Beyin ve Sinir Cerrahisi Yoğun Bakım Ünitesinde Beyin Ölümü Tanısı Alan Olguların Retrospektif Olarak Değerlendirilmesi

Retrospective Evaluation of the Cases Diagnosed with Brain Death in the Neurosurgery Intensive Care Unit

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Abstract

Introduction The diagnosis and follow-up of brain death cases in intensive care units are critical in terms of donor and organ transplantation. This study sought to retrospectively assess the cases of brain death in the neurosurgery intensive care unit.

Materials and Methods After the approval of the local ethics committee was obtained, patients who had been diagnosed with brain death between May 2011 and May 2021 in the Neurosurgery Intensive Care Unit of Health Sciences University Izmir Bozyaka Training and Research Hospital were evaluated retrospectively.

Results Of 19 patients diagnosed with brain death, 10 (52.6%) were male, 9 (47.4%) were female, and the mean age was 55.78 (30-74) years. Diagnosis at admission included intracranial hemorrhage (52.6%), traumatic brain injury (36.8%), brain tumor (5.2%), and hydrocephalus (5.2%). Accordingly, diagnostic procedures had been initiated. The diagnosis had been made via an apnea test and neurological examination in 15 of the cases. As the apnea test could not be performed in two cases, additional tests had been performed to support the diagnosis. The rate of cases becoming a donor was 15.7%.

Conclusion In this study, we found that the proportion of patients who had been diagnosed with brain death and had become a donor in the neurosurgery intensive care unit was low. It should be kept in mind that patients with pathologies, such as head trauma, cerebrovascular events, and poor prognosis, may be potential donors and that the necessary examinations and tests for the diagnosis should be initiated without delay.

Keywords Apnea test, Brain death, Organ donation, Intensive care

Özet

Amaç Yoğun bakım ünitelerinde beyin ölümü olgularının tanı alması ve takip edilmesi donör ve organ nakli açısından önemlidir. Bu çalışmada beyin ve sinir cerrahisi yoğun bakım ünitesinde beyin ölümü tanısı alan vakaların retrospektif olarak değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler Bu çalışmada yerel etik kurul onayı alındıktan sonra Sağlık Bilimleri Üniversitesi İzmir Bozyaka Eğitim ve Araştırma Hastanesi Beyin ve Sinir Cerrahisi Yoğun Bakım Ünitesi'nde 2011 yılı mayıs ayı ile 2021 yılı mayıs ayı arasındaki beyin ölümü tanısı alan hastalar retrospektif olarak değerlendirilmiştir.

Bulgular 9 tane beyin ölümü tanısı alan hastanın 10 'u (%52,6) erkek, 9'u (%47,4) kadın olup, yaş ortalaması 55,78 (30-74) sene olarak bulundu. Yatış tanıları intrakranial kanama (%52,6), travmatik beyin hasarı (%36.8), beyin tümörü (%5,2) ve hidrosefali (%5,2) idi. Beyin ölümü tanısı 15 olguda apne testi ve nörolojik muayene ile konuldu. 2 olguda apne testinin yapılamaması sebebiyle tanıyı desteklemek için ek testler uygulandı. Hastaların %15,7'si donör oldu.

Sonuç Bu çalışmada beyin ve sinir cerrahisi yoğun bakım ünitesinde beyin ölümü tanısı alan ve donör olan hastaların oranının düşük olduğunu saptadık. Kafa travması, serebrovaskuler olay gibi patolojilere sahip, prognozu kötü olan hastaların potansiyel donör olabileceği unutulmamalı, zaman kaybetmeden tanıya yönelik gerekli muayene ve tetkikler başlatılmalıdır.

Anahtar Kelimeler Apne testi, Beyin ölümü, Organ bağışı, Yoğun bakım

INTRODUCTION

Brain death is defined as the long-term and irreversible loss of all brain activity, with no reversible conditions that simulate this clinical condition. It is characterized by the complete absence of voluntary movements, response to stimuli, consciousness, lower brain stem functions, and spontaneous breathing [1]. The diagnosis of brain death has serious medical, ethical, and legal ramifications. Once a brain death diagnosis is made, it will have irreversible consequences, such as organ removal.

A brain death diagnosis is determined by clinical examination following international standards [2]. Brainstem areflexia, low Glasgow coma scores (GCS), and loss of spontaneous breathing all point to a brain death diagnosis. Furthermore, ancillary tests that supplement the clinical examination can be used in the diagnosis. In some countries, the use of ancillary tests is required by law in certain circumstances [3].

In our country, brain death has been diagnosed unanimously by two physicians, one of whom is an anesthesiology and reanimation specialist or an intensive care specialist and the other a neurology specialist or neurosurgeon, following evidence-based medicine guidelines since 2014 [4].

Organ loss can occur if the diagnosis of brain death is delayed. As a result of this delay, patients awaiting transplantation will have fewer treatment options. Physicians working in intensive care units play critical roles in the donor and organ transplantation processes. Some of these roles include brain death diagnosis, donor care, informing family members of brain death, informing the organ transplant coordinator, and initiating the process.

In this study, cases diagnosed with brain death between May 2011 and May 2021 in the Neurosurgery Intensive Care Unit of the University of Health Sciences Izmir Bozyaka Training and Research Hospital were assessed retrospectively.

MATERIALS AND METHODS

This study was authorized by the Clinical Research Ethics Committee of Health Sciences University Izmir Bozyaka Training and Research Hospital (date: 08/06/2022 and number: 2022/98). This single-center study examined the archival records of cases diagnosed with brain death in a 4-bed secondary-level neurosurgery intensive care unit, covering ten years between May 2011 and May 2021.

All patients hospitalized in the intensive care unit were evaluated daily by a neurosurgeon or an anesthesiology and reanimation specialist. The diagnostic criteria for brain death (absence of metabolic imbalances, availability of normothermic conditions, and not being sedated) had been met. Diabetes insipidus, hypotension, hypothermia, and electrolyte imbalances were also observed during the follow-up of brain death cases. Data on patients diagnosed with brain death were collected, including age, gender, diagnosis at admission to the intensive care unit, additional diseases, surgical interventions, mean time from admission to the intensive care unit until brain death diagnosis, physicians who made the brain death diagnosis, supportive tests performed for diagnostic purposes, and family donation acceptance/rejection rates, were recorded.

The study's statistical analyses were carried out using the Statistical Package for Social Sciences version 20 (IBM Corp., Armonk, NY, USA). Descriptive statistics of the parametric quantitative data of the study group were provided using mean ± standard deviation, descriptive statistics of non-parametric quantitative data were presented using median values (lower, upper values), and categorical data were presented using percentages (%).

RESULTS

During this study, 19 patients were determined to have a brain death diagnosis. Three patients following surgery and 16 patients from the emergency department had been admitted to the neurosurgery intensive care unit. Of these patients, ten (52.6%) were male, nine (47.4%) were female, and the mean age was 55.78 (30–74) years. At admission, the most common diagnoses were intracranial hemorrhage (52.6%), traumatic brain injury (36.8%), brain tumor (5.2%), and hydrocephalus (5.2%) (Fig. 1).

The anesthesia and reanimation specialist had considered

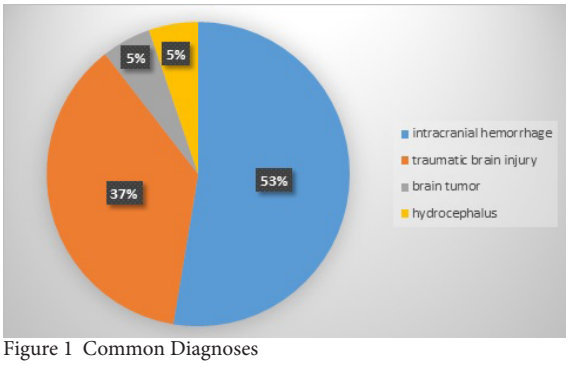

Figure 1 Common Diagnoses

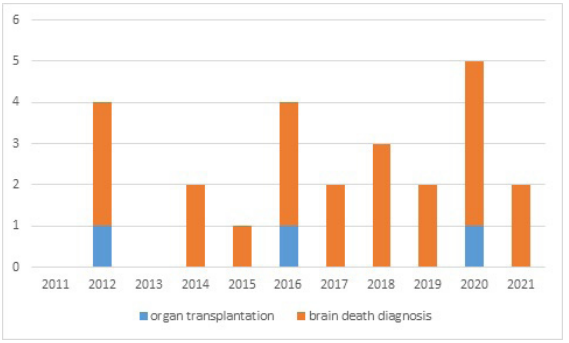

Figure 2

initiating the brain death procedure in five patients, and a neurosurgeon had considered it in fourteen patients. Diagnostic procedures had been initiated as a result. Brain death diagnoses were made using an apnea test and neurological examination in 17 patients. Additional tests were performed to support the diagnosis in two patients because the apnea test could not be performed. Brain death was diagnosed using brain computed tomography (CT) angio in the remaining two patients. Hypotension had developed in 84.2% of the patients, diabetes insipidus in 63.5%, and hypothermia in 47.3%, all of whom had received appropriate treatments. Three (15.7%) patients volunteered to be donors (Figure-2). While the GCS was determined in the emergency department examination during the initial admission as 10 (6–12), it was calculated as 6 (4–9) at the time of admission to the neurosurgery intensive care unit. The mean time from admission to the neurosurgery intensive care unit to brain death diagnosis was 28.9 (15.9–131) h, and the mean time to brain death diagnosis after determining GCS as three was calculated as 20.8 (5.8–55) h. Thirteen (76.4%) of the patients admitted with intracranial hemorrhage and traumatic brain injury had a GCS of ≤ 8. In 17 (89.47%) patients, deep coma, brainstem areflexia, and a positive apnea test were used to diagnose brain death. The diagnosis was supported by computed tomography (CT) angiography in one (5.26%) patient and by electroencephalography (EEG) in another (5.26%) patient. In total, three (15.7%) patients had become donors. 16 patients were unable to donate due to family rejection. The reasons why non-donor patients' families refused organ transplantation were investigated. It was discovered that all families were concerned about the deterioration of bodily integrity and had refused organ transplantation due to religious beliefs.

DISCUSSION

In this study, we discovered that patients in the neurosurgery intensive care unit of the University of Health Sciences Izmir Bozyaka Training and Research Hospital were diagnosed with brain death most frequently due to intracerebral hematoma between May 2011 and May 2021, with the male gender having a higher rate. The rate of organ transplantation (15.7%) was low.

The number of people waiting for organ transplants is steadily increasing. According to official data from the Ministry of Health of the Republic of Turkey, the number of patients in need of organ transplantation exceeds 25 thousand. Of the patients awaiting organ transplantation, 85%–90% have kidney failure, and 5%–10% have liver failure [5].

Many studies have found that males outnumber females in patients with brain death [6, 7, 8]. Avcı and Gündoğdu, in contrast, reported that 52.3% of the patients diagnosed in their study were female [9]. Similar to the results of most studies, we found in our study that men were diagnosed with brain death at a higher rate than women, with a rate of 52.6%.

In their observational study, Escudero et al. found that intracerebral hemorrhage (42%) and subarachnoid hemorrhage (14%), respectively, caused brain death [10]. The rate of brain death from a traumatic brain injury was de-

termined to be 19%. According to Palabıyık, the leading causes of brain death etiology are traumatic brain injury (41.5%) and cerebrovascular events (41.5%) [11]. In our study, intracerebral hemorrhage and subarachnoid hemorrhage were considered together, and it was discovered that intracranial hemorrhage was the most common cause (52.6%"), followed by traumatic brain injury (Epidural, subdural, contusion, or intraparaenchimal hemorrhage) (36.8%), brain tumor (5.2%), and hydrocephalus (5.2%). We believe we obtained these findings because the study was limited to patients diagnosed in the neurosurgery intensive care unit.

Clinical findings and, when necessary, supportive diagnostic tests are used to make a diagnosis [6]. In our study, two patients required supportive diagnostic tests. Palabiyik reported a mean time between admission and brain death diagnosis of 8.83 ± 8.4 (2–44) days [11]. Another retrospective study found that brain death was diagnosed in an average of 4.82 ± 3.6 days before 2014 when the regulation was changed, and 2.3 ± 1.72 days in 2014 and thereafter [6]. In the current study, these periods were found to be shorter. We reasoned that this difference was because the patients were being followed every day by a neurosurgeon, anesthesiology and reanimation specialist with education and experience in brain death diagnosis.

According to some studies, organ donation rates in our country range between 19.4% and 65%. For example, this rate was reported to be 20.5% by Avcı et al. and 69% by Kıraklı et al. [9,12]. In contrast, Escudero et al., in their multicenter study, discovered a rate of 70%, which corresponded to 1291 out of 1844 patients [10]. In our study, the organ donation rate was 15.7%, which was lower than the rates reported in other studies. We believe that better communication with patient relatives, social media projects that highlight the importance of organ transplantation, and education can all help to increase this proportion.

A study of patients diagnosed with brain death within 6 years discovered that 95.5% developed hypotension, 78% diabetes insipidus, and 61.9% hypothermia [7]. In our study, these clinical conditions were discovered at comparable rates. Our patients had received all the necessary treatment methods.

When the reasons given by patients' relatives for rejecting organ donation were investigated, they were identified as religious objections to organ transplantation and donation, insufficient education given at school about organ donation, family pressure, social pressure, and religious fear and anxiety [13]. In our study, we discovered that refusal to donate organs was motivated by religious beliefs.

The main limitation of this study was the small number of cases included in the study and the study population's extreme homogeneity (including only neurosurgery ICUs, excluding anesthesia, general surgery, or internal medicine ICUs).

CONCLUSION

In this study, the proportion of patients diagnosed with brain death and becoming donors in the neurosurgery intensive care unit was found to be low. Given the gradual increase in the number of patients awaiting organ transplantation, it is clear once again that increasing the number of cadaver donors is critical. Patients with pathologies such as head trauma, cerebrovascular events, and poor prognosis should be considered potential donors, and the necessary examinations and tests for the diagnosis should be initiated as soon as possible. Furthermore, we believe that with proper donor care and education, the number of organ donations can rise.

Ethics Committee Approval

All steps of this study were approved by the Institutional Ethics Review Committee of the University of Health Sciences Turkey, İzmir Bozyaka Training and Research Hospital (date: 08/06/2022 and number: 2022/98) following the World Medical Association Declaration of Helsinki and its most recent amendments.

Informed Consent

Informed consent was obtained from all individual participants including the study.Conflicts of Interest

No conflicts of interest were declared by the authors.

Financial DisclosureThe authors declare that this study received no financial support.

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