

정상 MRI 소견을 보이는 외상성 뇌손상 환자에서 국소뇌혈류량의 이상

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Reduced Regional Cerebral Blood Flow in Patients with Traumatic Brain Injury Who Had No Structural Abnormalities on Magnetic Resonance Imaging : A Quantitative Evaluation of Tc-99m-ECD SPECT Findings

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ABSTRACT

Background & Purpose : Neuropsychological disorders after traumatic brain injury(TBI) are poorly correlated with structural lesions detected by structural neuroimaging techniques such as computed tomography(CT) scan or magnetic resonance imaging(MRI). It is well known that patients with TBI have cognitive and behavioral disorders even in the absence of structural lesions of the brain. This study investigated whether there are abnormalities of regional cerebral blood flow(rCBF) in TBI patients without structural abnormality on MRI, using technetium 99m ethyl cysteinate dimer(Tc - 99m - ECD) single photon emission computed tomography(SPECT) scans.

Materials and Methods : Twenty - eight TBI patients without structural abnormality on MRI(mild, n=13/moderate, n=9/severe, n=6) and fifteen normal controls were scanned by SPECT. A voxel - based analysis using statistical parametric mapping(SPM) was performed to compare the patients with the normal controls.

Results : rCBF was reduced in the right uncus and the right lateral orbitofrontal gyrus in the TBI patients. However, no increase of rCBF was noted in the patients in comparison to the normal controls.

Conclusions : These results suggest that the TBI patients, even in the absence of structural lesion of the brain, may have dysfunction of the brain, particularly of the orbitofrontal and anterior pole of the temporal cortex. They also suggest that SPECT can be a useful method to identify brain dysfunctions in combination with structural brain imaging and neuropsychological tests.

KEY WORDS : Traumatic brain injury · Single photon emission computed tomography · Statistical parametric mapping.

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서 론

TBI 가 (traumatic brain injury ; TBI) 10 200 ,¹⁾ 1996 36 , 2000 43 ,²⁾ TBI 가 가 , TBI (stroke) 가 가 ,³⁾ TBI rCBF 가 가 , (ex-ecutive functions), (statistical parametric mapping ; SPM) MRI 99m - Tc - ECD SPECT rCBF 가 ,⁴⁾ ,⁵⁾⁶⁾

연구대상 및 방법

1. 연구대상

1) 대상환자군

1997 1 1 2002 7 가 MRI TBI 가 28 19 , 9 TBI 가 TBI 가 5 (2 , 3) 26 61 (42.0±8.7) TBI Glasgow 가 13 , 9 , 6 가 (6 ~72)

2) 대조군

TBI ,⁷⁾⁸⁾ TBI (computed tomography ; CT) (magnetic resonance imaging ; MRI) TBI ,⁹⁾ TBI ,¹⁰⁾¹¹⁾ TBI CT MRI가 ,¹²⁾ CT MRI (single photon emission computed tomography ; SPECT) (regional cerebral blood flow ; rCBF) 가 ,¹³⁻¹⁵⁾ SPECT (positron emission tomography ; PET) ,¹⁶⁾ rCBF ,¹³⁾¹⁵⁾¹⁶⁾

15 가 , 4 , 22)23) 가 가 .
 MRI SPECT 가 (signal to noise ratio) ,
 16mm FWHM(full width at half maximum) 가
 (Gaussian kernel) (convolution)
 (smoothing) .
 26 61 (40.3 ± 11.5) .
 t - test

2. 연구방법

1) MR 영상 촬영

1.5 te-
 sla GE Signa Horizon LX(GE Medical System, Milwau-
 kee, Wisconsin, USA)
 , T1 -
 (TR : 450~500msec, TE : 9msec), T2 -
 (TR : 4000msec, TE : 128msec) ,
 FLAIR(fluid attenuated inversion recovery),
 (diffusion weighted image)

2) SPECT 영상 촬영

Tc - 99m ECD SPECT Siemens
 MultiSPECT III(Siemens Medical System, Inc. Hoff-
 man Estates, III, USA) 3
 360
 (low energy high resolution collimator)
 120 . Technetium 99m ethyl cystei-
 nate dimer(Tc - 99m - ECD) 740MBq(20mCi)
 , 30 . SPECT

3) SPECT 영상 자료의 분석 및 통계처리

Analyze SPM 99(St-
 atistical Parametric Mapping 99, University College
 of London, UK)²⁰⁾²¹⁾ MNI(Montreal Ne-
 urological Institute, McGill University, CA)
 (spatial normalization)

4) 자료분석

SP-
 ECT SPM99
 . 28 15
 rCBF ' compare -
 populations : 1 scan/subject(two sample t - test) '
 가
 (global count) (normalization) . ,
 ' × 0.8 ' 가
 ' 50 ' (count
 normalize)
 rCBF 가
 100 ,
 (p<0.001)
 MR T1 -
 , rCBF가
 Talairach
 23)

Table 1. Demographic data and clinical characteri-
 stics

	TBI(N=28)	Control(N=15)
Sex : Male/Female	19/9	13/2
Age(years)		
Mean(SD)	42.0(8.7)	40.3(11.5)
Range	26 - 61	26 - 61
Severity :	13/9/6	
Mild/Moderate/Severe		
Time after injury(months)		
6 - 12	9	
12 - 24	14	
>24	5	

TBI indicates traumatic brain injury ; and SD, standard deviation
 Statistical significance by student t-test for age & sex

결 과

1. 연구대상의 인구학적 및 임상적 특성

(1).

2. 환자군과 대조군 간 rCBF의 비교

$p < 0.001$

rCBF

(right uncus),

(right lateral orbitofrontal gyrus)

가

(1).

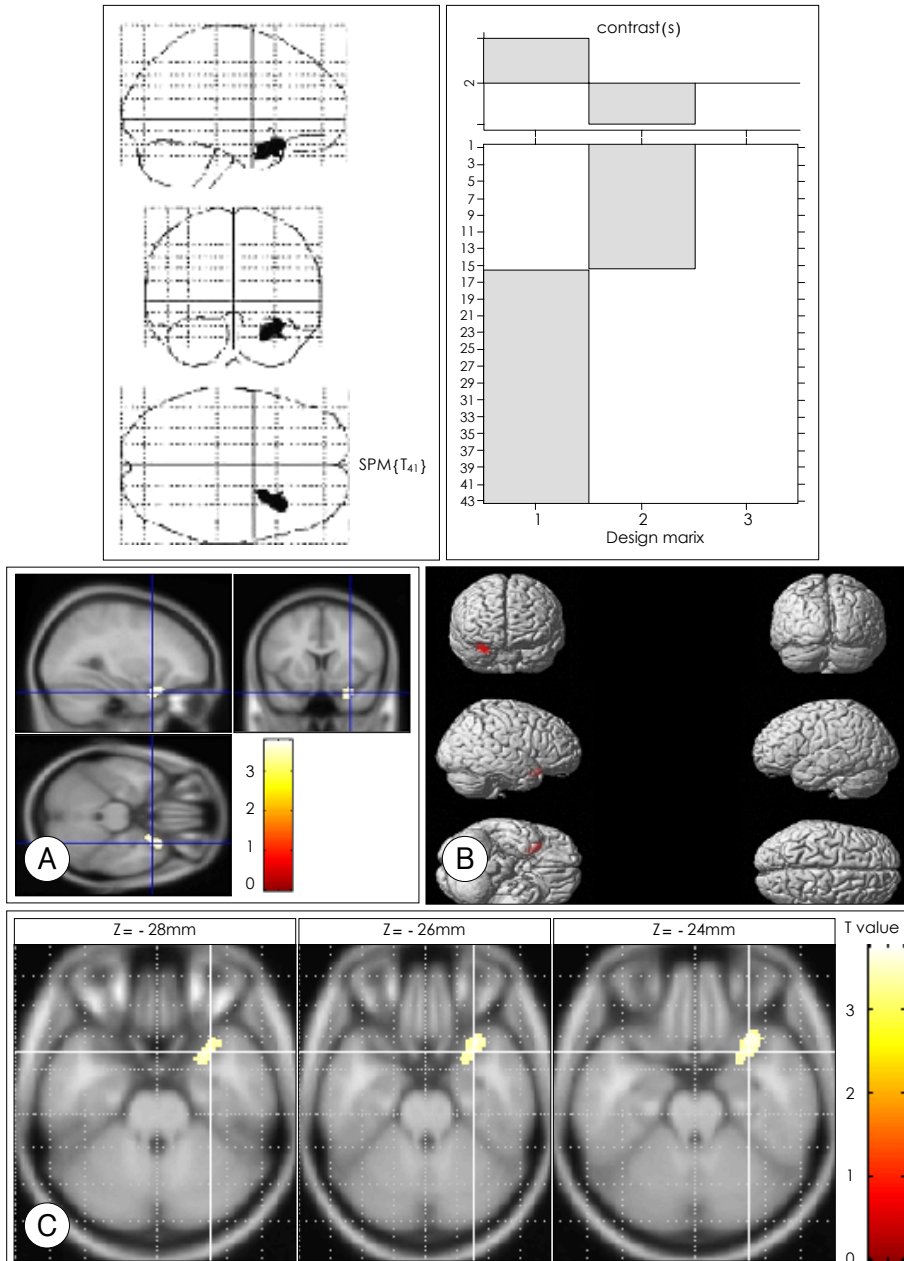


Fig. 1. Brain regions where rCBF was lower in the TBI group ($n=28$) compared with the normal control ($n=15$). The yellow and red areas showed lower rCBF in TBI group ($p < 0.001$). Reduced rCBF is noted in the right uncus and the right lateral orbitofrontal gyrus. (A) sections view, (B) render view, (C) slices view.

고 찰

TBI 가 , 가 ²⁷⁾ SPECT
rCBF , SPECT
. CT MRI
. SPECT
. rCBF 가 , SPECT가
, MRI SPECT 가
TBI 가 , MRI
. SPECT
. ¹⁶⁾²⁴⁾ , SPECT 가
, TBI
TBI 가 가 , TBI
가 (orbital area) (an-
terior pole) ¹⁾²⁴⁾²⁵⁾ Wiedmann 가
²⁶⁾ rCBF Stamatakis ²⁷⁾ 가
(cingulate gyrus)
. Ichise ¹⁶⁾ ,
TBI
rCBF MRI
Prayer ²⁸⁾ 18 CT , SPECT
TBI 가 , MRI rCBF SP-
, SPECT , ECT가
rCBF
. rCBF 가 ,
MRI 가
가 가 SPM , SPECT
가 . 가 ,
¹⁸⁾²⁹⁾ TBI SPECT 가
¹⁾¹⁷⁾³⁰⁾ Ichise ¹⁶⁾ , ROI
SPECT 가
. Fontaine ³¹⁾ PET (pre-
frontal cortex) (cingulate gyurs) **결 론**
rCBF 가 TBI rCBF , rCBF
. SPM SPM
, SPECT 가 SPECT가

MRI가 TBI
rCBF

rCBF

가

중심 단어 :

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