2.4	63	5	7.9
Total	227	8	3.5	184	11	6.0

HI= Head injury
HIH= Hypertensive intracerebral hemorrhage
AN= Cerebral aneurysm

together with 2 cases brain contusion (Tables 3, 4 and 5).

(5) Administration of steroids

Steroids were administered to 12 cases out of 19 cases with gastrointestinal bleeding. More than 80% of the cases without gastrointestinal bleeding were administered steroids.

(6) Administration of Dogmatyl®

Dogmatyl was not administered to 227 cases who had been hospitalized between January 1977 and February 1979, but it was administered intravenously to 184 cases from March 1978 to December 1980 at a dose of 300 mg per day. An adequately reduced dose was administered to children. Castrointestinal bleeding was observed in 8 cases (3.5%) of the non-administered group and in 11 cases (6.0%) of the administered group. The difference was not statistically significant (Table 6).

(7) Operation for disease of the head

Of the 7 cases of hypertensive intracerebral hemorrhage, 4 cases (all being putaminal hemorrhage) underwent surgery for removal of hematoma. Of the 7 cases of ruptured cerebral aneurysm, clipping of aneurysm was made in 5 cases. Craniotomy was conducted on 3 cases out of 5 cases of severe head injury.

(8) Treatment and prognosis of gastrointestinal bleeding

Of the 19 cases of gastrointestinal bleeding, laporatomy was performed on 6 cases and conservative therapy was given to the remaining 13 cases. A total of 10 cases expired, that is, 2 cases among those who underwent laporatomy and 8 cases among those who received conservative therapy, for a mortality rate of 10/19 or 53%. The cause of death of all the cases was aggravation of the head disease (Table 7).

Table 7. Therapy and prognosis of GI bleeding

	Gastrectomy	Conservative therapy	Total
HI	1	4[3]	5[3]
HIH	2[1]	5[2]	7[3]
AN	3[1]	4[3]	7[4]
Total	6[2]	13[8]	19[10]

[ ]= No of dead cases. Total mortality rate= 10/19
HI= Head injury
HIH= Hypertensive intracerebral hemorrhage
AN= Cerebral aneurysm

(9) Level of consciousness during gastrointestinal bleeding

There were 6 cases of gastrointestinal bleeding with level of consciousness of one digit, of whom one case died; four cases of gastbointestinal bleeding with level of consciousness of two digit, of whom two died; and 9 cases of gastrointestinal bleeding with level of consciousness of three digits, of whom 7 died. The poorer the level of consciousness during gastrointestinal bleeding, the poorer was the prognosis.

(10) Interval from injury or onset of disease to gastrointestinal bleeding

The shortest interval was one day and the longest was 22 days for an average of 7.9 days. In cases of hypertensive intracerebral hemorrhage the interval was short for cerebellar hemorrhage and brain stem hemorrhage and the interval was relatively long for ruptured cerebral aneurysm. As a whole, in all cases of death, gastrointestinal bleeding developed within 10 days and the number of survival cases tended to be greater in cases of gastrointestinal bleeding after an interval of more than 10 days (Table 8).

Table 8. Interval between attack and GI bleeding

Day	0	2	4	6	8	10	12	14	16	22
HI	○⊕	○⊕			⊕					
HIH	○⊕		⊕	○	⊕	○	○			
AN					⊕	⊕	⊕⊕	○	○	○

○=Alive
⊕=Dead
HI=Head injury
HIH=Hypertensive intracerebral hemorrhage
AN=Cerebral aneurysm

DISCUSSION

In reviewing the literature on the frequency of gastrointestinal bleeding as a complication of disease of the head, the frequency in hypertensive intracerebral hemorrhage is 9–10% among those with definite hematesis or bloody discharge, while that in ruptered cerebral aneurysm is 2–5%, and that in severe head injury is 2–20%[1,5,9–11,16]. On autopsy, a high rate of 76% has been observed in a report focussed on hemorrhagic lecions of the gastric mucosa[22]. According to the report of Doi et al. on the endoscopic findings of the stomach within 24 hours after onset of cerebral vascular accident in 47 cases, petechial or diffuse hemorrhage or ulcer has been detected in 39 cases. Of these cases, gastric catheter produced coffeelike fluid in 7 cases[3]. The frequency depends on the criterion of lesions of the gastric mucosa and on the level of attention given to gastrointestinal bleeding, but the frequency of gastrointestinal bleeding which requires clinical attention is considered to be 5–15%.

With regard to the interval from onset to gastrointestinal bleeding, Hori et al. have reported that the interval is short in cases of severe brain lesions and is delayed in cases of mild brain lesions[6]. This is a tendency similar to that observed in our cases. Generally, in cerebral hemorrhage and head injury, during the early period of 72 hours after onset brain edema is severe and respiration, blood pressure, and pulse are unstable. If hypovolemic shock due to gastrointestinal hemorrhage should develop at this stage, the condition will become extremely unsatisfactory. After the 10 th day following onset, however, brain edema will have improved and respiratory function and circulatory function will have become stable so that the patient is better able to endure the shock attributable to gastrointestinal bleeding which would facilitate conduct of such drastic procedure as laporatomy. The difference in the aforementioned condition is considered to influence the prognosis of the patient.

According to a number of reports, in the cases of ruptured cerebral aneurysm the time of gastrointestinal bleeding coincides with the time of spasm of the cerebral artery[5,16,22]. A same tendency was also observed in our cases, for gastrointestinal bleeding mostly developed 7–10 days after onset. However, in 2 cases, gastrointestinal bleeding developed rather late, that is, on the 17 th and 22 nd day after onset.

As for the site of intracranial hematoma and gastrointestinal bleeding, it is said that gastrointestinal bleeding is prone to develop in cases of hematoma located at a site which strongly affects the hypothalamus[1,5]. As for hypertensive intracerebral hemorrhage, gastrointestinal bleeding is said to be common with hematoma of the thalamus and brain stem which are anatomically proximal to the hypothalamus[1,22]. In our cases, however, no definite tendency could be observed between the site of the hematoma and gastrointestinal bleeding.

It has been reported in autopsy of the brain with ruptured cerebral aneurysm that ischemic necrosis and perivascular hemorrhage are observed in the hypothalamus and that its frequency is high in anterior communicating artery aneurysm and internal carotid-posterior communicating artery aneurysm[5]. Handa et al. have given the following as the mechanism involved[5].

(1) Injury develops after the hemorrhage directly reaches the hypothalamus.
(2) The hematoma in the subarachnoid space remains at the base of the hypothalamus and after extending and bending the perforating arteries the hematoma extends toward the hypothalmus to bring rise to ischemic lesions.
(3) Due to the chemical action of the blood in the subarachnoid space spasm develops in the arteries supplying blood to the hypothalamus to give rise to ischemic changes in the hypothalamus.
(4) Due to the acute hyprocephalus which developed secondary to subarachnoid hem-

orrhage, the brain blood flow decreased and the hypothalamus becomes damaged due to the mechanical compression attributable to enlargement of the 3 rd ventricle.

(5) During direct surgical procedure of the aneurysm, though short, an acute contracture of the blood vessels supplying the hypothalamus develops to cause blood shortage.

In our cases the frequency of gastrointestinal bleeding was the highest in anterior communicating artery aneurysm.

By age, there was no outstanding characteristics in hypertensive intracerebral hemorrhage and ruptured cerebral aneurysm in view of the age distribution of the primary disease. As for severe head injury, there were three children less than 5 of age, indicating a high frequency in children. There is no report in the literature which describes the tendency of head injury. James et al have reporded on the course of severe head injury in 3-12 year old children, but have not detected any gastrointestinal hemorrhage[7].

As for sex difference, all the reports in the literature point out that the frequency of gastrointestinal bleeding is high in males. Yamaguchi et al in their study of autopsy cases have reported detecting gastrointestinal lesions in cases of hypertensive intracerebral hemorrhage in 52 males and 19 females[22], but have not given any mention of the cause for sex difference. In our cases, there were 16 males and 3 females of whom one was less than 5 years of age and two cases were over 60 years of age. These lead to the speculation that sex hormones might be involved.

With regard to etiology, as shown in Fig. 1, it is considered that there are three paths via the hypothalamus, that is, (1) the path via the sympathetic nervous system, (2) the path via the parasympathetic nervous system, and (3) the path via the pituitary adrenocortical system. The most important of these is the path via the sympathetic nervous system[15]. With regard to the role played by the pituitary adrenocortical system, Oda has made a study by measuring the steroid hormones in the blood and urine of brain disease patients. He has stressed that as the pituitary adrenocortical system is in a state of hyperfenction when afflicted with brain disease, its function readily reaches the saturation

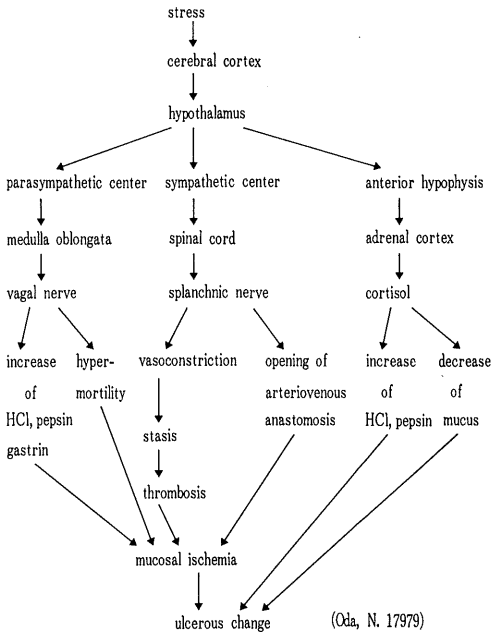

Fig. 1. Mechanism of the development of gastrointestinal lesion.

level and in order to withstand still stronger stress, administration of extrinsic steroids becomes necessary[15]. According to Kitamura et al, the endoscopic findings of the stomach during the acute stage of stroke did not show any difference between the group administered steroid hormones and the group not administered hormones[1,11]. Cooper et al. conducted medical treatment of 76 cases of severe head injury by dividing them into the group administered steroid hormones and the placebo group and observed one case of severe gastrointectinal bleeding in the placebo group[2]. In our case we did not observe any tendency for steroid hormones to stimulate gastrointestinal bleeding. However, it has been reported that aggravation of gastric mucosal lesions has been observed by gastric endoscopy[3]. In reviewing several reports in the literature, it appears evident that steroid hormones do have the action of aggravating the endoscopic lesions, but do not induce clinically manifest gastrointestinal bleeding. A sudden suspension of steroid hormone administration should be avoided[15].

Cooling of the gastric region, gastric lavage, injection of antacids, administration of hemostatics, blood transfusion, and others are available as conservative therapy for gastrointestinal

bleeding, but the hemostatic effect of these against massive bleeding is either uncertain or practically negligible[18].

As a prophylatic, Dogmatyl has been suggested from the past as a drug which acts on the hypothalamus and prevents gastrointestinal bleeding, but in our cases this drug has not demonstrated itself to be effective. Recently, Cimetidine is said to have prophylatic effect, but it is at present at a stage of being examined clinically[14].

Clipping and coagulation hemostasis have been employed heretofore as hemostatic methods under endoscopy, but in recent years coagulation hemostasis employing laser beam has been introduced[18]. However, hemostasis by this procedure is limited by the site and scope of hemorrhage and the depth of the ulcer.

A reliable hemostatic plocedure is to undertake laporatomy, followed by subtotal gastric resection or extensive gastrectomy and vagotomy[18]. When recovery of brain function cannot be expected even though recovery from hypovolemic shock is possible, laporatomy is not indicated, but if damage is considered to be reversible even though the neurologic condition is aggravated, it is recommended that early laporatomy be performed withoud missing the opportunity.

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