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(corticospinal tract, CST)

4 CST (diffusion tensor imaging DTI) CST FA (" "),
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Q959.848

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0254-5853-(2013)02-0103-05

A DTI study of the contralateral corticospinal tract modeled through simulated intracranial space-occupying lesions in macaque brain motor areas

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Abstract: Recent studies found that a loss of motor function following corticospinal tract (CST) damage can, to some extent, be restored. Few studies, however, examine how space-occupying lesions in the brain motor area may affect the contralateral CST structure and function. We performed a simulation of intracranial space-occupying lesions in the brain motor area by implanting of balloons into the brains of the two healthy macaques. Diffusion tensor imaging (DTI) was performed on the macaques' brains four times to measure the FA values of the contralateral CST operative area. The results showed that on the day of balloon implantation, the FA values had no obvious effect, but with time the effect increased, becoming increasingly apparent one week after removing the balloons. Experimental results demonstrated that this model was both feasible and reliable. After the simulated space-occupying lesions occurred in the brain motor area, DTI showed a compensatory response of the contralateral CST, which remained for a short period of time even after the lesions were removed. This result suggests that the contralateral CST may then also contribute to recovery of limb function.

Keywords: Macaque; Simulation model of intracranial space-occupying lesions; Corticospinal tract; Diffusion tensor imaging

2012-10-15

2013-03-05

(2008CD006)

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				FA		(Barrick & Clark, 1)
	(corticospinal tract CST)		2004; Klose et al, 2004)	FA		
				DTI		
CST			Yu et al, 2009)			
	(Susan, 2005)		CST			
CST						
(Meintzschel & Ziemann, 2006; Dong, 2006)				DTI		
				CST	FA	
			CST			
			1			
			1.1			
	(Kuai et al, 2009)			5 a		7.1 kg
	(Liao & Su, 2012)		7.8 kg			
					AAALAC	
			1.2			
			1.2.1			
	CST	1	(0.4 mg/kg mg/kg)	12 h	6 h	15 30
	"	"		15 mg/kg		
	(diffusion tensor imaging DTI)		cm ²		1 cm	2x3
			mL	5 min	0.5 mL	1.5
(Le et al, 2003; Eriksson et al, 2001)						
						4 h
	"	"				
(fractional anisotropy, FA) (Beaulieu & Allen,1994)			1.2.2			
					()	
			FA			
(Chenevert et al,1990)	0	1	1			
	0					
			1.2.3			

Glasgow (Teasdale & Jennett,1974),
 0 1 1.4
 2 () 3 SPSS17.0
 () 4 mean±SD
 3 P<0.05
 MRI 2
 1.3 DTI 2.1
 DTI (Achieva 3.0T ()
 PHILIPS) 1 1 2) (P>0.05)
 1 d (Before) 2 0
 (Just) 3 7 d (P<0.05
 1 d (Remove) 4 14 d (P<0.05
 7 d (Recover)
 MP-RAGE DT-MRI P<0.05
 DTI 12 2.2 DTI CST FA
 FA
 CST (regions of interest, ROI) FA DTI CST (1)FA
 ROI

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Table 1 Contralateral limb function in macaques after balloon implantation

Post-operation	Same day	1 1d	2 2d	3 3d	4 4d	5 5d	6 6d	7 7d
Macaque 1	4	3	3	3	3	3	2	2
Macaque 2	3	3	3	3	3	2	2	2

Z=-0.617 () P=0.537 () P=0.721 P>0.05
 Z=-0.617 Asymp.sig. (2-tailed) P=0.537 Exact sig [2*(1-tailed sig.)] P=0.721, P>0.05.

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Table 2 Contralateral limb function in macaques after balloon removal

Post-operation	Same day	1 1d	2 2d	3 3d	4 4d	5 5d	6 6d	7 7d
Macaque 1	2	2	2	2	2	1	1	1
Macaque 2	2	2	2	2	1	1	1	0

Z=-0.657 () P=0.511 () P=0.574 P>0.05
 Z=-0.657 Asymp.sig. (2-tailed) P=0.511 Exact sig [2*(1-tailed sig.)] P=0.574, P>0.05.

3 DTI FA (mean±SD)
Table 3 FA values of 4 DTI on two macaques (mean±SD)

	Before (before operation)	Just (day of operation)	Remove (day before balloon removal)	Recover (7 days after balloon removal)
Macaque 1	0.3570± 0.0038	0.3588± 0.0089	0.3651± 0.0076	0.3991± 0.0059
Macaque 2	0.4974± 0.0095	0.4985± 0.0227	0.5028± 0.0064	0.5344± 0.0056

CST

FA

CST

ROI

FA

CST

CST

Yeo et al (2010)

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