Anesthetic Management of a Renal Autotransplant

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Learning Objectives

- ✓ The learner will be able to define a renal autotransplant.
- ✓ The learner will be able to identify conditions that may indicate a renal autotransplant.
- ✓ The learner will be able to explain the physiology of nutcracker phenomenon.
- ✓ The learner will be able to describe the anesthetic considerations regarding a renal autotransplant.

What is it?

A renal autotransplant is a procedure in which the surgeon removes a kidney with a vascular or ureteral malformation, corrects the malformation, and returns it back to the patient.

Indications

Kidney autotransplant is a procedure to relieve chronic pain caused by kidney stones, ureter injuries, loin pain hematuria syndrome, and nutcracker phenomenon.

Kidney stones: During a renal autotransplant, a surgeon can shorten the length of a patient's ureter from ~20cm down to just 3cm, as well as severing the kidney's connection with its nerves. Even though the patient will still produce stones after the procedure, the stones will have a much shorter distance to travel and the patient will no longer have intact nerves to perceive the calculi.

Nutcracker phenomenon: Nutcracker phenomenon refers to the compression of the left renal vein between the superior mesenteric artery and the aorta, impeding blood flow from the kidney into the inferior vena cava. Pain is the most common symptom, but patients may also experience orthostatic proteinuria, orthostatic incontinence, hematuria. In an autotransplantation, the surgeon removes the kidney and relocates it closer to the bladder, relieving the left renal vein of the compression.

Renal autotransplantation is only a treatment consideration for patients with severe kidney pain that doesn't improve with other interventions.

Complications

Organ rejection, a common complication in traditional transplant procedures, is not a concern in an autologous renal transplant. Hence, the patient is not prescribed immunosuppressants.

The most common complications for renal autotransplant are hemorrhagic in nature. Full efforts to optimize patient status preoperatively should be taken.

Anesthetic Considerations

Induction: Propofol is considered safe for induction. Ketamine should be avoided in patients with CAD or IHD as it is a sympathomimetic agent, whereas etomidate may be a better candidate.

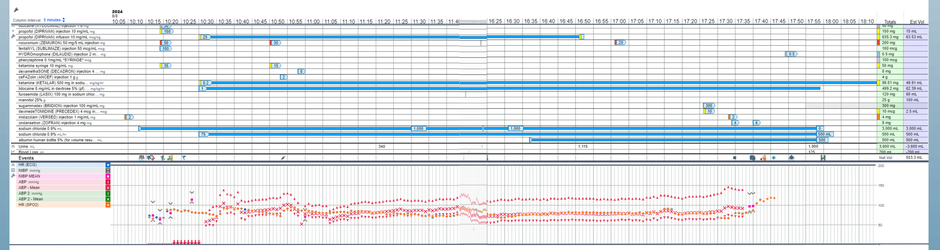
Maintenance: Sevoflurane, desflurane, isoflurane, and propofol are all suitable agents for renal autotransplantation.

Relaxation: Patients with ESRD are known to be a greater risk of aspiration, although the prevalence of ESRD in renal autotransplant patients is not as great as in classical renal transplant patients. Succinylcholine may be administered in patients with serum potassium < 5 mEq/L. Rocuronium and vecuronium may result in an increased duration of action due to clearance through the kidneys. Atracurium and cisatracurium may not be affected due to its spontaneous hoffman elimination. However, its downstream metabolite laudanosine can induce seizures.

Fluid Therapy: Mannitol is an excellent agent to administer during renal autotransplantation to increase intravascular fluid volume, flow through the kidneys, as well as providing protection against acute tubular necrosis. However, excessive mannitol administration can exacerbate underlying heart failure or pulmonary edema. Furosemide is commonly administered prior to clamp release for ischemic protection by blocking active tubular transport in the proximal tubule. However, low urine output following furosemide administration predicts the need for postoperative renal replacement therapies.

Antinociception: Fentanyl, as well as its analogs sufentanil, alfentanil, and remifentanil are all acceptable narcotics. Morphine should be avoided as its downstream metabolite morphine-6-glucuronide can accumulate to toxic levels during renal transplants. Ketamine is a suitable opioid-sparing candidate for neuropathic, chronic, and postoperative pain. No dose adjustment is needed for patients with renal history. Magnesium achieves many of the same effects as ketamine through blockage of NMDA receptors. Dexmedetomidine is an excellent candidate for anesthetic-sparing and respiratory-sparing analgesia. Dexmedetomidine also inhibits the stress response from surgery, limits inflammation, and protects immune function.

Case Study



- ➢ Pt: 39 y/o M, presenting for left renal autotransplantation
- ➢ PMHx: Nutcracker phenomenon, smoker, awareness under anesthesia
- ➢ Plan: GA/ETT, peripheral regional anesthesia, arterial line placement, extubate
- ➢ Induction: The patient was pre-medicated with 2mg of midazolam, and induced with 100 mcg of fentanyl, 50 mg of lidocaine, 150 mg of propofol, 35 mg of ketamine, and 50 mg of rocuronium.
- ➢ Maintenance: Unconsciousness was maintained with sevoflurane and a 25 mcg/kg/min infusion of propofol. Akinesia was achieved with intermittent boluses of rocuronium guided by peripheral nerve stimulation. Antinociception was maintained with a 0.2 mg/kg/hr infusion of ketamine, 1 mg/kg/hr infusion of lidocaine, as well as ketamine boluses PRN. 2g of cefazolin was administered Q4H for antibiotic protection. Due to the length of the procedure, a scopolamine patch, 8mg of dexamethasone, 8mg of ondansetron, and the background infusion of propofol stated earlier were used for antiemetic protection. 120mg of furosemide was administered prior to clamp release, and 500mL of albumin and 300g of mannitol were administered to increase plasma oncotic pressure.
- ➢ Emergence: 10 mcg of dexmedetomidine was given for anxiolysis, and an additional 2 mg of midazolam for amnesia.

Discussion

Postoperatively, the patient progressed very well. The patient had issues with nerve pain in his right groin and scrotal swelling, which were expected. The nerve pain improved, the swelling was stabilized, and the patient was discharged six days later. On the day of discharge, the patient was tolerating diet, had functioning bowels, and was ambulating well. Kidney function was noted to have improved since before the transplant.

The anesthesia team believe that the anesthetic plan was thorough and took into account the physiology of the patient. Due to the neuropathic nature of the patients pain postoperatively, perhaps gabapentin or a magnesium infusion would have been beneficial to include in the patients analgesic plan.

No regional anesthesia was used for this procedure. Given the patient's health and body habitus, a transversus abdominis plane block may have been beneficial in reducing the patient's need for opioids, as well as reducing postoperative pain.

Conclusion

Although kidneys are redundant organs, preserving both of them can dramatically increase an individuals quality of life. That, along with the fact that no immunosuppressants are required for the patient, make autologous renal transplants a rare but ideal treatment for patients with certain indications. Anesthetic considerations are similar to that of a traditional renal transplant, but generally differ in common patient comorbidities and baseline renal health.

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