An Overview of Anesthetic Management for the Brain-Dead Donor and Organ Recovery

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Transplantation of tissue is playing an increasing role in modern therapeutics. Survival of recipients and transplanted organs is excellent, making transplantation of many major organs a very successful therapeutic option. Evidence shows that a multidisciplinary approach to managing the brain-dead donor (BDD) offers a better opportunity for successful organ survival after transplantation. Organ procurement procedures are most commonly performed in community hospitals and rural settings. The anesthesia provider’s role in organ procurement procedures and BDD management is essential for maintaining allograft organ survival and the CRNA may be asked to assume a collaborative role in nontertiary hospitals in community or rural settings. The perioperative role of the CRNA immediately before and during organ procurement is an important piece in the progression to a successful outcome. The CRNA therefore must understand the overall process to guide appropriate BDD treatment and allograft protection. The focus of this article is to present a historical overview of organ donation and procurement, and an evidence-based examination of clinical management of the BDD from diagnosis to organ procurement, including anesthetic management.

Keywords: Anesthetic management, brain death, organ procurement.

Introduction
Transplantation of human tissue is gaining importance in modern therapeutics. Corneas, heart valves, blood vessels, and tendons are relatively inert and can be transplanted with great success. Cartilage and tendons can be used as a framework for cells of healthy native tissue. Solid organs can extend the lives of patients with chronic or terminal diseases.

Organ and tissue donation is required for any transplantation procedure. Survival of both the recipient and transplanted organs is excellent, making transplantation of many major organs a very successful therapeutic option.1-3 The transplantation process begins with identifying the potential brain-dead donor (BDD) or living related donor (LRD) and ends with the organ transplantation into a matched recipient. In the United States, BDDs comprise the largest segment of available donor pools, and most BDD organ procurement procedures are performed in community hospitals or rural settings.3 Evidence supports a multidisciplinary approach to managing the BDD, which offers a better opportunity for successful organ survival after transplantation.4,5 The collaborative role of the CRNA immediately before and during organ procurement is an important piece in the progression to a successful outcome.

Objectives
Upon completion of this course, the reader will be able to:
1. Describe the collaborative role of the Certified Registered Nurse Anesthetist (CRNA) functioning as multidisciplinary team member in the clinical management of brain-dead donors before and during organ procurement procedures.
2. Classify the criteria required to verify brain death and potential organ donors.
3. Review the physiologic mechanisms of organ rejection and principles of posttransplantation immunosuppressive therapy.
4. Identify the physiologic challenges in the clinical management of a brain-dead donor before and during organ procurement procedures.
5. Examine specific challenges to the anesthesia provider of brain-dead donors undergoing organ procurement procedures.

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A thorough understanding of the physiologic changes associated with brain death is essential to preserve BDD organ function and optimize organ viability after transplantation. The focus of this article is to present a historical overview of organ donation and procurement, and provide an evidenced-based examination of clinical management of the BDD from diagnosis to organ procurement, including anesthetic management.

### Historical Background and Significance

The first solid organ transplant occurred in 1906 when Dr. Mathieu Jaboulay tried unsuccessfully to perform a renal transplant with a goat and pig kidney to 2 patients with end-stage renal disease (ESRD); both patients died. In 1963 newly available veno-veno bypass techniques allowed liver transplants to be performed. The first human cardiac transplant was performed in 1967. The first cadaver heart-lung and living related lung transplant procedures were performed in 1983 and 1990, respectively. Unfortunately, the mortality from these groundbreaking procedures was extremely high. Attempts in research studies to improve survival rates are ongoing and remain a challenge.

In the United States, the federal government determined that oversight for organ procurement and transplantation needed to be developed. This led to the national Organ Transplant Act of 1984 and the establishment of the Organ Procurement and Transplantation Network (OPTN). The OPTN is operated by a private nonprofit organization, the United Network for Organ Sharing (UNOS), under federal contract to ensure effectiveness and efficiency in equity of organ sharing in a national system of organ allocation. Through an organ sharing system it established, UNOS maximizes the efficient use of deceased organs through equitable and timely allocation. Also, UNOS collects data on graft survival rates and provides educational resources to the public and healthcare providers. Additionally, UNOS provides consultants and resources to organizations concerned with human organ transplantation to increase the number of organs available for transplantation.

Recipients of BDD organs must meet stringent criteria that include a financial plan to cover direct and indirect costs from donor selection to lifelong immunosuppressive therapy. The costs for organ procurement vary according to organ. For example, the Milliman Report stated that in 2014 the procurement costs alone for kidney, liver, and double lung organ allografts were $84,000, $95,000 and $120,000, respectively. Multiple organ procurements costs are roughly double the single organ rate.

Most BDD organ procurement procedures take place in community or rural hospitals, increasing the likelihood that the anesthesia provider will be asked to participate in the overall management of the potential BDD. As such, the CRNA’s collaborative role relates to early verification of appropriate individuals who meet the specified brain death criteria as well as ongoing monitoring and support of the BDD to ensure there is no physiologic event that can damage or interrupt the procurement process. The value the CRNA adds to the organ procurement and transplantation process is critical if one considers that the available tissue must be pristine and must function properly for optimal recipient outcomes.

### Whose Organs Can Be Donated for Transplantation?

Solid organs suitable for transplantation in humans are known as allografts. Brain-dead or “cadaver” organ donors are the source of most allograft transplants in the United States; however, LRDs are gaining popularity, particularly in the pediatric population. Allografts from BDDs must be carefully separated from the donor, preserved temporarily to maintain viability, and transplanted in the recipient in a timely manner. The overall health of the donor and recipient must be considered during the matching process as well the allograft size and current organ function. Suitable BDDs must meet brain death criteria and must not have suffered any pro-
longed circulatory compromise or sepsis during the hospital course. Donors must be relatively healthy and cannot have chronic incurable disease such as hepatitis C, herpesvirus, tuberculosis, active toxoplasmosis, and acquired immunodeficiency syndrome (AIDS). Absolute contraindications include advanced age and metastatic malignancies. Because of limited organ availability and the prevalence of certain diseases, otherwise suitable BDDs with hepatitis C, cytomegalovirus (CMV) infections, or autoimmune diseases may still be considered in select cases. For example, if an organ donor has hepatitis C, his or her organs may be transplanted into a recipient who has the same disease or diagnosis.2,10-12

The number of people who require organs—the demand—is greater than the available organ supply. As a result, the lack of available BDDs has led to widening of the donor pool using expanded donor criteria, such as utilization of “cardiac death” donors for lung allograft harvesting, and to increasing the number of LRDs via marketing strategies.13 Snell et al12 note that technology, improved preservation techniques, air travel, and widening of the donor pool for scarce organs (eg, lungs) has permitted organ procurement from previously ineligible BDDs. As the science of organ transplantation advances, the opportunity to utilize LRDs increases.

Living related donors eliminate the need to establish brain death criteria and allograft support during and after separation from donors. Living related donors have increased the number of viable donors, but the need for allograft organs still vastly outpaces suitable donors, whether BDD or LRD. Social media efforts may increase the number of LRDs.14,15 Recent trends in renal transplants have shown that stringent immunosuppressive therapy can override nonrelated living organ donation.8

Verifying “Legal” Brain Death
Legal brain death is difficult to assess and determine because not every patient who presents with profound unconsciousness demonstrates a definitive clinical course leading to the diagnosis of brain death.16 The main concern with labeling a patient as brain dead is that the patient may not actually be physiologically dead, even though his or her brain has ceased to function and in essence is dead! The singularly most important criterion to consider when determining brain death in a potential donor is irreversibility of the condition.16-19 Irreversibility is fundamental to the diagnosis of brain death and is established by a lack of improvement in physical examination findings or clinical studies for a minimum of 24 hours. All potential reversible factors must be ruled out before death is pronounced. These factors include but are not limited to hypothermia, postictal states, cardiovascular or metabolic instability, and central drug effects.3

In recent years, establishing standardized brain death criteria and guidelines has been attempted, in an effort to regulate the type of tests and evaluations performed in potential donors. Unfortunately, these guidelines have done little to improve the ability to accurately make the diagnosis of brain death in potential donors.10 Despite these limitations, most hospitals have established policies outlining the mandatory criteria used to make a brain death diagnosis. A combination of a physical examination (ie, apnea test) and diagnostic testing, such as serial electroencephalograms and computed tomography scans, are used.3,17 Once a donor is determined to possess an irreversible condition, time is of the essence and UNOS is contacted. A UNOS representative immediately begins selecting a suitable recipient to receive the donor organ (Figure).

Clinical Management of the Donor Following Brain Death
The main goal of clinical management following brain death in anticipation of the patient as a donor is to maintain homeostasis. Physiologic instability often accompanies brain death and must be controlled to maintain viability of donor organs. A strong, coordinated, multidisciplinary approach is the best strategy to preserving organ function during the donor/recipient cross-matching process. Posttransplant organ viability begins with the physiologic stabilization of the donor before the procurement procedure.3,5,16,17 This includes several facets of care ranging from cardiopulmonary and systemic pressure control to core temperature regulation, avoidance of coagulopathy, and/or neurologic instability.

Cardiopulmonary and Systemic Pressure Control
Two of the main problems typically encountered with the cardiopulmonary system is hypoxemia and hypotension.3-5 Hypoxemia is treated by adjusting the fraction of inspired oxygen (FiO₂), minute ventilation, and positive end-expiratory pressure to maintain an oxygen saturation greater than 95%. Care must be taken to prevent “wet lungs” from aggressive fluid resuscitation. Initially, a Cushing reflex (hypertension and bradycardia) presents as the brain stem continues to deteriorate. Once endogenous catecholamines are rendered ineffective, profound hypotension will ensue because of the loss of central nervous vasomotor center activity. In this phase, marked vasodilatation requires carefully monitored restoration of intravascular volume with colloid and/or crystalloid solutions using hemodynamic parameters such as cardiac output or transthoracic echocardiography to guide fluid administration.3,9 Treatment of central vasomotor inactivity with vasopressin and dopamine infusions is an effective strategy. Vasopressin is the preferred vasopressor, at a dosage of 0.5 to 15 U/h. Dopamine at “renal” doses (3-5 μg/kg/min) may also be effective. Both vasopressin and dopamine are preferred over phenylephrine4,5 by preserving mesenteric circulation so abdominal organs are not compromised because of vasoconstriction. This may be of particular importance with hepatic
allografts. Findlater and Thomson⁹ report a newer but controversial approach combining methylprednisone, vasopressin, and triiodothyronine (T₃) to globally improve hemodynamics of the BDD.

Cardiac dysrhythmias are common in brain-dead patients, with the most common being bradydysrhythmia origin and having varying degrees of heart block. This is due to myocardial contusions, ischemia, electrolyte or acid-base imbalances, hypoxia, or increasing intracranial hypertension. Brain-dead patients exhibiting bradycardia are usually unresponsive to atropine. The drug of choice then becomes isoproterenol because of its direct-acting chronotropic properties. Temporary pacing may also be necessary to override symptomatic bradycardia.³,⁵

- **Core Temperature Regulation.** It is common for brain-dead patients to exhibit poikilothermic activity. Clinical poikilothermia is the inability to maintain a stable internal or core temperature and is due to damage to the thalamus, which disrupts autoregulation of core temperature. As the BBD’s core temperature drifts toward ambient room temperature, it is important to maintain core temperature as high as possible to prevent ventricular irritability, acute kidney injury, and development of coagulopathies.²⁰ Hypothermia may be worsened with environmental exposure. Patients may benefit from fluid warmers as well as forced-air convection warmers and any other mechanism designed to keep the core temperature above 30°C to 35°C.

- **Coagulopathy Development.** Another common issue is the development of coagulopathy. This is not usually a primary problem; rather, it occurs secondary to other disorders. Coagulopathy may result from continuous release of large amounts of tissue thromboplastin and plasminogen from ischemic or necrotic brain tissue into the systemic circulation, creating a disseminated vascular coagulopathy scenario. Hypothermia and loss of catecholamines also affect clotting factors and contribute to coagulopathy development. This is especially true for hypothermia. Last, aggressive fluid resuscitation may also cause a dilutional coagulopathy.⁹,²¹,²²

- **Neurologic Instability Management.** The most common problem seen with neurologic instability with a brain-dead patient is polyuria, which may suggest diabetes insipidus. The diagnosis is made with a urine hyperosmolality of greater than 300 mOsm or a serum hyperosmolality above 310 mOsm/L. Hypernatremia is manifested at above 150 mEq/L and may also indicate diabetes insipidus. The treatment of choice is replacement of free water loss, normalization of serum osmolarity and electrolyte values, and vasopressin infusions.²¹,²²

**Recipient and Donor Selection: Principles of Organ Matching and Tissue Preservation**

The most important element to consider when determining recipient and donor compatibility is to guarantee the right organ goes to the right recipient. Ensuring the donor’s organ is preserved and maintained appropriately is another vital factor influencing successful allograft survival after transplantation.²³,²⁴ Although there are specific contraindications that must be considered for each donor and recipient, there are general contraindications common to all recipients. General contraindications include incurable malignancy, extreme age, active systemic or incurable infection, other major systemic diseases, morbid obesity, emotional instability, and unsupportive social milieu, as well as current alcohol, drug, or tobacco use.⁸,²¹,²² Relative contraindications include hepatitis C and CMV pathology. For example, recipients who have hepatitis C (or CMV) may still receive organs from donors who also contracted hepatitis C (or CMV).²¹,²⁴

Another key issue to consider when matching an organ donor to a recipient is the size of the allograft, particularly in liver, heart, and lung transplants. This is because the native liver, heart, or lungs must first be removed from the recipient’s body before the allograft can be transplanted. Therefore, if the size of the donor’s organ is too large to fit into the native organ anatomical space, the allograft will not survive. Size differentiation contributes to low availability of certain BDD organs in the pediatric population.²,²³,²⁶

- **Principles of Organ Matching.** The ideal organ for transplant has no incompatibilities with the recipient and is usually only seen between twin donor and recipient cases.³ A transplanted organ from nontwin donors of the same species is known as an allograft. Immunologic identity of allografts is established by glycoproteins on the cell membrane known as major histocompatibility complex (MHC) antigens class I or human leukocyte antigens (HLAs). Class II MHC antigens are responsible for the activation of macrophages, T cells, and B cells. They are primary targets for helper T cells. Major blood groups (ABO) surface cell surface markers are important for transplantation because the degree of ABO incompatibility determines probability of rejection, particularly in cardiac transplanted organs. ABO matching is essential before cardiac transplantation. This is because of short donor ischemic time, which severely restricts perspective matching according to HLA screening.²⁷

Survival outcomes, reflected by other diagnostic tests, include the panel reactive antibody (PRA), which cross-matches recipient serums and donor cells to detect preformed antibodies. Literature supports the correlation of a positive PRA with an increased organ transplant rejection rate in renal allografts.²⁸

All allograft distribution depends primarily on biological factors such as ABO compatibility, HLA compatibility, T cell and PRA cross-matching. Cardiac and hepatic allograft distribution is dependent on additional criteria than ABO compatibility, with the most important being size compatibility. The next biggest consideration is the
overall medical emergency and allograft ex vivo time (time separated from donor to transplantation).²⁸,²⁷

- **Principles of Organ Preservation.** Donor organs are temporally separated from blood supply and must be protected from ischemia. This is accomplished by placing the donor organ in a specialized solution specific for that particular organ. Preservation solutions are designed to delay the process of deterioration that occurs immediately on aortic cross-clamp time during organ procurement. Biologically tolerable limits of survival or ex vivo time have been extended by combining hypothermia techniques with the use of preservation solutions³ (Table 1). Organ preservation solutions contain specific electrolyte concentrations, which provide ready sources of energy. Chemical additives in the given solution are cryoprotective and prevent vasospasm, cellular swelling, and the buildup of toxic metabolites.²⁷

- **Tissue Rejection.** After allograft transplantation, if otherwise untreated, an immunocompetent recipient will mount an immune response to foreign cell surface antigens. The response comprises a proliferation of both cellular elements and humoral factors. Fulminant rejection will occur if surface markers do not match between donor and recipient. The cellular immune response consists of T cells, macrophages, and other leukocytes.²⁷ T cells are central to transplanted tissue immune response; they initiate antigen recognition and may ultimately mediate the allograft destruction. Humoral response plays a central role in the allograft rejection process with the presence of immunoglobulins and B lymphocytes or antibodies. B lymphocytes are activated by antigens presented by the macrophages. After antigen MHC complex binds to helper T-cells receptors, cytokines are produced, followed by a B-cell activation.²⁹,³⁰

**Immunosuppressive Therapy**

Immunosuppressant drugs control or attenuate immune response to prevent allograft rejection. Several different drug classes are available to suppress the inflammatory response to the donor organ. Serious side effects and toxicities require diligent management to prevent life-threatening adverse reactions. The high toxicity of the drugs limits their use to only allografts essential for life. Almost all drug regimens use a combination of immunosuppressant drugs, to lower doses of all drugs and minimize side effects. Antirejection drug classes include calcineurin inhibitors, mTOR (mammalian target of rapamycin) drugs, antiproliferative agents, corticosteroids, and antibodies (Table 2).³¹-³³

Despite toxicity concerns, immune suppressive therapy has provided a high quality of life for allograft recipients who tolerate the ongoing immunosuppression. The classic combination of cyclosporine, prednisone, and azathioprine is well tolerated, has a well-documented therapeutic profile, and is relatively inexpensive. Mohty et al³³ reported this “triple therapy” should be a first choice for patients at low to moderate risk of rejection.

Opportunistic infections are a major concern for recipients receiving immunosuppressive therapy. Other drug classes that may be prescribed include antifungals, antibiotics, and antivirals. Immunosuppressive drug therapy requires continual monitoring, and all allograft organ recipients must remain on some type of immunosuppressive therapy for the remainder of their lives to prevent allograft rejection.³¹

- **Cytokine Release Syndrome.** Both anti-inflammatory and pro-inflammatory cytokine activity occurs in a number of infectious and noninfectious diseases, including adult respiratory distress syndrome, sepsis, systemic inflammatory response syndrome, and graft-versus-host disease. Pro-inflammatory cytokines are released by

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**Table 1. Allograft Ischemic Times**

<table>
<thead>
<tr>
<th>Allograft</th>
<th>Ischemic time, h</th>
</tr>
</thead>
<tbody>
<tr>
<td>En bloc heart/lung</td>
<td>4</td>
</tr>
<tr>
<td>Heart</td>
<td>4-6</td>
</tr>
<tr>
<td>Lung</td>
<td>6-8</td>
</tr>
<tr>
<td>Liver</td>
<td>24</td>
</tr>
<tr>
<td>Kidney</td>
<td>48</td>
</tr>
</tbody>
</table>

**Table 2. Commonly Prescribed Immunosuppressive Drugs**

<table>
<thead>
<tr>
<th>Drug class</th>
<th>Drug name</th>
<th>Trade name</th>
<th>Main allograft use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcineurin inhibitor</td>
<td>Cyclosporine</td>
<td>Neoral</td>
<td>Kidney</td>
</tr>
<tr>
<td>mTOR</td>
<td>Tacrolimus</td>
<td>Prograf</td>
<td>Liver</td>
</tr>
<tr>
<td></td>
<td>Sirolimus</td>
<td>Rapamune</td>
<td>Kidney</td>
</tr>
<tr>
<td>Antiproliferative</td>
<td>Azathioprine</td>
<td>Imuran</td>
<td>All</td>
</tr>
<tr>
<td>Monoclonal anti-IL2R receptor antibodies</td>
<td>Basiliximab</td>
<td>Simulect</td>
<td></td>
</tr>
<tr>
<td>Polyclonal anti-T-cell antibodies</td>
<td>Antithymocyte globulin (ATG)</td>
<td>Thymoglobulin</td>
<td></td>
</tr>
<tr>
<td>�</td>
<td>Anti-T-cell antibodies</td>
<td>Antilymphocyte globulin (ALG)</td>
<td>n/a</td>
</tr>
<tr>
<td>�</td>
<td>Murine monoclonal antibody CD3 antigen</td>
<td>Muromonab CD3</td>
<td>Orthoclone OKT3</td>
</tr>
<tr>
<td>�</td>
<td>Corticosteroid</td>
<td>Prednisone</td>
<td>n/a</td>
</tr>
<tr>
<td>�</td>
<td>Mycophenolic acid</td>
<td>Mycophenolate mofetil</td>
<td>CellCept</td>
</tr>
</tbody>
</table>

Abbreviations: IL, interleukin; mTOR, mammalian target of rapamycin; n/a, not available.
activated T cells and produce a systemic inflammatory response normally suppressed with a variety of signaling and negative feedback mechanisms. A frequent and immediate complication occurring in recipients receiving anti-T-cell antibody infusions such as antithymocyte globulin (ATG) or muromonab CD3 (Orthoclone OKT3) is known as a cytokine storm. Pathogenesis occurs when drug antibodies bind to T-cell receptors and activate T cells before destruction. Cytokines chemotactically signal immune cells to migrate to the infection site, increasing the number of T cells and macrophages at the allograft location and stimulating the production of more proinflammatory cytokines not controlled with the usual negative feedback mechanisms.

The amplification reaction can become uncontrolled, with too many activated immune cells producing clinical signs and symptoms similar to severe infections or sepsis. The primary clinical symptoms of cytokine storm are high fever, swelling and redness, extreme fatigue, and nausea. Cytokine storms have the potential to do substantial physiologic damage.

Organ Procurement Procedures: A Critical Phase for Nurse Anesthetists

- Ethical Concerns. All BDDs are classified as ASA class 6 patients. Ethical considerations for organ procurement include recognizing that viable organs for transplant are scarce resources so it is important that wealth or power does not influence the choice of recipient, because this will compromise the integrity of UNOS. The UNOS donors list begins with the sickest patients and ends with the least sick patients. Unfortunately, black-market organs are a very profitable business for renal and lung organs, particularly in third world countries. The UNOS network will not accept anyone as an organ donor or recipient if financial gain is part of the plan.

Another ethical concern raised by healthcare providers is the increasing utilization of expanded criteria donors such as cardiac death donors. The issues under discussion include the ethical unease of removing organs from a donor who is not brain dead and therefore may have awareness during organ procurement procedures.

- Main Anesthetic Goals. Commonly, BDDs are brought to the OR for organ procurement with a separate surgical team for each type of organ allograft procurement (heart, lungs, liver, etc). The 2 main anesthetic goals are to promote donor organ perfusion and oxygenation and to minimize warm ischemic time and surgical trauma to the viscera. Organ procurement procedures usually last about 1 to 3 hours. Adequate perfusion is indicated by pulse oximetry reading above 95%, systolic blood pressure greater than 100 mm Hg, a mean arterial pressure higher than 70 mm Hg, and a central venous pressure greater than 12 cm H2O. Renal perfusion is ensured by a urine output greater than 100 mL/h. Essentially, strategies employed to stabilize the donor (ie, vasopressin infusion) before the organ procurement should be continued. Usually, BDDs are intubated and receiving ventilatory support.

To maintain effective circulating volume, plasma expansion may be necessary. This can be accomplished with crystalloids or colloid products, but excessive crystalloid solutions may create or complicate dilutional coagulopathies and acid-base and electrolyte disorders. Vasopressin at a dosage of 0.5 to 1.5 U/h or low-dose dopamine (2-5 µg/kg/min) are the vasopressors of choice in the perioperative environment to prevent splanchnic vessel vasocstriction and potential abdominal organ ischemia.

Amnestic anesthetic agents (ie, volatile agents) or opioids are not required, but muscle relaxants may be needed to neutralize spinal reflexes. Additional medications that may be administered are 25% mannitol, furosemide (Lasix), and heparin. Clinically significant cardiac bradydysrhythmias should be treated with isoproterenol. One of the most important steps is noting the aorta clamp time because it is essential to record the onset of the ischemic or ex vivo time for vital organs. Allograft ischemic time begins with aortic clamping (see Table 2). Viability of the allograft is partially dependent on transplanting the organ before the expiration of the ischemic interval. All supportive measures are terminated after the proximal aortic is cross-clamped. This includes oxygenation, monitoring and fluid replacement.

Organ Function After Transplant

Donor factors that may affect organ function after transplantation include extreme age, presence of preexisting diseases, hemodynamic or metabolic instability, and extended ex vivo time. This includes the period starting when the donor was declared brain dead and before arrival to the perioperative environment. Procurement-related factors include extended ischemic time, type of preservation solution, metabolic instability, and overall clinical management of the donor during before and during organ procurement. Recipient factors include technical surgical problems such as aberrant anatomy and immunologic sensitization before infusion of the immunosuppressive drugs. Unanticipated drug reactions or hemodynamic or metabolic instability may also occur.

Hyperacute rejection is allograft destruction that is immediate and secondary to HLA or ABO incompatibilities. The most common clinical sign of hyperacute rejection is the development of intravascular thrombus within hours of the transplantation procedure. Acute rejection can occur within the first 6 months, is mediated by T cell-dependent immune responses, and may be reversible. Chronic rejection occurs in the first 6 months and is ongoing, with cytokine proliferation into graft arteries causing ischemia and fibrosis. Nonimmune factors...
include immunotherapy noncompliance or intolerance and failure to change lifestyle. 5,27

Conclusion

The need for solid-organ donors continues to rise as the population grows. Approximately 22 people die daily while awaiting a suitable allograft. 6 In community hospitals and rural settings, aggressive and competent care of the BDD is essential for a successful outcome. 3 Managing the BDD from diagnosis to procurement requires meticulous care and coordination of services and the CRNA may be asked to assume a major role during this critical time. The anesthesia provider’s role in organ procurement procedures and BDD management is essential for continuity of care in maintaining allograft survival. The CRNA, therefore, must have an understanding of the overall process to guide appropriate BDD treatment and allograft protection.

In the United States, unintentional injuries rank as the fourth leading cause of mortality. 37 The emotional pain of loss of life due to unintentional injuries can be ameliorated with organ donation and help families cope with sudden loss. For every organ donated, a life is potentially saved. As the procedures for organ procurement are refined and technological advances are made, people can live longer and fuller lives—all thanks to donors.

REFERENCES


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