Organ donation: Process

As of May 2015, 123,331 people waiting for life-saving organ transplants in the U.S. Of these, almost 100,000 await kidney transplants. Over 100,000 Americans are on the waiting list in need of an organ, yet on average there are only 30,000 transplants performed each year. Currently, in the United States organ donation is done only with consent of the family or donator themselves.

There are two agencies that govern organ procurement and distribution. *The United Network for Organ Sharing and the Organ Procurement and Transplant Network* regulate Organ Procurement Organizations with regard to procurement and distribution ethics and standards. Once a donor has been evaluated and consent obtained, provisional allocation of organs commences. UNOS developed a computer program that automatically generates donor specific match lists for suitable recipients based on the criteria that the patient was listed with. Organ Procurement Organizations enter donor information into the program and run the respective lists. Organ offers to potential recipients are made to transplant centers to make them aware of a potential organ.

Various factors are considered: distance from transplant center, blood type, medical urgency, wait time, donor size and tissue typing.

For heart transplantation, medical urgency is denoted by a recipient's Status (Status 1A, 1B and status 2).

Lungs are allocated based on Lung Allocation Score that is determined based on urgency and wait time.

Livers are allocated using both a status system and MELD/PELD score.

Kidney and pancreas lists are based on location, blood type, Human Leukocyte Antigen (HLA) typing and wait time. When a recipient for a kidney or pancreas has no direct antibodies to the donor HLA the match is said to be a 0 ABDR mismatch or zero antigen mismatch. A zero mismatch organ has a low rate of rejection and allows a recipient to be on lower doses of immunosuppressive drugs.

Location of a transplant center with respect to a donor hospital is given priority due to the effects of Cold Ischemic Time (CIT). Hearts and lungs need to be transplanted within 4–6 hours from recovery, liver about 8–10 hours and pancreas about 15 hours; kidneys are the most resilient to ischemia. Kidneys packaged on ice can be successfully transplanted 24–36 hours after recovery.

Sources

- Organ Procurement and Transplantation Network

Siminoff, Laura A., Amma A. Agyemang, and Heather M. Traino. Consent to Organ Donation: A Review. Progress in Transplantation (2013): 99-104. EBSCO. Web . 29 June 2014.

The Transplantation of Human Organs (Amendment) Bill, 2011, Act No. 136-C of 2009. Retrieved on 8 March 2014.

Organ Donation, Wikipedia. Accessed 5/28/15

Organ donor: bradycardia Rx

Bradycardia in donors may be sinus (ex. as part of Cushing's triad), or non-sinus (ex. if the sinus node fails). Anticholinergics may not be effective if vagal nuclei have been compromised, thus direct-acting agents (ex. isoproterenol, a.k.a. Isuprel, 1.0 µg IV) are preferable. If isoproterenol is not available, consider dobutamine, epinephrine, or dopamine. External, transcutaneous pacing should be reserved for instances in which pharmacologic therapy fails. Occasionally, transvenous pacing may be necessary.

Organ Donor: Arrhythmia Treatment

- Bradycardia: isoproterenol (or dobutamine, epinephrine, or dopamine. Anticholinegics may not work)
- Sinus Tachycardia: esmolol
- SVT: adenosine
- Atrial Fibrillation: rate control (esmolol, diltiazem), likely no benefit for conversion (amiodarone)
- Non-Sustained PVCs: consider amiodarone
- Ventricular Fibrillation: defibrillation + 300 mg amiodarone

Sources

Prog Transplant;2006 Mar;16(1):74-80; quiz 81

Organ donor: Rx of DI

The brain dead donor may produce inadequate amounts of antidiuretic hormone (ADH) from the posterior pituitary resulting in urine volumes of over 1000 mL/hour, resulting in diabetes insipidus. This frequently causes hypernatremia, which can affect the funciton of the transplant in the organ recipient. Diabetes insipidus contributes to hyperosmolarity, hemodynamic instability, and electrolyte abnormalities.

Volume replacement milliliter for milliliter with D5 in water can replete volume if the urine output is less than 200 mL per hour. It is appropriatly managed with

desmopressin in patients with higher urine output, with the goal of keeping urine output between 100 to 200 mL/hour. Desmopressin is an ADH analogue, speicific for the V2 receptor with antidiuretic, but no vasopressor activity. It can be given subcutaneously, intramuscularly, intravenously, or intranasally and acts for 6 to 20 hours. Fluid replacement and electrolyte supplementation should be based on serum electrolytes that should be monitored every two to four hours.

Organ Transplant: Cold Ischemia Times

Donation following cardiac death:

- Liver 8-10 hours

- Kidney 24 hours

- Pancreas 12-18 hours

- Heart 4 hours

- Lungs 4-6 hours

- Intestine 6-12 hours

Longer ischemic times is highly correlated with increased rate of primary nonfunction and associated with delayed graft function.

II. Organophosphate poisoning: diagnosis and treatment

Organophosphate compounds are used as commercial insecticides (isulfoton, phorate, dimethoate, ciodrin, dichlorvos, dioxathion, ruelene, carbophenothion, supona, TEPP, EPN, HETP, parathion, malathion, ronnel, coumaphos, diazinon, trichlorfon, paraoxon, potasan, dimefox, mipafox, schradan, sevin, and dimetonor) in chemical warfare (nerve gases such as tabun and sarin) and are applied as aerosols or dusts. They can be rapidly absorbed through skin and mucous membranes or by inhalation.

Organophosphates are also used in ophthalmology – echothiopate is used to treat glaucoma.

Organophosphate mechanism of toxicity:

- Acetylcholinesterase inhibitors that form a stable irreversible covalent bond to the enzyme.

- Occurs at cholinergic junctions of the nervous system including postganglionic parasympathetic junctions (sites of muscarinic activity), autonomic ganglia and the neuromuscular junctions (sites of nicotinic activity) and certain synapses in the CNS.
- Acetylcholine is the neurohumoral mediator at the cholinergic junctions. Since acetylcholinesterase is the enzyme that degrades acetylcholine following stimulation of a nerve, **by inhibiting acetylcholinesterase, organophosphates allows acetylcholine to accumulate** and result in initial excessive stimulation followed by depression.

Signs and Symptoms

Muscarinic signs

(SLUDGE) salivation, lacrimation, urination, diaphoresis, gastrointestinal upset, emesis and progressing to bronchospasm, bronchorrhea, blurred vision, bradycardia or tachycardia, hypotension, confusion, and shock.

Nicotinic effects

Skeletal muscle initially exhibits fasciculation (involuntary irregular, violent muscle contractions) followed by the inability to repolarize cell membranes resulting in weakness and paralysis. Severe reactions can lead to ventilatory failure and death (cholinergic crisis).

Treatment

- Termination of the exposure including removing all soiled clothing. Gently cleanse with soap and water to hydrolyze organophosphate solutions.
- Airway control and adequate oxygenation. Intubation may be necessary in cases of respiratory distress due to laryngospasm, bronchospasm, bronchorrhea, or seizures. Immediate aggressive use of atropine may eliminate the need for intubation. Succinylcholine should be avoided because it is degraded by AChE and may result in prolonged paralysis.
- Continuous cardiac monitoring and pulse oximetry should be established; an ECG should be performed. Torsades de Pointes should be treated in the standard manner. The use of intravenous magnesium sulfate has been reported as beneficial for organophosphate toxicity. The mechanism of action may involve acetylcholine antagonism or ventricular membrane stabilization.
- Irrigate the eyes of patients who have had ocular exposure using isotonic sodium chloride solution or lactated Ringer's solution. Morgan lenses can be used for eye irrigation.

Pharmacologic Treatment

- **Atropine – The endpoint for atropine is dried pulmonary secretions and adequate oxygenation. Tachycardia and mydriasis must *not* be used to limit or to stop subsequent doses of atropine. The main concern with OP toxicity is respiratory failure from excessive airway secretions.** Start with a 1-2 mg IV bolus, repeat q3-5min prn for desire effects (drying of pulmonary secretions and adequate oxygenation). Consider doubling each subsequent dose for rapid control of patients in severe respiratory distress. An atropine drip titrated to the above endpoints can be initiated until the patient's condition is stabilized.
- **Pralidoxime** – Nucleophilic agent that reactivates the phosphorylated AChE by binding to the OP molecule. Used as an antidote to reverse muscle paralysis resulting from OP AChE pesticide poisoning but is not effective once the OP compound has bound AChE irreversibly (aged). Current recommendation is administration within 48 h of OP poisoning. Because it **does not significantly relieve depression of respiratory center or decrease muscarinic effects of AChE poisoning** , administer atropine concomitantly to block these effects of OP poisoning. Start with 1-2 g (20-40 mg/kg) IV in 100 mL isotonic sodium chloride over 15-30 min; repeat in 1 h if muscle weakness is not relieved; then repeat q3-8h if signs of poisoning recur; other dosing regimens have been used, including continuous drip.

Acetylecholinesterate Poisoning: Treatment

- Remove clothing and wash skin with soap and water
- Airway management (secretions are the main issue), avoid SCh (degraded by AChE)
- **Atropine** (titrated to dried secretions, not HR) and **pralidoxime** (reactivates AChE)

III. PACU bypass: Rationale

- The PACU is traditionally divided into phases 1 and 2. Phase 1 has monitoring and staffing ratios equivalent to the ICU. Phase 2 is a transitional period between intensive observation and either the surgical ward or home. The concept of bypassing or "fast-tracking" phase 1 is becoming more common as fast-offset anesthesia agents and practices are emerging. Bypass is typically appropriate for patients who have received either MAC or peripheral regional anesthesia, while phase 1 is typically required for general inhalational anesthesia or neuraxial regional techniques. Ultimately, however, patient co-morbidities, surgical techniques/complications and pharmacological choices also determine the appropriate level of post-operative care on an individual basis.

- Additionally, the Aldrete scoring system is commonly used to determine when patients can be safely discharged from phase 1 to phase 2. The scoring basis includes the five parameters of activity, respiration, circulation, consciousness and oxygen saturation.

III PACU bypass: Stage I bypass criteria

Generic Clinical Sciences

Aldrete's original scoring system has been modified, but originally required a score of 9 or greater to leave the PACU (i.e. you could only miss one point on the following scale)

- Able to move four extremities on command: 2
- Able to move two extremities on command: 1
- Able to move 0 extremities on command: 0

Breathing :

- Able to breathe deeply and cough freely: 2
- Dyspnea: 1
- Apnea: 0

Circulation :

- Systemic blood pressure ≠ 20% of the preanesthetic level: 2
- Systemic blood pressure is 20% to 49% of the preanesthetic level: 1
- Systemic blood pressure ≠ 50% of the preanesthetic level: 0

Consciousness :

- Fully awake: 2
- Arousable: 1
- Not responding: 0

Oxygen Saturation (Pulse Oximetry):

- 92% while breathing room air: 2
- Needs supplemental oxygen to maintain saturation >90%: 1
- 90% even with supplemental oxygen: 0

Adapted from Aldrete JA (see Sources)

Discharge to Home

Patients who score of 9 or greater and have an appropriate escort are ready to go home

Adapted from Table 85-15 – Criteria for Determination of Discharge Score for Release Home to a Responsible AdultVital Signs (stable and consistent with age and preanesthetic baseline):

- Systemic blood pressure and heart rate within 20% of the preanesthetic level: 2
- Systemic blood pressure and heart rate 20% to 40% of the preanesthetic level: 1
- Systemic blood pressure and heart rate >40% of the preanesthetic level: 0

Activity Level:

- Steady gait without dizziness or meets the preanesthetic level: 2
- Requires assistance: 1
- Unable to ambulate: 0

Nausea and Vomiting:

- None to minimal: 2
- Moderate: 1
- Severe: 0

Pain:

- Minimal to no pain, controllable with oral analgesics: 2
- (above conditions not met): 1

Surgical Bleeding (consistent with that expected for the surgical procedure):

- Minimal (does not require dressing change): 2
- Moderate (up to two dressing changes required): 1
- Severe (more than three dressing changes required): 0

Modified from Marshall and Chang F (see Sources)

Sources

Miller, RD et al. Miller's Anesthesia, 7th edition, Churchill Livingstone: p 2708, 2723-4. 2009, (see in particular Miller Tables 85-14 and 85-15)

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