

Bolus Injection 방법을 이용해서 측정한 정상 성인의 뇌척수액 배출저항*

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= Abstract =

Resistance to Cerebrospinal Fluid Outflow Measured by Bolus Injection Method in Normal Adults

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Objectives : The measurement of resistance to cerebrospinal fluid outflow(R_o) can clearly delineate cerebrospinal fluid dynamics in patients with ventricular dilatation and can help in selecting patients to undergo shunt placement. With regards to type of infusion method, bolus injection is known to be more practical and safer than continuous infusion. The purpose of this study was to obtain R_o of normal adults using lumbar bolus injection method.

Material and Methods : Twenty adults aged 25 to 52 years were studied using lumbar bolus injection method. Fifteen patients with hemifacial spasm and five with cerebral concussion underwent R_o measurement under propofol general anesthesia and local anesthesia, respectively.

Results : The mean values of R_o determined 1 minute and 2 minutes after bolus injection were 4.8 ± 1.7 and 4.4 ± 1.6 mmHg/ml/min, respectively. There was no significant difference of R_o between propofol general anesthesia group and local anesthesia group. Two patients showed R_o greater than 6 mmHg/ml/min. One patient revealed unexpectedly high level of R_o due to severe spinal stenosis.

Conclusion : Mean R_o in this study was higher than that of Shapiro's study. Borderline R_o near 6 mmHg/ml/min should be regarded with caution and compared with clinical symptoms and results of other studies. Patients with severe spinal stenosis should be evaluated with caution.

KEY WORDS : Resistance to cerebrospinal fluid outflow · Hydrocephalus.

서 론

(normal pressure hydrocephalus)

3)5-7)16), 29), 9), 8)12), 13) 28), 4)5)14)18)19)21)23)24), 가¹⁰⁾, 60~74%, 50%, 3)7)20), 가 2)5)14)15)17-19)23), 가 (bolus injection) (continuous infusion) 2)5)15)17-19)21)23)24), 가 15)23-25)27), 가 15)17)23)25), 가 2)11),

2. 방법 15 2microgram/kg fentanyl 2mg/kg propofol (nitrous oxide) 1:1 propofol 100 microgram/kg/min 5 20 3-way stopcock (manometer) (P₀, mmHg) 3~7ml (V, ml) 1ml/sec (P_p, mmHg) t (1, 2, 3) (P_t, mmHg) (pressurevolume index, PVI) (resistance to cerebrospinal fluid outflow, R₀) Marrou 18)19)23) 2

$$PVI = \frac{V}{\log \frac{P_p}{P_0}}$$

$$R_0 = \frac{t \times P_0}{PVI \times \log \left(\frac{P_t}{P_p} \times \frac{P_p - P_0}{P_p - P_0} \right)}$$

대상 및 방법

결과

1. 연구대상 20 15 20 25 52 41

5~11mmHg, 8. 8 ± 1.2mmHg 3~7ml, 5ml 3 1 19 (PVI) 17~83.8ml, 27 ± 8ml 19 1 (R₀) 1.9~6.4mmHg/ml/min, 4.8 ± 1.7mmHg/ml/min, 2

Table 1. Results of resistance to CSF outflow in 20 patients

Patient category	Resistance to CSF outflow(R_o) (mmHg/ml/min)		
	R_o at 1 minute	R_o at 2 minute	R_o at 3 minute
Hemifacial spasm			
Case no.	1	1.7	1.7
	2	5.8	4.9
	3	2.5	1.9
	4	5.7	5.0
	5	5.9	5.4
	6	5.8	5.2
	7	5.8	5.3
	8	3.1	2.7
	9	5.8	5.0
	10	6.15	5.5
	11	3.0	2.2
	12	5.8	5.0
	13	2.1	1.7
	14	5.7	5.1
	15	6.4	5.6
Cerebral concussion			
Case no.	16	5.8	5.1
	17	2.0	1.9
	18	5.6	5.2
	19	5.9	5.4
	20	Failed	Failed
Mean \pm SD*	4.8 \pm 1.7	4.4 \pm 1.6	4.2 \pm 1.5

* : SD = standard deviation

(R_o) 1.7~5.72mmHg/ml/min,
 4.4 \pm 1.6mmHg/ml/min, 3
 (R_o) 1.7~5.6mmHg/ml/min, 4.2 \pm
 1.5mmHg/ml/min

가
 . 2 1
 6.4, 6.15mmHg/ml/min 6mmHg/
 ml/min (Table 1).

Propofol nitrous oxide 14
 5 1
 4.9 \pm 1.3mmHg/ml/min, 4.6 \pm 1.8mmHg/
 ml/min 가

3
 1 12
 42.9mmHg/ml/min .

20

고찰

가 2)5)14)15)17-19)23),
 (idiopathic) 가
 3)5-7)29).
 5)8)14)17)22)23).
 Glasgow Coma Scale 8
 44%가 1
 (>0.3),
 56% , 24%
 , 21% 가 26%

17).
 (arrested hydrocephalus)
 (compensated hydrocephalus)

4)27)30).
 가

가
 가

가
 4)27)30).
 (con-

tinuous infusion), (bolus injection)
 (cerebrospinal fluid space)

가

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18)19)21)23) 가
 , 가 1980 Shapiro 7 23
 1.5~4.36mmHg/ml/min, 2.8 ± 0.8mmHg/ml/min²³⁾
 Shapiro
 6mmHg/ml/min
 가가¹⁷⁾²³⁾
 가 1
 1.9~6.4mmHg/ml/min, 4.8 ± 1.7mmHg/ml/min
 Shapiro 2
 가 6.4, 6.15mmHg/ml/min 6mmHg/ml/min
 6mmHg/ml/min
 가
 15)23)25)
 가
 (pressure relaxation)
²⁴⁾ Sullivan 2) 20 1
 가
 Shapiro, Marmarou 가²⁴⁾
 15) 1998 Albeck 가
 가 , 가
 가 가²⁾¹¹⁾
²³⁾ Kosteljanetz 가
 가 가
 가
¹⁵⁾ 가
 1 2
 4.8 ± 1.7mmHg/ml/min, 4.4 ± 1.6mmHg/ml/min
 , 20
 . 20 15 2 6mmHg/ml/min
 가
 propofol¹⁾²⁶⁾
 propofol

결 론

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