

Brief Communication



Single-photon emission computed tomography imaging for brain death donor counseling

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Abstract

Organ donation awareness is very poor in India. We have a high demand for transplant organs with poor supply. Apnea test is the confirmatory test for brain death in our country. The Transplantation of Human Organs Act does not support any ancillary testing for the confirmation of brain death in our country. Radionuclide scan is used widely in western countries as a confirmatory test. We in our institution used this as a tool for family counseling with successful conversion rate.

Keywords: Organ donation, radionuclide imaging, single-photon emission computed tomography

Access this article online

Website: www.ijccm.org

DOI: 10.4103/0972-5229.188200

Quick Response Code:



Introduction

Awareness of brain death and possibility of organ donation is poor among the population of India. We have high demand rates for transplants, and the supply does not match the need. The doubts in the legal procedure of declaring brain death add to this poor statistics in our country. The intensivist needs to be aware and declare all brain deaths and introduces them to the choice of organ donation. The conversion rates in India are very challenging due to various cultural and social aspects. The intensivist should use every opportunity and counsel all families not using medical jargons, but with language, they can understand to agree for organ donation. A visual representation of brain death of their loved ones most times helps in positive conversion rate. We share our institutional experience of using radionuclide scan images for family counseling with successful conversion rate.

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Center

Our private hospital is situated in a big city in Tamil Nadu, India. We had 28 successful donations over 17 months which were started in February 2014. This center contributed to 50% of the total donations which happened in the city during these 17 months until June 2015.

Population

All the brain dead patients in our institutions who underwent radionuclide scan as a part of their workup for brain death confirmation. There were 6 out of 28 patients who underwent this test. All these patients were confirmed brain death using apnea test. All six patients agreed for organ donation. The test was done for all patients, and it was done on the discrimination of

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How to cite this article: Palaniswamy V, Sadhasivam S, Selvakumaran C, Jayabal P, Ananth SR. Single-photon emission computed tomography imaging for brain death donor counseling. *Indian J Crit Care Med* 2016;20:477-9.

each family circumstances and the progress of the family counseling done by the intensive care team. Our nuclear medicine department used technetium-99m (^{99m}Tc) ethylene cysteine diamine for the procedure. This is similar to the one used in western countries.

Single-photon Emission Computed Tomography

Radionuclide imaging is one of the ancillary testing methods used in western countries for brain death confirmation. It includes using a radionuclide isotope ^{99m}Tc hexamethylpropylene amine oxime (HMPAO) which helps in assessment of brain perfusion. ^{99m}Tc HMPAO is a brain-specific tracer, and it is not an agent which is influenced by quality of the bolus given and the delayed images proves the absence of cerebral blood flow. A gamma camera with a field of view large enough to image entire head and neck is required. Tracer flow, static, and single-photon emission computed tomography (SPECT) images will be taken. SPECT images allow better visualization of perfusion to brainstem and posterior fossa structures.

Flow images in brain death are characterized by a lack of blood flow to the middle cerebral artery, anterior cerebral artery, and posterior cerebral artery. There will be a lack of tracer activity in the superior sagittal sinus during the venous phase of the flow study. There will be a lack of "blush" of activity in the middle of the head during flow images. It is termed as "hollow skull or empty skull sign" [Figures 1 and 2]. There will be

accompanying blush of activity in the region of the nose called the "hot nose sign." Delayed planar or SPECT images should not show any tracer uptake in the brain to confirm brain death.^[1]

Discussion

SPECT imaging is one of the recommended ancillary testing methods for determination of brain death. It is used along with clinical determination to confirm brain death. In Indian setup, Transplantation of Human Organs Act – amended 2014 does not recommend any ancillary testing for confirmation of brain death other than apnea test. The apnea test is the gold standard test in our country. We are sharing our experience where this test was used for counseling families which led to a successful conversion rate. This is a single center experience.

In our hospital, we declared 35 brain deaths over 17 months of which 28 families agreed for organ donation. We did the radionuclide scan along with apnea test in 6 patients. The scan was done for more visual presentation during counseling and helped us to get hundred percent conversions in all these patients. Family accompanies during our transport of the patient to the nuclear medicine department. The procedure was explained, and consent was obtained. The isotope was injected in a peripheral line and images were done. The nuclear medicine specialist explained the procedure and what those images mean with normal SPECT images of the brain. He confirms the findings for brain death and advises the family. The intensive care specialist continues the second phase of counseling in the counseling room with the reports. We explain about the clinical brain death testing and the ancillary test which was performed to double confirm brain death.

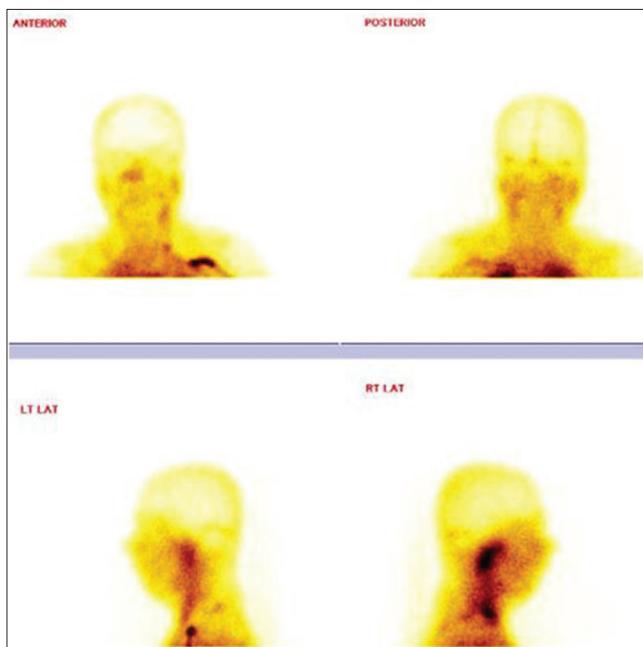


Figure 1: The "hot nose sign"

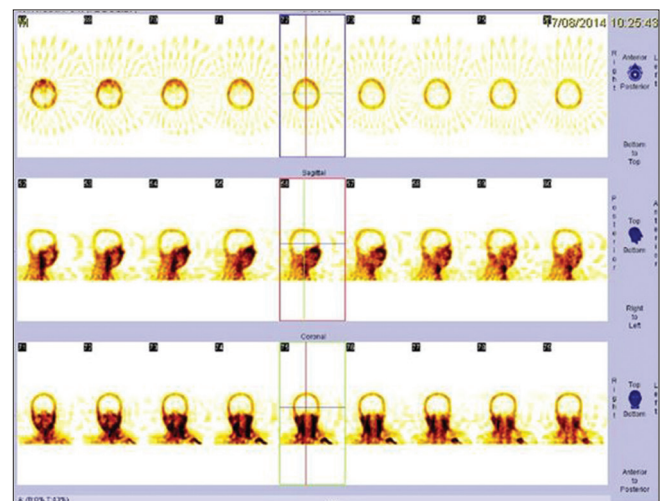


Figure 2: The "empty skull sign"

Radionuclide scan with ^{99m}Tc for brain death confirmation is done in most western countries. This ancillary testing is used in situations where performing of apnea test is not possible due to severe chest injuries and lung contusion. This is also done when the apnea test done is indeterminate or doubtful. Four-vessel angiography, electroencephalogram (EEG), and transcranial Doppler are the other ancillary testing methods which are used in these circumstances. EEG, which is widely used in the United States, has higher sensitivity and specificity compared to somatosensory potentials and transcranial Doppler. The sensitivity and specificity of the radionuclide scan are yet to be compared and studied.^[2] There are studies which compared the radionuclide scan to contrast angiography and found it to be very reliable, noninvasive, and safe test.^[3]

Conclusion

Organ transplants and their success are the only hope for patients with end-stage failure. There is an acute shortage of donations in spite of high population of brain dead patients. A timely diagnosis and declaration help in

this noble cause. A detailed family counseling with right results of the test will help the donor family from undue hope and anxiety. The intensivist can lead the team in this process. A visual representation with imaging can sometimes help in conversion. A larger study in the perspective of imaging as a process of declaration in an Indian setup will be helpful.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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