

# 수술적 치료를 받은 파열성 뇌동맥류환자에서의 예후와 뇌실-복강 단락술의 예측인자로써의 Hunt-Hess Grade와 Fisher Grade

홍창기 · 박종운 · 현동근 · 하영수

= Abstract =

## Hunt-Hess and Fisher Grades as Predicting Factors for Chronic Hydrocephalus in Surgically Treated Ruptured Aneurysm

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**Objective :** The popular grading systems in use, such as Hunt - Hess grade and Fisher scale score, are based primarily on the patient's clinical conditions or computerized tomography score after aneurysmal subarachnoid hemorrhage(SAH). The author investigated whether the need for ventriculoperitoneal(VP) shunt for chronic hydrocephalus and outcome can be predicted by Hunt - Hess grade and Fisher scale.

**Methods :** A series of 146 patients admitted to our hospital from August 1991 to July 1999, who presented with SAH and underwent craniotomy for aneurysm clipping were studied retrospectively. Chronic hydrocephalus was defined as clinically and radiographically demonstrated hydrocephalus that lasted 2 weeks or longer after initial hemorrhage which required shunting. Patients were evaluated based on following factors : Hunt - Hess grade, Fisher scale, age, sex, hypertension, aneurysm location, and intervals from aneurysm rupture to operation.

**Results :** The overall mortality rate of the study group was 8.2%. Hunt - Hess grade( $p=0.001$ ) or Fisher scale ( $p=0.001$ ) at all pretreatment times was significantly correlated with outcome. In addition, there was an increased risk of poor outcome in older age( $65<$ ). However, there were statistically no significant relationship between outcome and sex, location of aneurysm, hypertension, and interval from aneurysmal rupture to operation( $p>0.05$ ). Of 134 surviving patients, 16 patients(12%) underwent VP shunt placement secondary to chronic hydrocephalus. Hunt - Hess grade( $p=0.001$ ) is more predictive of chronic hydrocephalus than Fisher scale( $p=0.146$ ). Aneurysm location was significantly correlated with development of chronic hydrocephalus ( $p<0.05$ ), without significant correlations in sex, age, hypertension, IVH, and ICH.

**Conclusion :** This study suggests that there is a high clinical correlation between outcome and Hunt - Hess grades and Fisher scales on admission, but Hunt - Hess grade is more predictive for chronic hydrocephalus than Fisher scale. In addition, age( $<65$  yrs) is the significant factor for prediction of outcome. There was a trend of increasing risk for chronic hydrocephalus according to aneurysmal location.

**KEY WORDS :** Hunt - Hess grade · Fisher grade · Chronic hydrocephalus · Aneurysmal subarachnoid hemorrhage · Shunt.

## 서 론

(4~13 ), (14 ) (0~3 ),  
 4 (21).  
 (leptomeningeal reaction)  
 7)11)13)16)21)22).  
 가 , 15)21).  
 가 20%  
 Hunt -  
 Hess grade, Fisher scale, ( , , )

## 대상 및 방법

1991 8 1 1999 7 31  
 6 가  
 146 Glasgow Out -  
 come Scale(GOS) good(good, excellent), poor,  
 dead 2  
 [bifrontal index(BFI), 3 ,  
 2mm ]  
 . BFI 35  
 , 35~40, 40

<sup>18)</sup>. GOS

Hunt - Hess grade, Fisher scale score, , ,

## 결 과

### 1. 성별 및 연령 분포

146

53 : 93(1 : 1.75) 가 , 53  
 39 65 22

### 2. 예후 추정인자

#### 1) Hunt-Hess grade

Hunt - Hess grade가 가 (p=  
 0.001), Hunt - Hess grade  
 17 (89%), grade 62 (88%), grade III 23  
 (69.6%), grade 5 (27.4%), grade  
 (Table 1).

#### 2) Fisher scale score

Fisher scale score가 (p=  
 0.001), score 1 20 (90%),  
 score 2 37 (75%), score 3 37 (64.9%),  
 score 4 12 (44.4%), score 5  
 가 6 (35.2%),  
 가 6 (60%)  
 (p=0.458)(Table 2).

### 3) 동맥류의 위치

(p=0.093),

Willis 가

**Table 1.** Outcome and VP shunt operation according to H-H grade

GOS grade	Good (n=106)	Poor (n=28)	Dead (n=12)	VP(+) (n=16)	VP(-) (n=130)	Total (n=146)
	No(%)	No(%)	No(%)	No(%)	No(%)	
I	17(89.5)	2(10.5)	0	2(10.5)	17(89.5)	19
II	62(88.6)	5(7.14)	3(4.30)	2(2.85)	68(97.1)	70
III	23(69.7)	6(18.2)	4(12.1)	10(30.3)	23(69.7)	33
IV	5(27.4)	12(63.2)	2(10.5)	2(10.5)	17(89.5)	19
V	0	2(40.0)	3(60.0)	0	5(100)	5

H-H : Hunt-Hess grade ; VP : ventriculoperitoneal shunt

**Table 2.** Outcome and VP operation according to Fisher scale score

GOS score	Good (n=106)	Poor (n=28)	Dead (n=12)	VP(+) (n=16)	VP(-) (n=130)	Total (n=146)
	No(%)	No(%)	No(%)	No(%)	No(%)	
1	20(90.9)	2(9.09)	0	2(9.09)	20(90.9)	22
2	37(92.5)	2(5.00)	1(2.50)	3(7.50)	37(92.5)	40
3	37(64.9)	13(22.8)	7(12.3)	10(17.5)	47(82.5)	57
4(ICH)	6(35.3)	8(47.0)	3(17.6)	1(5.88)	16(94.1)	17
4(IVH)	6(60.0)	3(30.0)	1(10.0)	0	10(100)	10

VP : ventriculoperitoneal shunt

ICH : intracranial hemorrhage

VH : intraventricular hemorrhage

**Table 3.** Outcome and VP operation according to aneurysm location

location	GOS		Dead (n=12) No(%)	VP(+) (n=16) No(%)	VP(-) (n=130) No(%)	Total (146)
	Good (n=106) No(%)	Poor (n=28) No(%)				
A-com	45(83.3)	6(11.1)	3(5.56)	6(11.1)	48(88.9)	54
MCA	32(69.6)	10(21.7)	4(8.69)	3(6.52)	43(93.5)	46
ICA	28(68.3)	9(21.9)	4(9.76)	6(14.6)	35(85.4)	41
Post.Cir	1(20.0)	3(60.0)	1(20.0)	1(20.0)	4(80.0)	5

VP : ventriculoperitoneal shunt  
 Post.Cir : Posterior circulation  
 ICH : intracranial hemorrhage  
 IVH : intraventricular hemorrhage

**Table 4.** Outcome and VP operation according to hypertension

HT	GOS		Dead (n=12) No(%)	VP(+) (n=16) No(%)	VP(-) (n=130) No(%)	Total (n=146)
	Good (n=106) No(%)	Poor (n=28) No(%)				
HT(+)	27(69.2)	7(17.9)	5(12.8)	4(10.3)	35(89.7)	39
HT(-)	79(73.8)	21(19.6)	7(6.5)	12(11.2)	95(88.8)	107

VP : ventriculoperitoneal shunt  
 HT : hypertension

**Table 5.** Outcome and VP operation according to age

age (yr)	GOS		Dead (n=12) No(%)	VP(+) (n=16) No(%)	VP(-) (n=130) No(%)	Total (n=146)
	Good (n=106) No(%)	Poor (n=28) No(%)				
<65	95(76.6)	23(18.5)	6(4.84)	14(11.3)	110(88.7)	124
65	11(50.0)	5(22.7)	6(27.3)	2(9.09)	20(90.9)	22

VP : ventriculoperitoneal shunt

**Table 6.** Outcome and VP operation according to intervals from aneurysm rupture to operation

time	GOS		Dead (n=12) No	VP(+) (n=16) No	VP(-) (n=130) No	Total (n=146)
	Good (n=106) No	Poor (n=28) No				
<1day	39(73.6)	10(18.8)	4(7.55)	8(15.1)	47(88.7)	53
<3day	15(62.5)	6(25)	3(12.5)	1(4.2)	23(95.8)	24
<2wks	33(75)	7(15.9)	4(9.1)	4(9.1)	40(90.9)	44
2wks<	19(76)	5(20)	1(4)	3(12)	22(88)	25

VP : ventriculoperitoneal shunt

가 (Table 3).

**4) 고혈압, 나이 및 수술시기**

가 , (p>0.05).  
 가 (p>0.05), (65 ) 가 (p=0.001)(Table 4, 5, 6).

**3. 단락술의 예측인자**

16 (10.9%)  
 59.13(SD=45.28) . (6.9%)

**1) Hunt-Hess grade와 Fisher scale score**

Hunt - Hess grade grade 가  
 33 10 (30.3%) 가 , Hunt - Hess  
 grade가 가 (p=0.001).  
 Fisher scale score score 3(17.5%) 가  
 , Fisher scale score  
 (Table 2)(p= 0.146).

**2) 동맥류의 위치와 고혈압**

가 가 ,  
 가 (p<0.05)  
 (Table 3).  
 (p=0.473)(Table 4).

**3) 성별과 나이**

53 4 (7.5%), 93 12 (12.9%)  
 ,  
 가 (p=0.319). 64  
 124 14 (11.2%), 65 20 2  
 (10%) 가  
 (p= 0.761)(Table 5).

**4) 동맥류 수술시기**

50 (34.2%) 가  
 , 46 (31.5%), ,  
 7.76 59 (40.4%) 3  
 .  
 (Table 6)(p=0.072).

**5) 방사선학적 소견**

BFI 35% 78 9 (11.5%),  
 36~40% 61 6 (9.8%) 41%  
 7 1 (14.2%)  
 (p=0.912). 가 2mm  
 96 15 (15.6%) , 2mm  
 50 1 (2%) ,  
 가 (p=0.012).  
 22 4 (18.2%),  
 124 12 (9.7%) ,  
 (p=0.239). 3 8mm  
 60 10 (16.7%), 7mm 86 6  
 (6.9%) ,

**Table 7.** Radiologic factor vs VP operation

Factors	VP(+)	VP(-)	p value
	(n=16)	(n=130)	
	No(%)	No(%)	
BFI ratio			p=ns
35%	9 (11.5)	69 (88.5)	
36 - 40%	6 ( 9.8)	55 (90.2)	
40%<	1 (14.2)	6 (85.8)	
Temporal horn			p=0.012
2mm	1 ( 2)	49 (98)	
>2mm	15 (15.6)	81 (84.4)	
Round figure of frontal horn			p=ns
Yes	4 (18.2)	18 (81.8)	
No	12 ( 9.7)	112 (90.3)	
3rd ventricle			p=ns
<8	6 ( 6.9)	80 (93.1)	
8	10 (16.7)	50 (83.4)	

ns : not significant(p>0.05)  
 VP : ventriculoperitoneal shunt  
 BFI : bifrontal index

(p=0.065)(Table 7).

**고찰**

grading system, Hunt - Hess grade, Fisher scale score, Hunt - Hess grade, Fisher scale score, grade 0 - 1, (grading), 17). Ogilvy Carter 17) 434, Hunt - Hess grade, grade - 88.7%, grade 53%, grade 6, Fisher grade, score 0 - 3 91%, score 4 51%, Chiang 3) 56, Hunt - Hess grade 38%, grade, grade 93%, Hunt - Hess grade, grade - 83.6%, grade 27.4%, grade 5, Fisher scale score, score 1 - 3 79.0%, score 4 44.4%

63, 63, 65, Ogilvy Carter 17), 52, Ca - 2.5, 가, 가, 가, 10)19), 가, 가, Bagley<sup>1)</sup>가 1928, 7.9~43%, 5)14), 가, 2)5)6)13)14), 3)15), 10, 9)12)17)21)22), 9)22), 3, 8)9)12)18)22), (p=0.012), Vale 21) 20%, Hunt - Hess grade 90%, Fisher scale score 4 46%, 16 (11.0%), Hunt - Hess grade 30.3%, Fisher scale score 3 17.5%

Hunt - Hess grade가 Fisher scale score  
 가 가  
 (Table 1, 2). 46%  
 21),  
 (10 ) 가 ,  
 (17 ) 1 .

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References

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- 1) Bagley C : *Blood in CSF. Resultant functional and organic alterations in the central nervous system. 1. experimental data. B. Clinical data. Arch Surg* 17 : 18-81, 1928
- 2) Black PMCL : *Hydrocephalus and vasospasm after subarachnoid hemorrhage from ruptured intracranial aneurysm. Neurosurgery* 18 : 12-16, 1986
- 3) Chiang VL, S Claus EB, Awad IA : *Toward more rational prediction of outcome in patients with high-grade subarachnoid hemorrhage. Neurosurgery* 46 : 29-36, 2000
- 4) Choi CY, Park SW, Kwon JT, Kim YB, Min BK, Hwang SN, et al : *Prognostic factors of the shunt operation on the hydrocephalus following subarachnoid hemorrhage. J Kor Neurosurg Soc* 27 : 178-185, 1998
- 5) Foltz EL : *Recognition and treatment of hydrocephalus following spontaneous subarachnoid hemorrhage-Discussion. J Neurosurg* 20 : 1047-1048, 1963
- 6) Foltz EL, Ward AA Jr : *Communicating hydrocephalus from subarachnoid bleeding. J Neurosurg* 13 : 546-566, 1956
- 7) Gjerris F, Borgesen SE, Sorensen PS, Boesen F, Schmidt K, Harmsen A, et al : *Resistance to cerebrospinal fluid outflow and intracranial pressure in patients with hydrocephalus after subarachnoid hemorrhage. Acta Neurochir* 88 : 76-86, 1987
- 8) Graff-Radford NR, Torner J, Adams HP Jr, Kassell NF : *Factors associated with hydrocephalus after subarachnoid hemorrhage. A report of the cooperative aneurysm study. Arch Neurol* 46 : 744-752, 1989
- 9) Joakimsen O, Mathiesen EB, Monstad P, Salseth B : *CSF hydrodynamics after subarachnoid hemorrhage. Acta Neurol Scand* 73 : 319-327, 1987
- 10) Kassell NF, Tomer JC, Jane JA, Haley EC Jr, Adams HP : *The international cooperative study on the timing of aneurysm surgery. Part 2. Surgical results. J Neurosurg* 73 : 37-47, 1990
- 11) Kibler RF, Couch RSC, Crompton MR : *Hydrocephalus in the adult following spontaneous subarachnoid hemorrhage. Brain* 84 : 45-61, 1961
- 12) Kolluri VRS, Sengupta RP : *Symptomatic hydrocephalus following aneurysmal subarachnoid hemorrhage. Surg Neurol* 21 : 402-404, 1984
- 13) Kusske JA, Turner PT, Ojemann GA, Harris AB : *Ventriculostomy for the treatment of acute hydrocephalus following subarachnoid hemorrhage. J Neurosurg* 38 : 591-595, 1973
- 14) Lee JW, Kim TS, Lim YJ, Ki GK, Rhee BA, Leem w : *Symptomatic hydrocephalus after subarachnoid hemorrhage. J Ko-*

15), Kassell 10)  
 가  
 15~32  
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결 론

Hunt - Hess grade Fisher sclae score  
 , (65 ) 가  
 .  
 Hunt - Hess grade  
 가 Fisher scale score ,  
 가 가 .  
 가  
 가 .

- rean *Neursurg* 23 : 103-109, 1994
- 15) Ljunggren B, Brandt L, Kagstrom E : *Results of early operations for ruptured aneurysm. J Neurosurg* 54 : 473-479, 1981
  - 16) Milhorat TH : *Acute hydrocephalus after aneurysmal subarachnoid hemorrhage. Neurosurgery* 20 : 15-19, 1987
  - 17) Ogilvy CS, Carter BS : *A proposed comprehensive grading system to predict outcome for surgical management of intracranial aneurysm. Neurosurgery* 42 : 959-970, 1998
  - 18) Park CO, Chae KB, Ha YS : *The study on frontal ventricular measurement and correlation between cerebroventricular index and cephalic index on normal computed tomography. J Korean Neurosurg* 19 : 607-614, 1990
  - 19) Pietila TA, Heimberger KC, Palleske H, Brock M : *Influence of aneurysmal location on the development of chronic hydrocephalus following SAH. Acta Neurochir* 137 : 70-73, 1995
  - 20) Shulman K, Martin BF, Popoff N, Ranschoff J : *Recognition and treatment of hydrocephalus following spontaneous subarachnoid hemorrhage. J Neurosurg* 20 : 1040-1047, 1963
  - 21) Vale FL, Bradley EL, Fisher III WS : *The relationship of subarachnoid hemorrhage and the need for postoperative shunting. J Neurosurg* 86 : 462-466, 1997
  - 22) Vassilouthis J, Richardson AE : *Ventricular dilatation and communicating hydrocephalus following spontaneous hemorrhage. J Neurosurg* 51 : 341-351, 1979