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A Case of Brain Death with Abnormal Movement after Craniocerebral Trauma

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Abstract | **Case Report**

Regulating rigorous judgement on brain death is the premise of organ donation for brain injury patients. During the process of judging brain death, there is abnormal movement, which should be identified. This article has reported a case of brain death patient, in which the patient was confirmed to be brain death according to Chinese brain death judgment instruction and by means of clinical judgement and three confirmation tests. But owing to the abnormal movement, there was misunderstanding between relatives and medical staff. Abnormal movement and brain death judgement are not conflict. The explanation on this should be done well, so that organ donation can be successfully implemented.

Keywords: Brain Death, Abnormal Movement, Spinal Reflex, Organ Donation.

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INTRODUCTION

Since January 1, 2015, organ donation patients with brain injury have become the only legal source of organ transplantation in China. The determination of brain death is crucial for organ donation: Apart from the criterion above, patients with brain injury have to meet the ethical requirements for organ donation [1]; at the same time, any abnormal movement must be identified to avoid misunderstanding, so as to facilitate the smooth implementation of organ donation [2]. In this paper, we report a case of severe brain injury, which ended up with brain death based on strict procedures. In this process, abnormal movement of upper limbs occurred, which greatly puzzled the family members and even some medical workers as there had been few reports before. For this reason, this paper reports this case in detail and discusses some problems in the implementation of brain death judgment.

CASE REPORT

History

The patient, a 30-year-old woman, was admitted to the intensive care department of the First Affiliated Hospital of Sun Yat-Sen University on May 12, 2016 8 days after 'consciousness disorder after falling'. On May 4, 2018, she developed into unconsciousness after a fall and was immediately sent to local hospital by ambulance. The Head CT indicated 'left frontal lobe cerebral contusion and laceration as well as brain swelling'. The patient was immediately treated with left frontotemporal craniotomy hematoma removal along with bone flap decompression. She was still in a deep coma after the surgery, and was transferred to our hospital for further diagnosis and treatment due to 'severe brain injury'.

Physical Examination

The patient was in a deep coma and showed no facial muscle activity at all with thumb strongly pressing her supraorbital notch on both sides. Glasgow Coma Scale (GCS) was 3 points [3]. Her neck was soft with both negative bilateral gram and Brudzinski's sign. Nociceptive stimulus of the upper extremity can cause upper extremity flexion. Bilateral pupil dilation at the diameter of 5 mm on both sides without direct and indirect light reflection. No corneal reflex. No cephalo-ocular reflex. No vestibular ocular reflex. No cough reflexes [4].

Spontaneous breathing: Observe the patient for two minutes after taking off the ventilator, with cotton swab in front of the tracheal catheter. No significant swab silk swinging, no chest or abdomen movement.

Apnea test

(1) give 100% oxygen for 10 minutes for blood gas analysis; (2) take away the ventilator for 10 minutes; (3) place the oxygen catheter at the carinal level through the artificial airway immediately after taking off the ventilator, the oxygen catheter was placed at the carinal level through the artificial airway, with input of 100% oxygen for 6 L/min;(4) closely observe

whether there is breathing movement in the chest and abdomen; (5)after 8-10 minutes away from the ventilator, arterial blood was extracted to detect $PaCO_2$ and mechanical ventilation was restored[5].

Tab-1: Results of blood gas analysis after disconnecting the ventilator

PH	7.2	K+	3.5 mmol/L
PaO_2	327 mmHg	Na+	150 mmol/L
$PaCO_2$	78 mmHg	Glu	8.9 mmol/L
BE	1.5 mmol/L	LAC	0.9 mmol/L
HCO_3^-	30.5 mmol/L	HB	92 g/L

Diagnosis: No spontaneous breathing with no sign of breathing movement at $PaCO_2$>60mmHg.

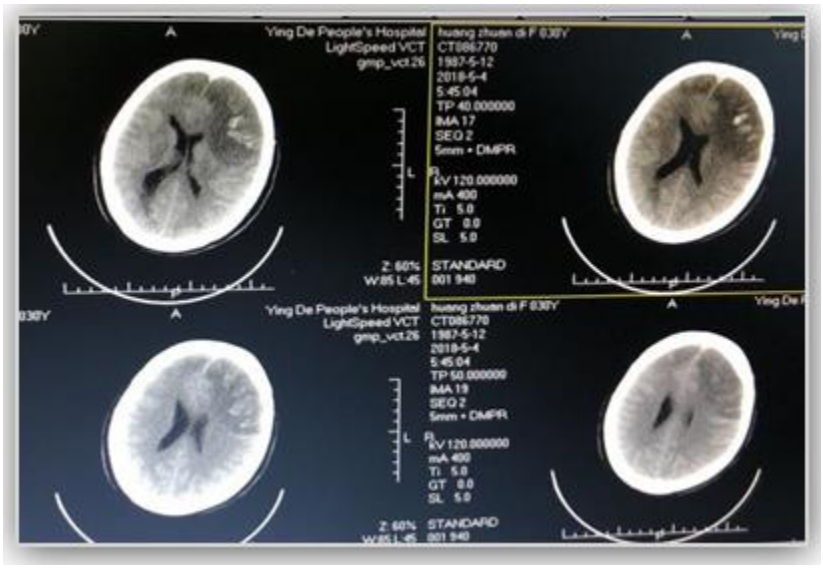

Fig-1: Head CT on the day of injury: contusion and laceration of the left frontal lobe, brain swelling, and midline displacement

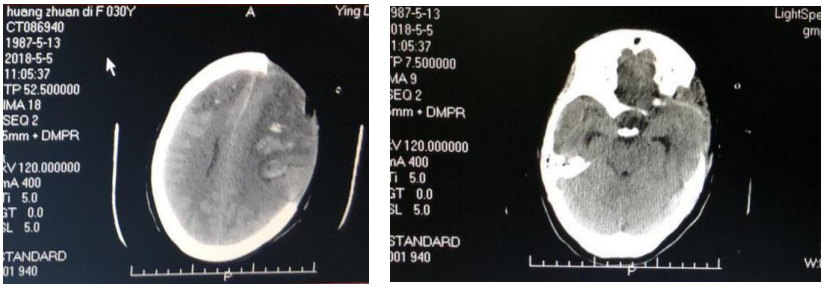

Fig-2: Head CT on the second day after injury: left cerebral infarction with cerebral hemorrhage, midline displacement, unclear .ambient cistern

Other auxiliary examinations

EEG: Continuous recording was performed for 39 min, and the wavebands of each lead were all less than 2uV/mm, during which the following treatment was given to the patients: 1. Facial and limb pain stimulation; 2. Acoustic stimulation; 3. Oulopupillary light stimulation without electrical stimulation. The brain was in an electrically quiescent state. (Figure 3):

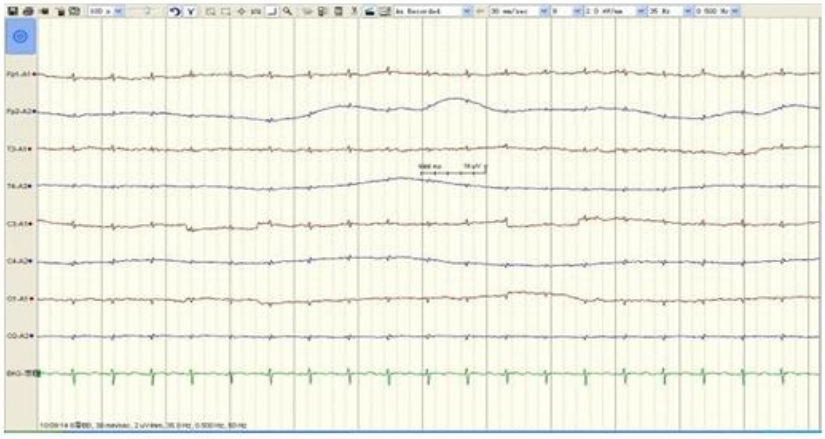

Fig-3

SLSEP (Short-Latency Somatosensory Evoked Potential): Indication of bilateral N9, with no sign of N13, P14, N18 and N20 (Figure 4).

TCD (Transcranial Doppler ultrasound): LMCA showed oscillatory wave; RMCA showed no blood flow signal; BA showed nail wave (Figure 5).

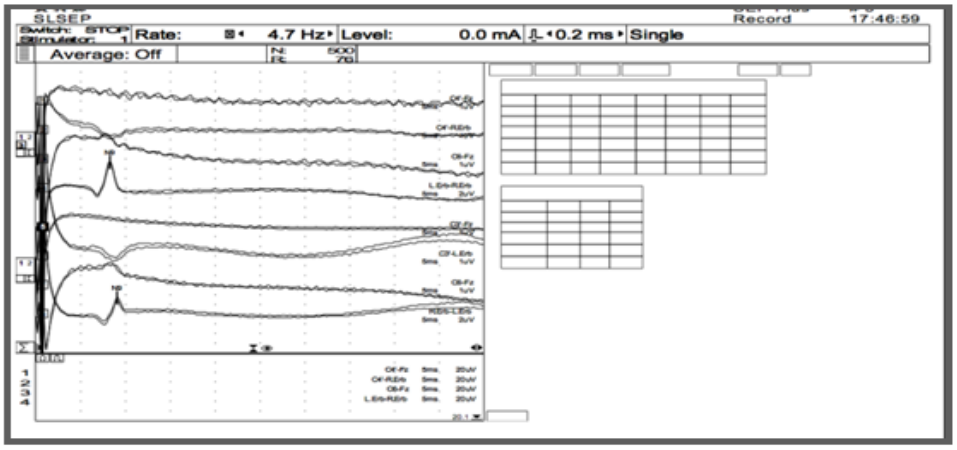

Fig-4

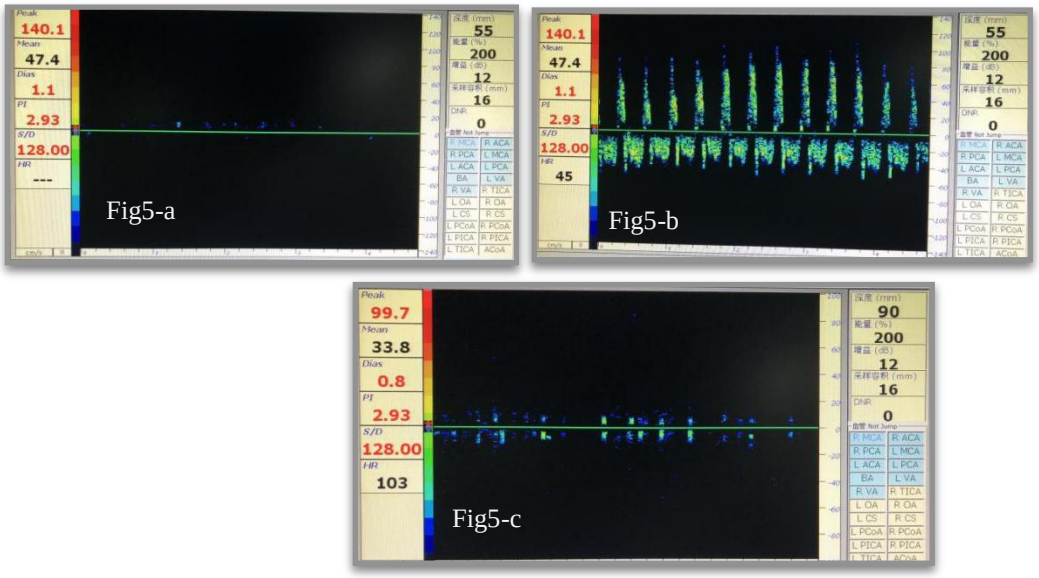

Fig-5: TCD images (Fig5-a: RMCA showed no blood flow signal; Fig5-b: LMCA showed oscillatory wave; Fig5-c: BA showed nail wave)

Apnea test, EEG, TCD and SLSEP should be reviewed at least 12 hours after being implemented. The second time, the patient still met the criteria for brain death. After two rounds of tests, the patient was confirmed as brain death [6]. However, the patient's family members proposed that the patient's upper limbs showed abnormal activities after being stimulated, and they believed that the patient was not in a state of brain death for the time being, and that the patient had the possibility of survival against craniocerebral injury. For these reasons, they refused to donate organs. Some medical staff showed different degrees of concerns for the patient, not sure whether the patient was in a state of brain death. We have made a clear explanation for this. After the patient was in a state of brain death, part of the spinal cord was functional, and the activity of the head and upper limbs stimulated were categorized as spinal reflex. An example of this was the "frog leg electrical stimulation": after the frog's head was removed, stimulation at the frog leg with electric current led to movement of the leg. Finally, the patient's family showed understanding and accepted the conclusion. In the end, they signed on the organ donation consent. The organ donation was performed successfully on May 15, 2018. A total of one liver, two kidneys and two corneas were obtained, and five patients were revived.

DISCUSSION

Potential organ donors of brain death are a major source of organ transplants worldwide. The standards for brain death must be strict and accurate; Organ donation meets the ethical standard only by going through qualified brain injury determination procedures. The patient fell into coma because of severe craniocerebral trauma based on the following evidence: 1) definite history of trauma. 2) Head CT: frontal lobe contusion and midline displacement; 3) surgical findings. Physical examination: deep coma, GCS score 3 and no sign of five stem reflex (pupillary light reflex, corneal reflex, head-eye reflex, vestibular eye reflex and cough reflex). There was no spontaneous breathing, which was verified by apnea test. The above clinical diagnosis had met the criteria for brain death. Three confirmatory tests: electroencephalogram (EEG), transcranial doppler ultrasound (TCD), and short latency somatosensory evoked potential (SLSEP) all met the criteria for brain death [6]. After the strict technical processes above, we determined that this patient was in the state of brain death without any doubt.

However, for some patients with brain death, there is abnormal movement. This abnormal movement could arouse misunderstandings that the patient is not brain-dead yet, discouraging the patient's family to consent on organ donation; In addition, some medical staff also misunderstood that the patient was not classified as brain dead, and did not contact relevant institutions to obtain the organs. This situation has resulted in a decrease in organ sources and exacerbated the current shortage of donor organs. Therefore, it is particularly important to correctly identify abnormal movement in patients with brain death and understand its pathophysiology and related factors.

There are two major types of abnormal movement in patients with brain death. One is spontaneous movement, and the other is abnormal movement caused by stimulations. This report looks at the latter situation where there is abnormal movement of the head and limbs after stimulation. In most cases, it occurs within 24 hours after brain death, usually no more than 72 hours. The incidence of such brain death abnormalities has been reported at a proportion of 13.4-75%, with large differences and diversities [7, 8]. After brain death, surviving spinal cord function is the source of abnormal movement. These abnormal movements are caused by single-segmental muscle stretch reflex, single-segmental dermatomyotic reflex or multi-segmental spinal automatic reflex. Most of these abnormal movements are caused by external mechanical stimuli [9]. In this case, upper limb dyskinesia was caused by nail bed compression, painful stimulation of upper limb and periodic turning. In order to avoid misunderstanding, it is suggested that doctors or organ donation coordinators should explain the causes of abnormal movements in a simple and accessible way when communicating with the patient's family members about the disease. It is strongly recommended to use "frog leg experiment" for this purpose. At the same time, in the donation process, avoid excessive stimulation of brain death patients as much as possible.

It is reported that changes in brain death are associated with higher systolic blood pressure (> 120mmHg). A higher blood pressure level is conducive to hemodynamic stability, thus causing reflex from remaining spinal cord [10]. It has also been reported that primary brain stem injury and spontaneous respiratory arrest within 72h and at the age of below18 years old are associated with abnormal movement in brain dead donors. Primary brain stem injury results in complete separation of the brain and spinal cord in a short period of time, which releases the spinal cord function under cerebral inhibition and leads to abnormal movement associated with spinal cord reflex. In the early stage, the spinal cord below the occipital perforation was still alive. During this period, when the spinal cord is stimulated by the outside world, it is prone to have abnormal movement. The younger the age, the less developed the brain function, and the more active the spinal cord. Relatively active spinal cord is prone to have abnormal movement. In the case of patients with brain death suffering from the above risks, possible abnormal movement should be put forward to the patients' family members as soon as possible along with a reasonable explanation.

CONCLUSION

In the process of organ donation, the criterions of brain death should be standardized and rigorous. Abnormal movement of patients with partial brain death should be identified. And for patients with abnormal movement after brain death, the causes should be explained to the patients' family members to facilitate the smooth implementation of organ donation.

REFERENCES

1. Powner DJ. Certification of brain death: Take care, Lancet. 2009; 9: 373(9675):1587-9.
2. Beckmann Y1, Çiftçi Y, Incesu TK et,al, Spinal reflexes in brain death, Acta Neurol Belg. 2014 Dec; 114(4):303-6.
3. Teasdale GM1, Pettigrew LE, Wilson JT. Analyzing outcome of treatment of severe head injury: a review and update on advancing the use of the Glasgow Outcome Scale, J Neurotrauma. 1998 Aug;15(8):587-97.
4. Eelco FM. Wijdicks, The Diagnosis of Brain Death, N Engl J Med. 2001; 344:1215-1221.
5. Ropper AH, Kennedy SK, Russell L. Apnea testing in the diagnosis of brain death: clinical and physiological observations. J Neurosurg. 1981; 55:942-6
6. Brain Injury Evaluation Quality Control Centre of National H, Family Planning C. Criteria and practical guidance for determination of brain death in adults (BQCC version). Chin Med J (Engl) 2013;126:4786-4790
7. Frequency of Spinal Reflex Movements in Brain-Dead Patients patients. Döşemeci L, Cengiz M, Yilmaz M, Transplant Proc. 2004 Jan-Feb; 36(1):17-9.
8. Spinal reflexes in brain death. Beckmann Y1, Çiftçi Y, Incesu TK Acta Neurol Belg. 2014; 114(4):303-6.
9. Brain death-associated reflexes and automatisms. Jain S1, DeGeorgia M, Neurocrit Care. 2005;3(2):122-6.
10. Factors Affecting the Occurrence of Spinal Reflexes in Brain Dead Cases. Hosseini MS1, Ghorbani F, Ghobadi O, Exp Clin Transplant. 2015;13(4):309-12.