

심방중격결손 소아에서 개심수술이 뇌 대사에 미치는 영향 : 수소 자기공명분광을 이용한 연구

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Evaluation of Cerebral Metabolism for Children Undergoing Open Heart Surgery for Atrial Septal Defect Using Proton Magnetic Resonance Spectroscopy

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ABSTRACT

Background and Objectives : The purpose of this study was to investigate whether a brief cardiopulmonary by-pass, with mild hypothermia and normal flow, would have any deleterious effects on brain metabolism in children. This is the first study using localized in vivo proton magnetic resonance spectroscopy (1H-MRS) in brains of children with ASD undergoing open-heart surgery (OHS). **Subjects and Methods :** Seven children undergoing surgical closure of ASD, with mild hypothermia and normal flow cardiopulmonary by-pass, were studied. Their ages ranged from 18 to 47 months, and body weights ranged from 11 to 17 kg. We performed 1H-MRS before OHS, and 1 -3 months after, then compared the values of brain metabolite ratios before and after surgery. The values from our patients were compared to those from 12, age-matched, normal children. All MR imaging, and localized 1H-MRS, were performed using a GE 1.5T SIGNA system (General Electric Medical System, Milwaukee, USA). Image guided STEAM-spectra were obtained from, the parietal white matter (PWM), and occipital gray matter (OGM), with TE of 30 msec, and TR of 3 sec, using a PROton Brain Exam (PROBE) (General Electric Medical System, Milwaukee, USA). **Results :** All metabolite ratios, measured by 1H-MRS, from patients before surgery showed no significantly difference from postoperative values. However, [choline/creatine] ratios, obtained from PWM, were higher in both pre- and postoperative ASD patients, as compared to those of normal children. **Conclusion :** We concluded, that brain metabolism, measured by 1H-MRS, does not change significantly after OHS, for children with ASD, with mild hypothermia and normal flow. (Korean Circulation J 2002;32(2):155-162)

KEY WORDS : Cardiopulmonary bypass ; Brain ; Metabolism ; Heart septal defects, atrial ; Magnetic resonance spectroscopy.

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서론

(magnetic resonance spectroscopy, MRS)

가 , ,
1-3)
(proton MRS, ^1H -MRS)
(proton containing metaboli-
tes), creatine(Cr), choline(Cho), N-acetyl-as-
partate(NAA), myo-Inositol(ml)

가 4-7)
NAA/Cho NAA/Cr 가
8-11)
NAA lactate
가 12)
가 13)

14)
15)16)
가
17)

가 18)

가

가

19)

대상 및 방법

대 상

1999 6 12
가 7
, ,
, ,
(
33) (nor -
mal flow cardiopulmonary bypass)
1 3
5
chloral hydrate 5%
Pentobarbital
vecuronium
isoflurane bupivac -
aine morphine
SARNs 5-Roller pump SX-10 oxygen -
ator Prime
Hartman NaHCO_3 20% ma -
nnitol, 20% albumin, heparin, cefa 가

방 법

가

Shielded gradient system
GE 1.5Tesla SIGNA system(General Electric Medical System, Milwaukee, USA)

T2 weighted image

(Fig. 1). Image guided STEAM(Stimulated Echo Acquisition Method) pulse sequence

(PROBE, PROton Brain Examination) (Spectrum)
(parietal white matter) (occipital gray matter)
Echo time 30 msec,
repeat time 3 second 36
(voxel) 6 8 mm

Sunsparc - 10 workstation

post - processing . N - acetyl - aspartate(NAA)
2.02 ppm, creatine 3.02 ppm, choline 3.25 ppm, myo - Inositol 3.56 ppm 가 peak
(Fig. 2). cr -

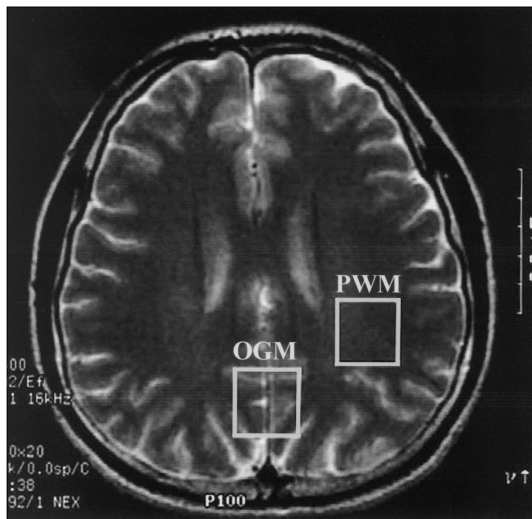


Fig. 1. Location of voxels in parietal white matter (PWM) and occipital gray matter (OGM) for localized proton magnetic resonance spectroscopic examination.

eatine

NAA/creatine , choline/creatine , myo - Inositol/creatine NAA/choline
Wilcoxon Signed Ranks Test
 $p < 0.05$

window version 7.51

SPSS

chloral hydrate

ate

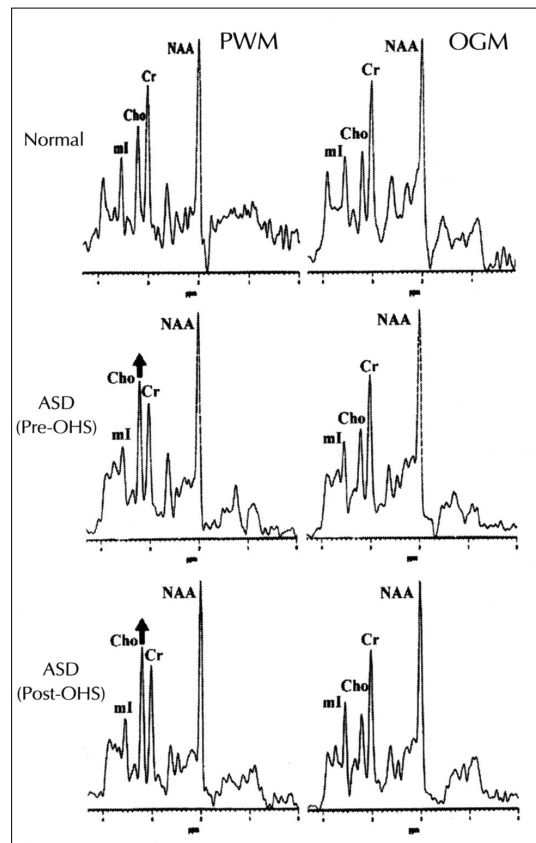


Fig. 2. Magnetic resonance spectrum acquired from a normal child and an ASD patient before (Pre-OHS) and after open heart surgery (Post-OHS) from the PWM and OGM of the brain. Arrows indicate the higher choline peak from an ASD patient before and after surgery as compared to choline peak from a normal child. Abbreviations are the same as shown in Table 1. PWM : parietal white matter, OGM : occipital gray matter, ASD : atrial septal defect, NAA : N-acetyl aspartate, Cho : choline, Cr : creatine, ml : myo-Inositol, OHS : open heart surgery.

Table 1. Cerebral metabolite ratios measured by proton magnetic resonance spectroscopy from patients with atrial septal defect before and after open heart surgery (n=7) in comparison to age matched normal children (n=12)

		PWM				OGM			
		NAA/Cr	Cho/Cr	ml/Cr	NAA/Cho	NAA/Cr	Cho/Cr	ml/Cr	NAA/Cho
ASD	Pre-OHS	1.51 ± 0.12	1.05 ± 0.11*	0.57 ± 0.07	1.45 ± 0.16	1.36 ± 0.11	0.59 ± 0.07	0.53 ± 0.06	1.66 ± 0.09
	Post-OHS	1.49 ± 0.11	1.01 ± 0.10*	0.57 ± 0.09	1.48 ± 0.17	1.38 ± 0.07	0.58 ± 0.07	0.56 ± 0.08	2.40 ± 0.32
NI	2 - 5 years	1.39 ± 0.14	0.81 ± 0.12	0.55 ± 0.12	1.74 ± 0.36	1.34 ± 0.08	0.57 ± 0.06	0.56 ± 0.08	2.36 ± 0.31

Values as mean ± SD. PWM : parietal white matter, OGM : occipital gray matter, ASD : atrial septal defect, NAA : N-acetyl aspartate, Cho : choline, Cr : creatine, ml : myo-Inositol, OHS : open heart surgery, NI : normal, * : p<0.05 by paired Student's t-test between pre- and postoperative values from ASD patients and the values form normal age matched children

Table 2. Cerebral metabolite ratios from two patients with atrial septal defect who had 1H-magnetic resonance spectroscopy before, 5 days after, and 2 months after open heart surgery

		PWM				OGM			
		NAA/Cr	Cho/Cr	ml/Cr	NAA/Cho	NAA/Cr	Cho/Cr	ml/Cr	NAA/Cho
Pt 1	Pre-OHS	1.49	0.88	0.54	1.69	1.30	0.71	0.61	1.83
	5 days PO	1.67	1.17	0.79	1.43	1.38	0.47	0.58	2.94
	2 mo PO	1.55	0.87	0.54	1.78	1.32	0.70	0.63	1.89
Pt 2	Pre-OHS	1.52	1.14	0.59	1.33	1.29	0.50	0.46	2.58
	5 days PO	1.39	0.96	0.56	1.45	1.24	0.45	0.48	2.76
	2 mo PO	1.62	0.99	0.57	1.64	1.32	0.53	0.62	2.49

PO : postoperative, Pt : patient, PWM : parietal white matter, OGM : occipital gray matter, NAA : N-acetyl aspartate, Cho : choline, Cr : creatine, ml : myo-Inositol, OHS : open heart surgery

결 과

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가 (16-28)

1
38 67
가 , , ,
가

Table 1, 2 Fig. 1, 2

가

Cho/Cr

29)

(Wilcoxon Signed Ranks Te -

st, p<0.05).

17) 가

, 가 가

5

가

고 찰

(reper -

[illegible]

¹⁾⁴⁻⁷⁾ Lactate

NAA/creatine
lactate 가가

⁸⁻¹²⁾

요 약

배경 및 목적 :

가

가

가

1

방 법 :

¹⁴⁾

1999 6 11

7

NAA
가

lactate

¹²⁾

3 5) 11 17 kg(13
kg) 1 2 3

creatine 가
¹³⁾

가

5

1 3

GE 1.5T SIGNA system(General Electric Medical System, Milwaukee, USA)

Image guided STEAM(Stimulated Echo Acquisition Method)

가

(PROBE) (parietal white matter) (occipital gray matter)

가

(N - acetylaspartate, creatine, choline, myo - Inositol) (TE : 30 msec, TR : 3 sec).

결 과 :

cho -

line/cratine ratio 가

Cho/Cr

가

가

가 (Wilco -

xon Signed Ranks Test, p<0.05). 5

결 론 :

가

중심 단어 : ; ; ;

(# 17, #242)

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