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Original Research

Retrospective Analysis of Patients Diagnosed with Brain Death in Our Hospital in the Last 15 Years

Murat Sahin,[1] Mustafa Altinay,[1] Ayse Surhan Cinar,[1] Hanife Yavuz[2]

[1]Department of Anaesthesia and Intensive Care, University of Health Sciences Türkiye, Sisli Hamidiye Etfal Training and Research Hospital, Istanbul, Türkiye
[2]Department of Organ and Tissue Transplantation, University of Health Sciences Türkiye, Sisli Hamidiye Etfal Training and Research Hospital, Istanbul, Türkiye

Abstract

Objectives: Retrospective analysis of cases diagnosed with brain death in our hospital in the last 15 years.

Methods: The files and computer records of the cases diagnosed with brain death in the intensive care units of our hospital between January 2008 and January 2023 were evaluated retrospectively. The demographic data of the cases, the primary disease leading to brain death, the complementary tests used in the diagnosis of brain death, the day on which brain death was diagnosed in the intensive care unit, and the donor status were examined.

Results: A total of 228 cases diagnosed as brain death were detected. Seven patients with missing data were excluded from the study. 61.99% of the cases were male, 38.01% were female, 14.02% were under 18 years old, 68.34% were between 18 and 65 years old, 17.64% were over 65 years old. Brain death was diagnosed in 69.69% of the patients admitted to the intensive care unit in the first 7 days, 22.17% in 7–14 days, and 8.14% after 14 days. The primary disease causing brain death was found to be 47% hemorrhagic cerebral injury, 21% traumatic hemorrhagic injury, 18% ischemic cerebral injury, and 14% hypoxic cerebral injury. No ancillary testing was used in 38% of the cases. Carotid doppler ultrasound was used in 36%, computed tomography angiography was used in 22%, and transcranial doppler was used in 4%. Families agreed to be organ transplant donors in 28.95% of the cases. 71.05% family members refused to be organ transplant donors.

Conclusion: The number of organ donations and the diagnosis of brain death has decreased rapidly with the covid-19 pandemic. In order to increase organ donation, we think that the necessary education should be given at an early age to increase organ donation awareness and social awareness.

Keywords: Brain death, computed tomography angiography, organ donation, organ transplantation

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Brain death is a clinical condition characterized by the complete and irreversible loss of brain, cerebellum and brainstem functions, which are the parts of the central nervous system located within the skull, and characterized by irreversible coma, areflexia and the absence of spontaneous breathing in the patient.[1]

The concept of brain death was first defined in 1959. The diagnosis of brain death was standardized in 1968 by establishing the Harvard Criteria.[2]

"Brain death" has been defined by legal regulations in coun-

Address for correspondence: Murat Sahin, MD. Department of Anaesthesia and Intensive Care, University of Health Sciences Türkiye, Sisli Hamidiye Etfal Training and Research Hospital, Istanbul, Türkiye
Phone: +90 507 066 66 80 **E-mail:** murat_sahin52@hotmail.com

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tries and significant progress has been made in establishing an organ transplant pool. The first legislation of what "brain death and organ transplantation" means in Türkiye was enacted in 1979 and lastly updated in 2022.[3]

The definitive treatment method for many diseases that result in organ failure is still organ transplantation. In recent years, the number of organ donations and transplants has increased significantly in our country. In our country, kidney, liver, heart, cornea, face, lung, pancreas and extremity transplantations are performed. Today, the use of new drugs and the improvement of postoperative care conditions improve the patient's quality of life and reduce the post-transplant mortality rate.[4]

In this study, we aimed to evaluate the demographic data of cases diagnosed with brain death in the last 15 years, the primary disease leading to brain death, the complementary tests used in the diagnosis of brain death, the day on which brain death was diagnosed in the intensive care unit, and the donor status.

Methods

The study, which was designed as a retrospective descriptive study, was approved by the ethics committee of our local hospital with the number 2249 dated February 21, 2023. All procedures were carried out in accordance with the ethical standards specified in the Declaration of Helsinki (2008). Between January 2008 and January 2023, it was planned to include patients diagnosed with brain death in the intensive care units of our hospital according to the diagnostic criteria in the legislation updated by the ministry in 2022, 2012 and 2002.[3,5-7]

Patients diagnosed with brain death who fulfilled these criteria were included in the study by scanning the hospital file and computer system. Patients with missing data were excluded from the study. The demographic data of the patients, the primary disease that led to brain death, the day on which brain death was diagnosed in the intensive care unit, the complementary tests used in the diagnosis of brain death, and whether there was a donor were recorded.

The relatives of the case diagnosed with brain death, first of all, are explained by the specialist physician who primarily followed the patient; the occurrence of brain death, what it means to be brain death, and the differences between it and vegetative life. Afterwards, an interview is held with the relatives of the case whose death was reported by the organ transplant coordinator, information is given about organ donation and the family's decisions on this issue are asked. In case they give consent for organ donation, their written consent is urgently sent to the organ transplantation regional coordination center affiliated to the ministry of health, and with their coordination, organs are distributed across the country, especially the patients waiting for emergency, organ extraction procedures are carried out simultaneously by the recipient centers authorized by the Ministry of Health.

Statistical Analysis

Statistical analyzes were performed using the SPSS Windows 16.0 (SPSS Inc, Chicago, IL, USA) program. All data were analyzed descriptively. Variables were expressed as percentages.

Results

The files of 228 patients diagnosed with brain death in the intensive care units of our hospital between January 2008 and January 2023 were accessed. Seven patients with a primary disease leading to brain death and missing data on the day of brain death in the intensive care unit were excluded from the study. 221 patients were included in the study.

61.99% of the cases were male and 38.01% were female. It was observed that 14.02% of the cases were under the age of 18, 68.34% were between the ages of 18–65, and 17.64% were over the age of 65 (Table 1).

Brain death was diagnosed in 69.69% of the patients admitted to the intensive care unit in the first 7 days, 22.17% in 7–14 days, and 8.14% after 14 days. Ancillary testing was not used in 38% of cases. Carotid doppler ultrasound was used in 36%, computed tomography (CT) angiography was used in 22%, and transcranial doppler was used in 4%. While 28.95% of the cases were accepted by their families to be organ transplant donors, 71.05% of their relatives refused to be organ transplant donors (Table 2).

Primary diseases causing brain death were hemorrhagic cerebral damage (47%), traumatic hemorrhagic damage (21%), ischemic cerebral damage (18%), and hypoxic cerebral damage (14%) (Fig. 1). If we look at the distribution by years, we see that the figures reached the highest level with 27 brain death diagnoses and 10 donors in 2013 (Fig. 2).

Table 1. Demographic data of patients

	Number of cases (%)
Age	
–18	31 (14.02)
18–65	151 (68.34)
–65	39 (17.64)
Gender	
Women	84 (38.01)
Men	137 (61.99)

Table 2. Diagnosis times, ancillary tests, and donor data

	Number of cases (%)
Brain death diagnosis time	
First 7 days	154 (69.69)
7–14 days	49 (22.17)
After 14 days	18 (8.14)
Auxiliary tests used in diagnosis	
Transcranial doppler USG	9 (4)
CT angiography	49 (22)
Carotid doppler USG	80 (36)
Not used	83 (38)
Donor status	
Became a donor.	64 (29)
Not became a donor	157 (71)

CT: Computed tomography; USG: Ultrasonography.

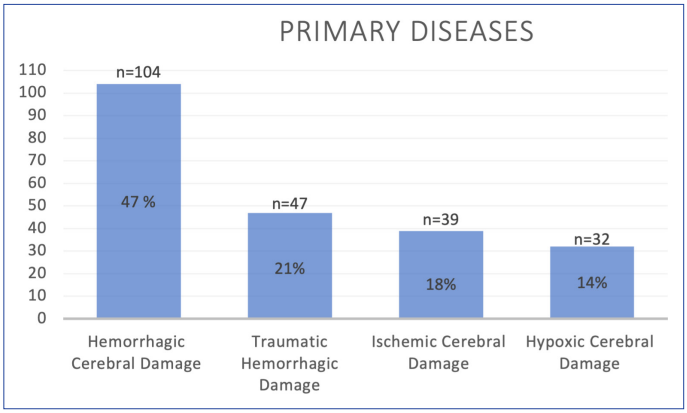

Figure 1. Primary disease leading to the diagnosis of brain death.

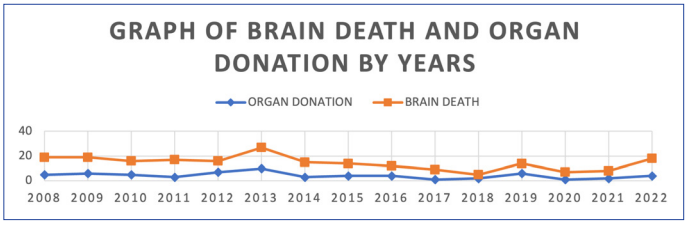

Figure 2. Donor status of cases and brain death diagnosis and organ donation status of cases by years

Discussion

Awareness of brain death is increasing in the world. The trainings, seminars and social media promotions of the Ministry of Health and related associations for the awareness of the diagnosis of brain death in our country lead to an increase in awareness. Despite all this, organ donation still has not reached the desired levels.

In two separate studies conducted in Türkiye between 2008–2019 and 2014–2018, it was determined that approximately 55% of the cases were male and the mean age was 49 and 53, respectively.[8,9] In addition, in the study of Sipahioglu et al.[10] examining the cases diagnosed with 1998 brain death between 2011 and 2019, 63.8% were male and 36.2% were female, and the median age of the cases was 38 years. In the cohort study conducted on 69,735 cases in the USA between 2012 and 2016, 56.47% of the cases were male and 43.53% were female. The mean age of the cases was found to be approximately 48 years.[11] In a study conducted in Switzerland, 50% of the 76 cases who accepted to be donors between 2013 and 2020 were male and 50% female, and the median age of the cases was 57.[12] In a study conducted with 116 cases in the Arabian peninsula between 2011 and 2012, it was found that 82.75% male/17.25% female, with a mean age of approximately 44.[13] They divided the cases diagnosed as brain death in South Korea between 2000–2010 and 2011–2020 into two groups. In the first decade, 23.8% of the cases were female and 76.2% were male, while in the second decade, 27.2% of the cases were female and 72.8% were male, with a mean age of approximately 36 and 46, respectively.[14] In our study, the mean age was found to be 43 years. It is seen that this data is compatible with the literature published in our country, America and Asia, but the average age is higher in publications in Europe. We attributed this to the high proportion of the elderly population of the European continent. In the study, we found that approximately 62% of the cases were male. In the literature review, it was observed that the male ratio was higher in all studies.

The primary disease causing permanent brain death in Türkiye has been identified as approximately 50–55% intracranial haemorrhage.[8,10,15] In Spain with 1844 cases and in Italy with 1286 cases, the primary disease causing death was found to be intracranial hemorrhage in 56% and 52%, respectively.[16,17] In the study literature, the primary disease of cases with brain death was found to be hemorrhagic cerebral damage in 47% of cases. In our study, traumatic brain injury, which caused brain death, was in the second place with 21%. It is seen that this rate is high when compared to western countries. The rate of traumatic brain injury in socio-economically low and middle-income schools is reported as 21–34%.[18-20] According to the World Health Organization, low-income school road traffic death rates are 24.1 and 9.2/100,000 people, respectively, according to high-income outcomes.[21,22] The rate of 12.9/100,000 people who have an annual traffic accident among donors explains the high rate of traumatic brain injury causing brain death.[21]

In studies conducted in Türkiye, the mean time between admission to intensive care unit and diagnosis of brain death was found to be 2.5–6 days.[9,10,15,23] In a study conducted

in Europe, it was found between 2.5 and 7 days.[17] In our study, the mean time between admission to the intensive care unit and the diagnosis of brain death was found to be 6 days, consistent with the literature.

According to the laws of the countries, the use of ancillary tests or which auxiliary test they will use varies.[24] In studies where confirmatory testing was used in diagnosing brain death in Türkiye, it was used in 30–70% of patients, and we see that CT angio was used most frequently.[8,10,15] Ancillary tests were used at a rate of 24% in Sweden and 95% in Spain. CT angio and EEG were used most frequently,[12,16] respectively. The use of brain death protocol and ancillary test differs in Asian and Pacific countries, except for 5 countries.[25] In our study, auxiliary tests were used to support the diagnosis in 62% of the cases that were clinically diagnosed with brain death. Among the auxiliary tests, carotid Doppler was used in 58% of cases, CT angiography in 35.5% and transcranial Doppler in 6.5%. While 70% of the carotid Doppler assisted tests were used in the first 10 years of our study, we see that CT angiography was used by 85% in the last 5 years. We attribute the reason for this difference to the fact that carotid Doppler is more open to the interpretation of the person doing it, and that CT angiography gives more objective results. In addition, we think that detecting the absence of brain flow with the auxiliary test 12 h after the apnea test without waiting for the second neurological examination is valuable in terms of potentially increasing the success of transplantation of organs to be taken from the donor.

It has been reported that the rates of refusal to be a donor by families of cases diagnosed with brain death are 46% in the United States, 41% in the United Kingdom, and 10.5% in France and Belgium.[26-28] However, according to the data registered in the Turkish National Coordination Center, the rate of organ donor rejections is 73.3%.[29,30] In addition, while the organs used in organ transplantation operations in our country are obtained from donations of 80% living and 20% cadavers, this rate is the opposite in developed countries.[30] In our study, the organ donor rejection rate of families was found to be 71%, consistent with the data of our country. We attribute the high rejection rates to education, social pressure and religious beliefs.

Conclusion

As a result, the retrospective analysis of patients diagnosed with brain death in the last 15 years in our hospital shows that the number of brain death and donors was at the highest level in 2013, and the decline accelerated in 2020 with the covid-19 pandemic, and these rates decreased by approximately 50% in 2022. We think that it is necessary to raise awareness of the society from the 1st years of education in order to increase brain death and organ donation from cadavers.

Disclosures

Ethics Committee Approval: This clinical study was approved by Sisli Hamidiye Etfal Training and Research Hospital Ethics Committee with the number 2249 dated 21/02/2023.

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Conflict of Interest: None declared.

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