

Halakhic Realities
Collected Essays on Brain Death





HALAKHIC REALITIES

COLLECTED ESSAYS
ON BRAIN DEATH

EDITED BY
Zev Farber

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Halakhic Realities
Collected Essays on Brain Death

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Foreword

It is with great satisfaction that the first book published under the auspices of the International Rabbinic Fellowship is this work of major significance for all of us. This extraordinary collection of essays by such an esteemed group of scholars presents an important contribution to the public on the topic of halakhic perspectives on brain death and organ donation. I am sure that this book will help shape the discussion and policy decisions reached on this issue for years to come.

We are all indebted to Rabbi Dr. Zev Farber, who has tirelessly edited this book, and without whose efforts it would never have been completed. We owe him a great debt of thanks. We are also indebted to Rabbi Jason Herman, who put more time and energy into this project than we could have reasonably asked of our executive director.

I would like to thank Maggid Books, its publisher, Matthew Miller, and its editor-in-chief, Gila Fine, for leading us through the publication process with such professionalism. I'd also like to express my *hakarat ha-tov* to Tomi Mager and Nechama Unterman, who worked so hard editing this volume.

It is a privilege to serve as president of the International Rabbinic Fellowship. The rich talent of our members in both scholarship and leadership throughout North America and Israel offers our people

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great hope as we tackle the many challenges going forward. May Hashem grant us the wisdom to bring His holiness into this world through our words and actions.

Rabbi Joel Tessler
President (2011-2013), International Rabbinic Fellowship
Senior rabbi, Beth Sholom Congregation, Potomac, MD

List of Abbreviations

EH:	<i>Even ha-Ezer</i>
HM:	<i>Hoshen Mishpat</i>
OH:	<i>Orah Haim</i>
YD:	<i>Yoreh De'ah</i>
IM:	<i>Iggerot Moshe</i> by Rabbi Moshe Feinstein
MT:	<i>Mishneh Torah</i>
b.:	Babylonian Talmud
j.:	Jerusalem Talmud
m.:	Mishna
t.:	Tosefta
BMJ:	<i>British Medical Journal</i>
JAMA:	<i>Journal of the American Medical Association</i>
NEJM:	<i>New England Journal of Medicine</i>



Introduction

The State of the Question

Life is over when brain waves cease.

DR. WILLIAM BRICKLEY, *TIME*, JUNE 2, 1941

Mostly dead is slightly alive.

MIRACLE MAX, *THE PRINCESS BRIDE*

It is with some trepidation that I undertake to introduce a topic as serious and fraught as organ donation. Most halakhic issues are not matters of life and death, but the stakes surrounding whether to donate organs are quite literally just that. The mantra of the Halachic Organ Donor Society is “Sign one card, save eight lives.” Exploring the question from only this angle makes the choice to sign an organ donor card seem obvious. Nevertheless, the issue becomes more complicated when one looks at the process from the perspective of the donor.

Since organs that experience a period of time without being perfused with oxygen become unusable in transplantation, most organs can be harvested only from “live” bodies. For this reason, organs are harvested from the deceased only in cases of brain death, with the body being kept alive through mechanical ventilation.

Mechanical ventilation is a modern miracle that can buy doctors time to properly diagnose a patient and administer treatment, allowing the patient to convalesce and begin breathing again on his or her own. This is the main use of a ventilator. However, due to the heart's unique ability to control its own beating without regulation by the brain, the body of a brain dead patient connected to a ventilator can continue to "live." As long as the lungs keep pumping – and the ventilator ensures that they do – the blood will continue to be oxygenated. The oxygenated blood will keep the heart alive, and the heart will keep beating, causing the blood to circulate and preserving the remaining organs of the body. A brain dead patient cannot be preserved this way indefinitely, but it is not unusual for the body to remain alive for days and sometimes longer.

The status of a person whose brain is dead but whose body is alive is a complex question and the subject of major debate among halakhists and ethicists. The question revolves around the definition of human life. Is a live human body without a functioning brain considered a human life? How does one define human life? Are there halakhic sources or *hashqafic* (Jewish-philosophical) axiomata that can help answer these questions? Can scientific arguments conclusively demonstrate the presence or absence of life? This book – a collection of essays on brain death – does not profess to answer these questions unequivocally. The purpose of the collection is to continue the vibrant conversation on this topic, and offer insights and perspectives from multiple vantage points.

PREVIOUS ESSAY COLLECTIONS

The controversy over brain death and organ donation in halakha has been raging from as early as the procedures became scientifically possible, and the matter was debated in Jewish communities around the world, especially in the two largest, Israel and the United States.¹ In the

-
1. An important monograph on the Israeli debate was penned by Naftali Moses: *Really Dead? The Israeli Brain-Death Controversy 1967–1986* (2011). For an overview of some of the issues and a survey of some of the main positions, see Rabbi Yitzchak Breitowitz, "The Brain Death Controversy in Jewish Law," <http://www.jlaw.com/Articles/brain.html>. For a longer, more thorough treatment, see Eytan Shtull-Leber,

Introduction: The State of the Question

United States, several responsa, articles, and even monographs have been written on brain death and halakha. Most important, two seminal journals focused on the debate in the Orthodox community.²

The first was the *Journal of Halacha and Contemporary Society*, volume 17, published in 1989. In this publication, a section called “Determining the Time of Death” included five articles. The first article, by Dr. Marshal Kielson, explored medical aspects, and the final article, by Chaim Dovid Zweibel, Esq., examined legal ones. The middle three articles offered three halakhic perspectives on the nature of brain death. The first – and I am oversimplifying all three articles – by Dr. Fred Rosner and Rabbi Dr. Moshe Tendler, argues that brain death should be considered death according to halakha.³ The second, by Rabbi Hershel Schachter, questions that. The third, by Rabbi Ahron Soloveichik, argues that brain death should *not* be considered death.⁴

The second journal to address the issue was *Tradition*, whose winter 2004 issue featured an exchange between two Orthodox Jewish doctors, Joshua Kunin and Edward Reichman. In “Brain Death: Revisiting the Rabbinic Opinions in Light of Current Medical Knowledge,” Dr. Kunin argues that shifts in the medical understanding of brain death call into question the possibility of using this definition in halakhic discourse. In “Don’t Pull the Plug on Brain Death Just Yet,” Dr. Reichman responds that the use of brain death in halakhic discourse remains sound.

“Rethinking the Brain Death Controversy: A History of Scientific Advancement and the Redefinition of Death in Jewish Law” (BA honors thesis, University of Michigan, 2010), <http://deepblue.lib.umich.edu/bitstream/2027.42/77671/1/eytansht.pdf>.

2. I am merely offering highlights. A full bibliography of the massive amount of writing on this topic is well beyond the scope of this introductory essay.
3. One classic article that paved the way for this perspective by pushing for the importance of organ donation was that of Rabbi Nachum L. Rabinovitch, “What Is the Halakha for Organ Transplants?” *Tradition* 9, no. 4 (spring 1968): 20–27. And in the 1970s, Rabbi Shlomo Goren, Israel’s Ashkenazic chief rabbi (1973–83), campaigned for organ donation in Israeli hospitals. One of the first major *posqim* to embrace the brain death definition of death, Rabbi Goren remained a firm advocate of organ donation throughout his life.
4. Another well-known and vociferous opponent of brain death as halakhic death is Rabbi J. David Bleich; see his *Time of Death in Jewish Law* (New York: Z. Berman Publishing, 1991).

I call these two publications “seminal” because each updated the debate, crisply presenting where the issues lie. The former focused on the halakhic debate and traditional sources, and the latter focused on advances in medicine.⁵

THE TWO RCA PRECEDENTS

One stimulus for the current publication has been the work of the Rabbinical Council of America (RCA). In 1991, the RCA took an important stand on organ donation by publishing its health care proxy.⁶ Knowing the importance of clarifying one’s wishes beforehand so as not to burden loved ones with tough decisions and great doubt, the RCA – under the leadership of Rabbis Marc Angel and Binyamin Walfish – published a health care proxy that allowed for organ donation.

With the many changes in the medical understanding of the mechanics of brain death, most poignantly clarified in the 2008 Presidential White Paper on brain death, the RCA – under the leadership of Rabbi Asher Bush – conducted a new study of the subject, publishing its conclusions in 2010.⁷ Although it wasn’t presented as a new *pesaq*, the study questioned many premises of the 1991 proxy.⁸ This challenge led numerous rabbis to wonder whether a new position on brain death and halakha was in order and spawned critical responses from a host of perspectives.⁹ One group issued a “Rabbinic

5. Since medicine changes and develops continuously, there is a persistent need for this type of updating.
6. For details, see Marc Angel, “The RCA Health Care Proxy: Providing Responsible Halachic Leadership to Our Community,” *Jewish Action* 52, no. 2 (spring 1992): 60, 62, <https://hods.org/pdf/Angel%20RCA%20Health%20Care%20Proxy.pdf>
7. For the white paper: http://bioethics.georgetown.edu/pcbe/reports/death/pellegrino_statement.html; for the RCA study: http://www.rabbis.org/pdfs/Halachi_%20Issues_the_Determination.pdf.
8. That the study was not intended to “override” the RCA’s position was clarified in a letter posted on the RCA website: <http://www.rabbis.org/news/article.cfm?id=105607>.
9. For a critique of the RCA document from a medical standpoint, see Noam Stadlan, “Death by Neurological Criteria: A Critique of the RCA Paper and the Circulation Criteria,” <http://torahmusings.com/2010/12/death-by-neurological-criteria/>. For a critique from a medical ethics perspective, see Drs. Kenneth Prager and Neil Schluger, “RCA and Brain Death,” *The Jewish Week*, http://www.thejewishweek.com/editorial_opinion/letters/rca_and_brain_death. For critiques from a halakhic

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Statement Regarding Organ Donation and Brain Death,”¹⁰ informing the observant public that many Orthodox rabbis still believed in the halakhic relevance of the brain death definition and the importance of donating organs.

Although I signed the petition, I felt that what was really needed was neither a univocal study (such as that of the RCA) nor a petition reaffirming the 1991 health care proxy, but a comprehensive update of the conversation, attacking the problem from more angles than merely the halakhic.¹¹ Several members of the International Rabbinic Fellowship (IRF) shared this sentiment, and it was decided that I would put together this comprehensive update under the auspices of the IRF. As an IRF publication, this book includes contributions by many important *posqim* and Jewish thinkers from the Modern Orthodox world.¹² Hopefully,

perspective, see Baruch A. Brody and Shlomo M. Brody, “Case for Organ Donation Remains Solid,” *Jewish Daily Forward*, <http://forward.com/articles/135146/case-for-organ-donation-remains-solid/>; and the three-part series by Rabbi Daniel Reifman, “The Brain Death Debate: A Methodological Analysis,” on the RCA’s *Text and Texture* blog; for part 1: <http://text.rcarabbis.org/the-brain-death-debate-a-methodological-analysis-part-1-yoma-passage-by-daniel-reifman/>.

10. “Rabbinic Statement Regarding Organ Donation and Brain Death,” <http://organdonationstatement.blogspot.com/>.
11. Two important such updates have recently been penned. For a defense of brain death as halakhic death, see Avraham Steinberg, *Respiratory-Brain Death* (ed. Yigal Shafran; trans. Fred Rosner; Science, Halacha and Education Series; Jerusalem: Merhavim, 2012). The book includes a translation of primary sources as well as appendices with detailed explanations of medical procedures. For a more critical approach to the halakhic status of brain death, which deals with the medical information and includes an up-to-date survey of the relevant *posqim*, see David Shabtai, *Defining the Moment: Understanding Brain Death in Halakhah* (New York: Shores Press, 2012). Both authors are rabbinic scholars as well as medical professionals. For a review of both books, see Noam Stadlan, “New Books and Points of Discussion in the Halakhic Definition of Death: *Respiratory-Brain Death* by Avraham Steinberg, and *Defining the Moment – Understanding Brain Death in Halakhah* by David Shabtai,” *Me’orot 10* (5773/2013), http://www.yctorah.org/images/stories/about_us/%235%20-%20stadlan.pdf. See as well <http://www.hakirah.org/Vol18Stadlan.pdf>.
12. A similar approach was taken by Rabbi Gil Student, who ran a nine-part online symposium on the ethics of brain death and organ donation in 2011. The contributions there are op-ed-style, not article-style, so the pieces are much shorter than most of those in this book. For an introduction and links to the pieces, see <http://torahmusings.com/2011/02/symposium-on-the-ethics-of-brain-death-and-organ-donation-introduction/>.

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the collection will facilitate important debate and discussion within our ranks and in the Jewish community at large.

THE STRUCTURE OF THE BOOK

This book is the first in a two-part series on brain death and organ donation. This volume focuses on brain death itself and is divided into four sections. Section I discusses the medical and legal reality surrounding brain death. The essays describe how a person is declared dead, outline the legal history of the brain death diagnosis, and debate the medical reality behind the concept. Sections II and III contain responsa focusing on the halakhic approaches to brain death. Section IV tackles the problem historically, philosophically, and ethically. Finally, the Afterword expresses some of my own views on the subject – it is in no way meant as a summary of the book or a consensus position – as well as some thoughts about the direction of future studies.¹³

This book has not been edited for content, and each author expresses his own opinion. On a personal note, compiling this volume was daunting, as I tried to avoid repetition without overlooking important issues. Although I agree with some essays more than others, I have learned from each one and each author. I hope the work will serve as a catalyst for discussions as well as a resource for rabbis and laypeople trying to navigate the exceedingly complex issues surrounding the definition of death and the donation of organs.

Rabbi Zev Farber, Ph.D., Editor
Rosh Hodesh Kislev 5775

13. Three further notes on the book. First, throughout the essays, I've added notes referencing where one can read similar or alternative discussions of the same point elsewhere in both volumes. Second, dividing the essays into brain-death-themed and organ-donation-themed was exceedingly difficult, since many touch on both topics. I apologize if I overlooked a better way to divide the volumes. Third, I originally planned on an appendix of translations of key primary sources. However, since the book turned out to be rather long, and other published works (such as Steinberg's recent book) include these translations, I decided that this addition didn't justify the added size and expense. Instead, the IRF will be including a link to my translations on its website (<http://internationalrabbinicfellowship.org/>).

Section I

*The Medico-Legal Issues:
An Overview*



Chapter 1

How a Person Is Declared Dead

Zelik Frischer

INTRODUCTION

It was 1975, and I was sitting outside the office of Israeli chief rabbi Shlomo Goren. It had taken me quite a while to get this appointment, and I was unsure how the consultation would unfold. I wasn't there to ask him for a personal favor or even a halakhic ruling. I was there to request his participation in an urgent project.

I originally trained as a urologist at Mechnikov University Hospital in Leningrad (today St. Petersburg).¹ Since then, I had immigrated to Israel and was practicing in Beilinson Medical Center in Petah Tiqva.² I was being called on more and more to do kidney transplants. The problem was (and remains) that there were many more patients who required a new kidney than there were kidneys looking for new owners.

-
1. The university is named after the Russian scientist Ilya Mechnikov, known as the father of immunology, who won the Nobel Prize in medicine in 1908.
 2. Now known as the Rabin Medical Center.

Section I – The Medico-Legal Issues: An Overview

Although kidneys can be harvested from live donors, the main way of procuring a kidney is by harvesting the organ from a brain dead patient. To do so, one needs the family's permission – a very touchy matter. In some countries, hospitals facilitate this process by assigning a social worker or chaplain to sit with brain dead patients' families, answer their questions, and help them decide how to handle the situation.

In Israel, no such service was provided. Facing the natural fear, confusion, and suspicion of family members charged with making the most painful of decisions, Israeli hospitals were encountering an overwhelming refusal to participate in the harvesting of organs from what many of us consider to be a ventilated cadaver. This is why I came to Rabbi Goren.

My idea was simple if somewhat avant-garde. I was going to ask the chief rabbi to set up a system whereby the rabbis employed by the Chief Rabbinate could counsel the families. Of course, Rabbi Goren would agree only if he believed that donation of organs from brain dead patients was halakhically valid.

Although somewhat reticent at first, Rabbi Goren quickly warmed to the idea, and with his characteristic energy, he organized a highly successful network of rabbis who took charge of ministering to patients' families and helping them through the decision-making process. In a sense, the Israeli system was one of the most active and competent of its kind. Donation rates rose, and Israel became a model state when it came to kidney transplants.³

Sadly, this is no longer true. I say so as a distant observer, since I've been practicing in Stony Brook University Hospital on Long Island for twenty-five years. Nevertheless, the same problems that now plague the hospitals in the State of Israel plague the United States as well.

Procurement of organs and tissues from heart-beating cadavers is a daily necessity. In 1999, UNOS (United Network for Organ Sharing) published a national transplant waiting list of 65,000 organs. Since then, the number has almost doubled. Unfortunately, organ donation has not kept pace with the ever-increasing recipient waiting lists. The critical

3. My role in effecting this change was minimal; many doctors and rabbis participated in the effort.

shortage of organs has resulted in increased use of live donation and expanded criteria for determining what cadaveric organs may be donated, but this response is hardly sufficient. The crisis is real.

Organ donation occurs only through the education and good will of the general public. Participation of professionals in the fields of ethics, law, and religion, as well as in the behavioral and social sciences, is a *sine qua non*. This is the reason I sat in Rabbi Goren's office that day, and it's why I participate in publications like this one. I hope to use my experience and knowledge to narrow the gap between the supply and demand for transplantable organs. If I can contribute to narrowing this gap even a little, it's all worthwhile.

BRAIN DEATH: DEFINITION AND HISTORY

A patient may be declared dead by either neurological or cardio-pulmonary criteria. Currently, 98% of organ donors are declared dead by brain death. Brain death is declared when complete and irreversible loss of brain and brainstem function occurs. This phenomenon presents clinically as complete apnea, brainstem areflexia, and cerebral unresponsiveness.

The definition of brain death was first suggested in a report by an ad hoc committee associated with Harvard Medical School in 1968. In 1981, with the Uniform Determination of Death Act (UDDA), irreversible loss of brain function was officially put forward as one of two ways to determine death.⁴

PREREQUISITES FOR A BRAIN DEATH DECLARATION

There are several prerequisites for a brain death determination. First, the patient must be in a grade 4 coma. Second, all appropriate diagnostic and therapeutic procedures (the cephalic reflex tests) must be performed. Third, the patient must be on a ventilator and unable to breathe independently. Fourth, the patient's condition must be irreversible. These prerequisites will be detailed below.

4. The other being irreversible loss of circulation; the UDDA has been adopted by law or precedent by essentially every state in the US.

Section I – The Medico-Legal Issues: An Overview

(1) Coma

As stated, to be diagnosed as brain dead, a patient must be in a grade 4 coma.⁵ The level of coma is demonstrated by the response to stimulation, usually presented in the form of pain. The most common response to pain is grimacing, which can be tested by applying deep pressure to the nail beds, supraorbital ridge, or temporomandibular joint (TMJ), or by placing a cotton swab in the nose.

(2) Cephalic Reflex Tests

Additionally, diagnostic tests must demonstrate the absence of cephalic reflexes.⁶ Evaluation can begin six hours after the onset of coma and apnea.⁷ Furthermore, in some states and/or countries this evaluation must be repeated.⁸

The tests are relatively straightforward. The following is a standard battery:⁹

- a. Pupillary testing: Light is shined into the patient's eyes. The pupils' lack of response to the light is consistent with brainstem injury.¹⁰

5. There are four levels of coma:

Grade 1 – reactivity to vocal stimuli;

Grade 2 – absence of reactivity to vocal stimuli, but with a coordinated response to painful stimuli;

Grade 3 – absence of reactivity to vocal stimuli with an uncoordinated response to painful stimuli;

Grade 4 – absence of response to painful stimuli.

In truth, this scale is somewhat outdated and no longer in use, but it remains suitable as a heuristic device.

6. For a chart summarizing this section, see Jeffrey A. Norton et al., *Essential Practice of Surgery: Basic Science and Clinical Evidence* (New York: Springer-Verlag, 2003), 610.

7. These regulations are intended to prevent hasty diagnoses.

8. Such was the law in New York State until recently.

9. I say “a standard” and not “the standard,” since one difficulty of brain death determination is that there is no uniform legal standard. The most commonly used criteria are based on the American Academy of Neurology (AAN) guidelines published in 1995 and reviewed in 2010.

10. Since no single test proves brainstem death, the more cautious term “consistent with” is preferred in the medical community. Brainstem death is proven by the combination of tests and the overall medical picture.

Chapter 1 – How a Person Is Declared Dead

As a rule, the pupils of brainstem-dead patients remain dilated at around 4–9 mm.

- b. Corneal reflex testing: The eye is daubed with a cotton swab or a gloved finger. Failure to blink is consistent with brainstem injury.
- c. Oculovestibular or oculo-auditory testing, also known as cold caloric testing: Ten to twenty ml of iced saline is sprayed into the auditory canal of each ear, irrigating the tympanic membranes.¹¹ Lack of eye movement is consistent with brainstem injury.
- d. Oculocephalic testing, also known as the doll's eye test: The patient's head is turned from side to side. Normally, the eyes turn away from the direction of movement. If the patient's eyes remain fixed in position and don't rotate with the head, it is consistent with brainstem injury, and is referred to as "negative doll's eyes."
- e. The cough or bulbar-function test: A suction catheter suctions all the way down the ETT (endotracheal tube). As the catheter is withdrawn, it is moved from side to side. No cough (as well as no head movement or facial twitch) is consistent with brainstem injury.
- f. Absence of the jaw jerk reflex, or masseter reflex: When the chin is tapped with a reflex hammer, the mandible should jerk slightly upward. Failure to do so is consistent with brainstem injury.
- g. The gag, swallowing, or pharyngeal reflex test: The oropharynx is stimulated with a tongue depressor or a Yankauer (long-tipped) suction tip. Failure to gag is consistent with brainstem injury.

No single reflex test proves brainstem death. It is the failure on *all* of them that confirms the likelihood of brainstem injury.

(3) Ventilation and the Apnea Test

Although the patient has already proven unable to sustain breathing – hence the need for ventilation – this inability is insufficient to demonstrate brainstem death.¹² What must be demonstrated is the

11. The ears must be tested five minutes apart.

12. Many patients, for one reason or another, require ventilation.

Section I – The Medico-Legal Issues: An Overview

absence of any spontaneous *effort* on the patient's part to initiate a breath. Therefore, the apnea test is administered.

To be eligible for the test, the patient must have a core temperature greater than or equal to 36.5°C (97°F) and a systolic blood pressure of greater than or equal to 90 mmHg (millimeters of mercury). Additionally, the patient's fluid volume must be normal (euvolemic).

Assuming the patient meets these criteria, his blood is preoxygenated for ten minutes. Next, the concentration of carbon dioxide in the arterial blood (PaCO_2) is tested; it should be at 35–45 mmHg. This can be determined by an arterial blood gas (ABG) test or by testing the end-tidal carbon dioxide (ETCO_2) concentration.¹³

At this point, the ventilator is disconnected, and physicians watch the patient for any sign of breathing.¹⁴ At around the eight-minute mark, another ABG test is administered. If the patient has shown no signs of attempting to breathe, and the PaCO_2 has risen to 60 mmHg, this is conclusive demonstration of total and irreversible apnea.

(4) Irreversibility

The cause of the underlying brain damage (trauma, brain hemorrhage, cerebral tumor, cerebral infection, or various types of cerebral hypoxia)¹⁵ must be known. Reversible causes of brainstem depression (hypothermia, drug or alcohol intoxication) must also be excluded.

Summary

With the patient in a grade 4 coma, demonstrating no signs of breathing with the apnea test and no cephalic reflexes (usually in two separate examinations), if all confounding factors have been excluded, he is declared brain dead.

Critically, brain death is declared by a team of specialists; such teams never include interested parties or those making procurement.

13. This is the maximal concentration of carbon dioxide in an exhaled breath.

14. If any such sign occurs, the patient is immediately reconnected to the ventilator.

15. Hypoxia occurs when the brain is deprived of adequate oxygen.

CONFIRMATORY TESTS

Confirmatory studies, although not always necessary, are performed where there may be confounding factors.¹⁶ Furthermore, they can be performed at the request of the patient's health care proxy.¹⁷

There are many kinds of confirmatory tests,¹⁸ falling into two basic categories. The first type tests electrical activity in the brain. The second tracks blood flow to the brain. I will discuss some of the most common or well-known tests in both categories.¹⁹ Since 2008, confirmatory testing has been legally required in Israel, although not in the United States.

Type 1 – Electrical Activity

- a. *Electroencephalography* (EEG) – This was the first confirmatory test, suggested in the original Harvard criteria. In this procedure, eight or more electrodes are placed on the patient's scalp. If the patient is, in fact, brain dead, the test should show no brain waves and no reactivity to intense somatosensory or audiovisual stimuli.²⁰
- b. *Evoked Potentials* (EP) or *Sensory Evoked Potentials* (SEP) – Similar to the EEG but more accurate, these tests measure electrical potentials generated by the nervous system in response to sensory stimuli. The tests are performed by placing electrodes on the patient's skin. Three main types of EP tests are relevant to brain death evaluation:
 - *Brainstem Auditory Evoked Potentials* (BAEP), also known as *Brainstem Auditory Evoked Response* (BAER) or *Auditory Brainstem Response* (ABR) – This is the EP test most commonly used

16. Confirmatory tests are also administered when the apnea test cannot be performed for physiological reasons, although whether it is appropriate to declare someone brain dead without an apnea test is a matter of some controversy.

17. For details, see Rabbi Prof. Daniel Sinclair's essay in this volume.

18. For a more technical discussion, see W. Mel. Flowers Jr. and Bharti R. Patel, "Persistence of Cerebral Blood Flow After Brain Death," *Southern Medical Journal* 93, no. 4 (2000): 364–70.

19. Some tests are not conducted because they're either too expensive or hard to access, such as PET (Positron Emission Tomography) or xecT (Stable Xenon Computed Tomography).

20. Although the EEG remains useful, it is the least effective test of its kind. Among other shortcomings, it is subject to electrical artifacts in the intensive care environment, and has failed to recognize coma reversibility in drug-intoxicated patients.

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to check for brain death. When sound enters the ear and stimulates the cochlea in the inner ear, the cochlea produces an electrical response along the nerve pathways. Lack of electrical response is consistent with brainstem injury.²¹

- *Somatosensory Evoked Potentials (SSEP)* – Stimulation occurs at the extremities, and recordings are made on the scalp, near the sensory cortex. In brain dead patients, potentials generated by structures above the lower medulla are absent. Bilateral absence of response to median nerve stimulation is consistent with brain death.
- *Visual Evoked Potentials (VEP)* – Although this test is not commonly used for determining brain death, it can be. The examiner uses a photoelectric, checkerboard-pattern flash to stimulate the optic nerve. This pattern is then recorded on the cortex, arriving at the back of the head, near the visual centers. In the visual pathways of brain dead patients, electrical activity is confined to the retina.

Type 2 – Blood Flow

- a. *Cerebral Angiography* – Angiography uses x-rays and a contrast material to produce pictures of blood vessels. Cerebral angiography tests blood flow in the brain. Although the various types of cerebral angiography use different imaging technologies, all (except the MRA) require the injection of contrast. In patients with normal kidney function, and in the absence of a known allergy to the contrast, the risks are minimal.
 - *Four-Vessel Cerebral Angiography* – Iodinated contrast media are injected into the aortic arch or the cerebral vessels. If the test shows no intracerebral filling from either the carotid or vertebral arteries, the brain is receiving negligible blood flow if any.²²

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21. To explain, a reaction from the auditory nerve without an electrical response from the brainstem demonstrates that the patient's ears are functioning but the brain isn't processing the sound. If the patient's ears weren't functioning, or if the patient were deaf, this test would be meaningless.
 22. The problem with this test is that it's expensive and invasive and carries a risk (albeit low) of significant side effects.

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- *Radionuclide Angiography* – A bolus²³ of radioactive material is administered intravenously. If the patient is brain dead, no venous sinuses will be observable due to lack of blood flow.²⁴ The test is consistent with brain death when the tracer doesn't show up in the territories supplied by the intracranial arteries (internal carotid arteries and vertebro-basilar arteries). While the intracranial venous sinuses usually don't appear either, the venous sinuses may show up after a while, because they can receive blood from tissue supplied by arteries that don't enter the brain, such as the external carotid artery.
 - *Computed Tomography Angiography (CTA)* – This technique combines computerized analysis with x-rays to visualize blood vessels.²⁵ There should be no evidence of blood flow in the brain for brain dead patients.
 - *Magnetic Resonance Angiography (MRA)* – This method utilizes magnetic resonance imaging to generate images of blood vessels.²⁶ As in the CTA, there should be no evidence of blood flow in the brain for brain dead patients.²⁷
- b. *Cerebral Perfusion Scintigraphy (CPS)* – Scintigraphy is the production of two-dimensional images using a scintillation or gamma camera. A radiopharmaceutical agent is injected,²⁸ and the distribution of the radioactivity in tissues is determined. Cerebral perfusion scintigraphy tests brain function by tracking the amount of blood taken up by the brain. As a type of

23. A *bolus* (Latin for “ball”) is the medical term for a dose of a drug or some other compound that is administered to raise its concentration in the blood to a specific quantity.

24. The major disadvantage of this procedure is that it doesn't evaluate circulation in the posterior fossa, i.e., the area of the brainstem and cerebellum.

25. Among its numerous advantages over standard angiography, this method is less invasive, more available, less operator-dependent, and faster, plus it can evaluate patients in the presence of CNS depressants. See E. Frampas et al., “CT Angiography for Brain Death Diagnosis,” *American Journal of Neuroradiology* 30 (2009): 1566–70.

26. Aside from sparing the patient exposure to ionizing radiation, this method tends to be less toxic than certain others.

27. This test requires no injection, although some versions – such as the Contrast Enhanced MRA – use one.

28. No bolus is necessary.

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radionuclide testing,²⁹ it is similar to radionuclide angiography. Yet angiography looks for blood flow in the arteries, while this test looks for whether the labeled chemical is absorbed by the tissue.³⁰ There are two basic types of CPS:

- *Planar CPS* – The patient is given an intravenous injection of a radiopharmaceutical agent, and a static planar imaging of the brain is performed with the scintillation camera. In brain dead patients, there is no uptake of the isotope in the brain parenchyma,³¹ demonstrating an absence of cerebral filling. The use of new tracers that normally enter the brain has made the test more accurate in visualizing all parts of the brain.
 - *Tomographic CPS or Single-Photon Emission Computed Tomography (SPECT)* – This test works essentially the same way as the planar CPS, but a single-photon emission computed tomographic (SPECT) scintillation camera is used instead of the standard scintillation camera, allowing for three-dimensional images.³²
- c. *Transcranial Doppler (TCD)* – This is an ultrasound test of the brain, with the probe placed on the temporal bone. If the TCD shows total absence of blood flow, to-and-fro flow (blood moves forward with the pumping of the heart, but backward when the heart relaxes), or small systolic spikes, this is sufficient to demonstrate that the brain is not receiving oxygen and is consistent with a determination of brainstem death.³³

29. The favored agent for these tests is technetium-99m HM-PAO (hexamethylpropyleneamineoxime), and the process is sometimes referred to as a technetium scan.

30. Frequently the same tracer is used, and the early images correspond to the angiography, while the later ones (giving the chemicals time to be absorbed) correspond to the perfusion.

31. I.e., the brain itself, not the blood vessels.

32. Although it adds great detail to the images, this method is extremely expensive and may not be significantly more accurate than the planar CPS.

33. This test requires a highly competent ultrasonographer experienced in TCD techniques. One benefit of the test is that it's totally non-invasive.

CARDIOPULMONARY DEATH

Death may be declared by cardiopulmonary criteria (CPC), and in certain instances – particularly when patients are being withdrawn from support – organ donation is possible. The donors are referred to as non-heart-beating organ donors (NHBD). Prior to the Harvard criteria, all organ donors were NHBD. Currently they constitute 2% of the total, and the percentage will likely increase. However, the majority of their organs are no longer viable for implantation.³⁴

CONCLUSION

The debate raging in Jewish and general society about brain death is a serious one. One of the principal qualities of a free mind, and its essential right, is the right of doubt, and it is no surprise that doubts plague the enterprise of organ harvesting. Some doubt whether a brain dead patient is really dead. Some doubt the integrity of the process of determining death, or the competence of the doctors involved.

I myself have doubts on occasion. Whenever I'm called in for a diagnosis of brain death, I perform a barrage of cephalic reflex tests on my own, regardless of who performed them before I was called in and what the findings were. In a matter this serious, it seems only proper to double-check one's colleagues, no matter how much one trusts them. Nevertheless, I don't doubt the vital importance of maintaining the brain death standard and encouraging the harvesting of organs from heart-beating cadavers wherever and whenever possible. The life-giving potential of both is simply too great to do otherwise.

I don't know whether I can offer conclusive medical proof that brain death should be equated with death. Certainly, I can offer none in the realm of halakha. However, I can say this: I have never seen a patient whose brainstem was determined to be dead return to the land of the living or even show any sort of improvement *at all*. The same cannot be said for the recipients of their organs, whose lives are saved by this miraculous process.

34. For details, see Dr. Kenneth Prager's essay in this volume.

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I recently met a rabbi whose son underwent a successful liver transplant. This son is a rabbi himself, and the father of seven children. In this case, neither the donor nor the transplant surgeon knew about the recent halakhic debates on this subject in Israel and the United States. Whether this is good or bad I cannot say, but it was certainly fortunate for the patient, who is now alive and well and with his family.