

: CT

1

2

CT
가
CT
(type I),
(type II),
(central cavitation)
(inner cerebral trauma)
(type III),
(type IV),
Graeb score
(type V)
CT
가
type V가 가
(p=0.001).
type III
Graeb score 4
(p=0.03).
(p=0.001).
CT
(type V)
(type I),
(type II)
CT
가
(1-3)
가
1)
(2-3, 22),
(4-6),
2)
rating vessel)
(23-24), 3)
(long axis)
(central cavita-
(14, 21), 4)
(22), 5)
(choroid plexus ar-
(16).
2-3%
(3, 14-15, 17-19),
6-8%
가 (3, 6, 9, 14-18,
가
(9, 14).

1
2

(5/6)

가

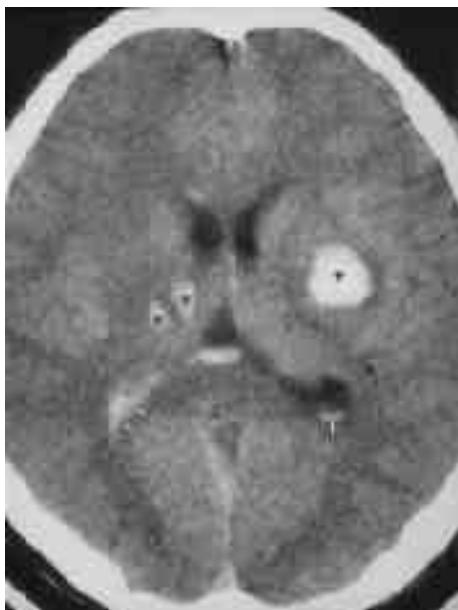
(p = 0.03) (Table 2).

61 51 , 10
 가 5 , 1 85
 10 39 가
 34.5
 Graeb Score (Table 1) 4 () 가
 37 (61%) 가 5-8 () 18
 (29%), 9 () 6 (10%)
 43% (16/37), 72% (13/18), 83%

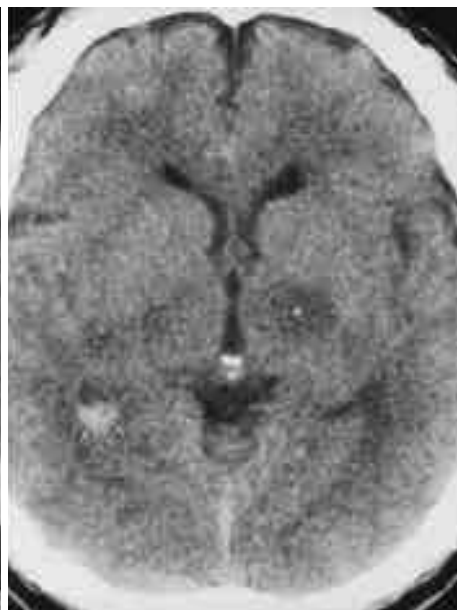
Table 2. Correlation between Graeb Score and Outcome

Graeb Score	Outcome					Total(%)
	GR	MD	SD	VS	D	
1- 4(Mild)	16	5	6	3	7	37 (61)
5- 8(Moderate)	2	3	2	-	11	18 (29)
9-12(Severe)	1	-	-	2	3	6 (10)
Total	19	8	8		21	61(100)

GR; good recovery, MD; moderate disability, SD; severe disability, VS; vegetative state, D; death



A

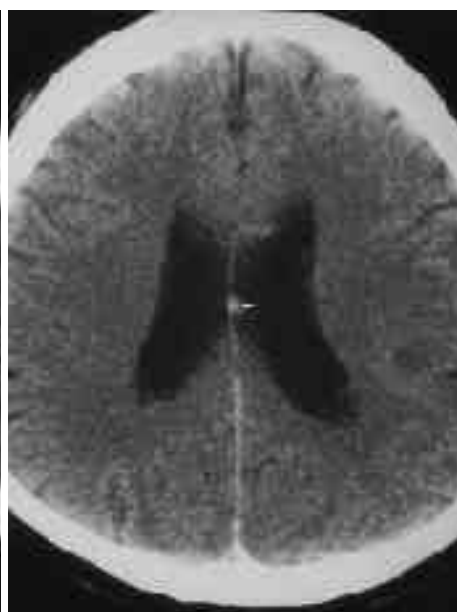


B

Fig. 2. Type II. Multiple variable-sized intracerebral hematomas(asterisks) are seen in the both basal ganglia, and some intraventricular hemorrhage(arrows) is noted in the ventricle(A). Non-hemorrhagic low density lesion(asterisk) is seen in the left gangliothalamic region with some intraventricular hemorrhage(arrows)(B).



A



B

Fig. 3. Type III. Small oval high density lesion is seen in the septum pellucidum(asterisk), and some intraventricular hemorrhage is noted in the adjacent ventricles(arrows)(A). Tiny high density lesion (arrow) is noted in the ventricular septum(B).



Fig. 4. Type V. Intraventricular hemorrhage(score 3) is noted in the both lateral ventricles.

Table 3. Outcome Characteristics of Different Mechanisms of TIVH

Type	Outcome					Total(%)
	GR	MD	SD	VS	D	
I	-	-	-	-	3	3 (5)
II	-	3	8	3	12	26 (42)
III	3	4	-	-	2	9 (15)
IV	-	-	-	-	-	0 (0)
V	16(8*)	1*	-	2	4(1*)	23 (38)
Total(%)	19(31)	8(13)	8(13)	5(8)	21(35)	61(100)

TIVH; traumatic intraventricular hemorrhage, GR; good recovery, MD; moderate disability, SD; severe disability, VS; vegetative state, D; death, *, pure intraventricular hemorrhage

Table 4. Glasgow Coma Score(GCS) and Clinical Outcome

GCS	Outcome					Total(%)
	GR	MD	SD	VS	D	
15-13	6	-	-	-	-	6 (10)
12-9	7	1	1	-	-	9 (15)
< 8	6	7	7	5	21	46 (75)
Total	19	8	8	5	21	61(100)

GR; good recovery, MD; moderate disability, SD; severe disability, VS; vegetative state, D; death

CT
38 (Type I, II, III) (62%),
(Type V) 23 (38%)
(Type II)가 26 가 , Type III가 9 ,
Type I 3 CT
(Type IV)
(Table 3).
가 Type I 100%
(3/3), Type II 85%(23/26), Type III 22%(2/9), Type
V 26%(6/23) ,
(Type V) (Type
III) 가 ,
(Type II)
(Type I) 가
(Table 3). Type V CT
10 가 가 1 8
가 가
GCS가 15-13 6 , 12-9 9 ,
8 46 GCS가 7.1
GCS가 8 46 21
(35%) (severe disability)
가 72% , GCS가 9
15 13 (87%) , GCS가 8
가 (Table
4).

가 , , ,
가 ,
가
(diffuse brain swelling)
가
2-3% (3, 14-15, 17-19),
(3, 6, 9, 14-18,
20-22)
(1).
가
(1, 5, 9,
13, 15-16, 20-21, 24, 26-27).
가 CT 가
가 (21). CT
가
가
(2-3, 5, 9, 13-14, 21-22, 28-

29). 가

가

61 3 Gentry (34-35)

(Fig. 1). 가 가 , Fujitsu , Lipper (36) CT 가 가

(21) (disruption) 6-12 Mendelsohn (37)

12 CT 가 51%

(23-24). 가 (Fig. 2A)

Type I 가 가 (Fig. 2B), thromboplastin (22), 가

(9, 21, 23-24). (1, 15) 가 (38)

(M1), 1 (A1), 1 CT

2 (P2) (long axis

of skull) 가 , 가

. Lee Wang (30) , LeRoux (9)

가 25%

가 CT 가 (),

42% 가 Fujitsu (21)

Unterharnscheidt Sellier(31) (midline

structure) 가

(negative pressure) 가

(sagittal direction) 가

(long axis) 가 (short axis) 가

가 가

가 ,

. Zuccarello (6, 21), CT 가 가

(Table 3).

(15) (central cavitation theory)

(inner cerebral trauma) (4-6, 8-15) 35-76%

가 (32). (5, 13-16, 18) 35%

(centro-axial)

(tela choroidea), , ,

가 (Fig. 가

3)(32). Tsai (20) 1/3 (1, 5, 13), Mizuno (16)

CT 6.6-19% (13-14) 50%

67%

Berry (33)

10 1 (1

(Table 3).

가 3 4 가 (9, 16). 가 (9, 14, 23-24). 가 가 가 가 (6, 13, 21). 가 (Table 2). CT 가 (39) 가 가 MR CT CT CT 가 가 가 CT

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Traumatic Intraventricular Hemorrhage : Classifications and Prognosis According to CT Findings¹

Hoon-hwa Kim, M.D., Won-kyong Bae, M.D., Chung-sik Choi, M.D., Chang-gook Kim, M.D.,
Gun-soo Han, M.D., Il-young Kim, M.D., Kyeong-seok Lee, M.D.²

¹Department of Radiology, Chonan Hospital, Soonchunhyang University

²Department of Neurosurgery, Chonan Hospital, Soonchunhyang University

Purpose : To determine clinical outcome in cases of traumatic intraventricular hemorrhage(TIVH) according to the mechanisms and amount of hemorrhage seen on initial CT.

Materials and Methods : We retrospectively reviewed the initial CT findings of 61 patients with TIVH. The mechanisms of TIVH were analyzed on the basis of the following CT findings: Type I; large intracerebral hematoma extending to adjacent ventricle; Type II: hemorrhagic and/or non-hemorrhagic diffuse axonal injury in the thalamus and basal ganglia; Type III: multiple small hemorrhagic lesions in the septum pellucidum, fornix, corpus callosum, and periventricular region, which may be due to inner cerebral trauma, Type IV: evidence of hypoxic brain injury, and Type V: TIVH with contusion and small subdural or epidural hematomas. The amount of TIVH was classified according to the Graeb score. We analyzed these mechanisms on the basis of CT findings, and for prognosis, correlated these with clinical outcomes and the Glasgow coma score.

Results : Prognosis was good in types V and III and poor in type I and II($p=0.001$). In patients with a Graeb score of 4 or less, the clinical outcome was better than in those with a Graeb score above 5($p=0.03$). Patients with a lower initial Glasgow coma score had poor outcomes($p=0.001$).

Conclusion : The hemorrhage mechanism in patients with TIVH could be important for estimating clinical outcome, especially during the early phase. In patients with type V or III TIVH, clinical outcome was better than in those with type I or II.

Index words : Brain, CT
Brain, injuries
Brain, ventricles

Address reprint requests to : Won-kyong Bae, M.D., Department of Diagnostic Radiology, Chonan Hospital, Soonchunhyang University
#23-20, Bongmyoung-dong, Chonan, Chungnam, 310-100 Korea.
Tel. 82-417-537-2101 Fax, 82-417-574-6265