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Renal Transplantation

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Summary

The standard monitorization proposed by the American Society of Anesthesiology will be sufficient for both the donor and the recipient. Electrocardiography (ideally with ST segment analysis), pulse oximeter, capnography, urine volume, non-invasive blood pressure, neuromuscular monitoring are required. Appropriate anesthesia technique should be selected taking into account the existing diseases of the patient, the duration of surgery and the possibilities of renal protection. Since preservation of graft function is directly related to graft perfusion, it is the primary issue of renal perfusion during donor nephrectomy. Renal transplant recipients without severe cardiac or respiratory problems are extubated after surgery. Very rarely, the patient needs mechanical ventilation in intensive care conditions.

Intraoperative Period

Anesthesia Monitoring

The standard monitorization proposed by the American Society of Anesthesiology will be sufficient for both the donor and the recipient [1]. ECG (ideally with ST segment analysis), pulse oximeter, capnography, urine volume, non-invasive blood pressure, neuromuscular monitoring are required. While renal transplant candidates are cardiac patients, central vein catheterization is used as a standard in some centers, while some centers are not preferred because they are not a good indicator of fluid need or response [2]. Wide Intravenous (IV) routes should be opened, but IV route interventions may not always be easy in these patients. Difficulty becomes even more pronounced, especially in patients with arteriovenous (AV) fistulas or who have had frequent central venous dialysis catheters. Central vein catheterization under ultrasound provides a great advantage in this respect. Central vein catheterization should be done from the side without AV fistula if possible. Invasive blood pressure monitoring is not indicated in every patient. Because donors are generally healthy patients, they rarely need invasive follow-up. In the recipients, depending on the AV fistulas present, the process may be inconvenient and also pose a risk for future fistulas. Therefore, intraoperative invasive blood pressure follow-up is recommended only in renal transplant candidates with advanced cardiac disease. Instead, non-invasive blood pressure monitoring is sufficient. Care should be taken to use the leg in the contralateral side of the side to which the allograft will be attached if the cuff is placed on the arm without AV fistula, if it cannot be used in both arms for some reason and the measurement will be made from the lower extremity [3]. Transesophageal echocardiography can be used in patients with ventricular insufficiency, pulmonary hypertension, or advanced coronary artery disease. New invasive monitoring techniques analysis is not preferred because it requires artery monitoring, but it is a good alternative to central vein pressure monitoring [4]. Inhibition of hypothermia is of great importance for direct graft function. Therefore, monitoring the body temperature is very important in the intraoperative period.

Anesthesia maintenance

Appropriate anesthesia technique should be selected taking into account the existing diseases of the patient, the duration of surgery and the possibilities of renal protection [5]. Regardless of the method of anesthesia, varicose stockings and blankets in which active heating can be provided should be used to prevent the destructive effect of hypothermia on the graft in terms of mechanical thrombophylaxis [3]. The use of central regional methods is rare and controversial in patients with chronic renal failure

[6-8]. However, in the literature, successful use of regional anesthesia in both donors and recipients has been reported many times during renal transplant. (4.6 to 8). Epidural anesthesia can be used both alone and in combination with general anesthesia and has a positive effect on graft by suppressing surgical stress in the intraoperative and postoperative period [4]. General anesthesia is the most preferred anesthesia method [1]. Induction and intubation may cause exaggerated hemodynamic changes in patients with cardiac pathologies and diabetes [1]. Especially in patients with diabetes, rapid serial intubation may be necessary due to gastroparesis due to autonomic disfunction.

End-stage renal failure affects the pharmacokinetics and pharmacodynamics of drugs. In addition, changes in body fluid distribution also affect drug distribution, causing changes in the metabolism of drugs used in the perioperative period [9]. It is important that these changes are known to the anesthetist. Midazolam can be used safely for premedication as its distribution and excretion do not change [10]. Propofol and thiopental are hypnotic agents that can be used safely during anesthesia induction [9]. Both agents are metabolized in the liver. In the intraoperative period, analgesia can be achieved with synthetic opioids independent of renal function such as fentanyl, sulfentanil, alfentanil or remifentanil. Unlike these agents that do not have an active metabolite, morphine and meperidine should not be used because they have active metabolites that can accumulate due to reduced kidney function. Due to the accumulation of morphine-6-glucoronide, these patients may experience prolonged respiratory failure in the postoperative period. Succinylcholine is a depolarizing neuromuscular blocker, the use of which should be avoided as it can cause hyperkalemia. Atracurium and cisatracurium, which are non depolarizing neuromuscular agents, are the first-choice muscle relaxants. They can be used safely in patients with kidney failure, since their metabolism is independent of any organ and is broken down by Hoffman elimination and ester hydrolysis. Since vecuronium and rocuronium clearance are dependent on both kidney and hepatic metabolism, their duration of action is observed. For this reason, it has been shown that rocuronium can be used safely in renal transplant patients, and that neuromuscular effect can be successfully reversed with sugammadex if they should be used with caution [11].

Maintenance of anesthesia can be done with both inhalation anesthetics and propofol induction. In a study in which propofol and sevoflurane were compared, it was reported that although there was no difference in terms of graft functions, lower 2-year rejection rates with sevoflurane were observed [12]. Although it is stated in the literature that sevoflurane may have a nephrotoxic effect due to compound A formation and floride, no significant nephrotoxic effect has been observed with clinical studies [13,14]. This effect can be prevented by keeping the fresh gas flow above 4 l / min [5]. Isoflurane, desflurane are inhalation agents that can be used safely.

Surgical

Except for very rare cases, the receiver and the transmitter are given different positions. The preferred position in the donor is the lateral position. As the left kidney is preferred because of the longer vein of the left kidney, the left lateral position is usually used. Although open nephrectomy is preferred in many centers, laparoscopic or robotic nephrectomy is also used safely in some centers [15]. In buyers, the position is supine position. Renal allograft is frequently placed in the right or rarely left extraperitoneal fossa.

Fluid maintenance

Since preservation of graft function is directly related to graft perfusion, it is the primary issue of renal perfusion during donor nephrectomy [3]. For this reason, by induction of crystalloid into the donor after induction, both normotension should be preserved and the urine output should be 10-20ml / kg until the renal artery is filled. It is preferred to keep the pressure of the central vein within the limits of 10-15mmHg. Administration of 1-2 ml / kg of 20% mannitol has a positive effect on the graft by preventing increased renal blood flow, clearance of free oxygen radicals and preventing tubular blockages. It may be desirable to give heparin before the vascular clamps are closed by the surgeon. Preferred liquid crystalloids in donors. Balanced electrolyte solutions containing K + can be used safely as these patients have healthy kidney functions.

Perhaps one of the most important issues in renal transplant recipients is fluid maintenance. Providing sufficient intravascular volume increases renal blood flow, causing serious positive effects on graft function. Generally, in the intraoperative period, it is desired to keep the central vein pressure between 10-15 mmHg by aggressive crystalloid therapy. In the intraoperative period, patients are in need of an average of 40 ml / kg of crystalloid [3]. However, targeting central vein pressure at 7-9 mmHg by keeping the amount of fluid around 15ml/kg in patients with previously uncompensated cardiac disease may prevent the development of pulmonary edema [16]. Keeping systolic blood pressure above 130 mmHg is important for perfusion. However, the use of vasopressors with an alpha adrenergic effect should be avoided as it may reduce the

graft bleeding [17]. If hypotension is present and adequate response cannot be obtained with fluid therapy, it may be necessary to use vasoconstrictive drugs. This is a situation that should be decided by talking to the surgical team. It has been shown that the need for inotropic support is higher in patients with elderly, second-time kidney transplant and primary renal pathology polycystic kidney disease, and the first year mortality, rejection and hospitalization periods of the patients with inotropic need were significantly higher [18].

The use of low-dose dopamine is not recommended because it does not cause an increase in renal graft function, but an increase in intensive care hospitalizations, heart rate and mortality is observed in the patients used [19]. Dobutamine can be used in patients with low cardiac output. Noradrenaline is the first choice drug in the treatment of hypotension, which continues after an optimized fluid treatment. Although crystalloids are seen as the first choice, the debate about which crystalloid can be used is still ongoing [3,20,21]. Although 0.9% NaCl is traditionally the first option, it has been shown in studies that hyperkalaemia increases in these patients due to the development of hyperchloremia and acidosis [20-22]. There are randomized prospective studies showing that balanced electrolyte solutions containing acetate such as lactated ringer or Isoltye S can be used safely, both hyperkalemia is less monitored and the need for catecholamine and inotrop is less [20,21].

It has been reported that colloids have negative effects on renal function and may increase bleeding. Although there are studies showing that the use of Hidroxy ethytl starch (HEP) not exceeding 15 ml / kg does not have negative effects on the graft, crystalloids are still the first choice [9]. In any case, all fluids should be given by heating. Fluids at room temperature cause hypothermia in the patient and decrease graft success significantly. Although mannitol and furosemide are recommended for optimization of graft function during reperfusion, only mannitol has been shown to reduce the incidence of acute tubular necrosis [23]. It is known that acute tubular necrosis is less frequently observed in patients with effective hydration [9]. In the period when clamps are opened and reperfusion is achieved, inadequate hydration may affect graft function by causing hypotension. Therefore, it is necessary to be careful in this period. Urinary output with perfusion is expected even in anuric patients. If urine output does not occur, it should be evaluated whether optimal fluid therapy can be achieved. In cases where there is no hypotension but renal vasoconstriction, calcium channel blocker infusions such as verapamil or diltizem can be started. In patients with delayed graft function, dialysis treatment may be necessary in the postoperative period.

Methylprednisolone (0.5-1 g) is given as an IV infusion just before reperfusion to prevent hyperacute rejection. It is very important to closely monitor blood sugar levels, especially in diabetic patients.

Blood and Blood Products

Patients with end-stage renal failure are often accustomed to low hemoglobin levels because they have been anemic for a long time. Since the expectation of bleeding is low in the intraoperative period, the need for blood and blood product transfusion is often minimal, but they can be accompanied by many complications such as febrile nonhemolytic reaction, graft versus-host disease and transfusion of infection source pathogens. For this reason, if blood products are required, leukocyte reduced, irradiated and washed blood products should be used [24]. In these patients, more than expected surgical bleeding may be associated with uremic thrombocytopathy, and these patients may need thrombocyte suspension. Thromboelastogram can be used to reveal thrombocytopathy in the preoperative and intraoperative period, as well as control of bleeding and clotting time can help determine the need for platelets.

Renal transplant recipients without severe cardiac or respiratory problems are extubated after surgery. Very rarely, the patient needs mechanical ventilation in intensive care conditions. Decurarization can be safely achieved with atropine and neostigmine. As mentioned before, there are studies showing that sugammadex can be used safely in patients who are receiving rocuronium. One of the things that should not be forgotten in this period is to continue preventing hypothermia. After dressing of the surgical site, the patient should be freed from wet surgical covers quickly and be warmed with blankets, passive and active heating methods.

Postoperative analgesia

Renal pain stimuli originate from the multisegmental spinal nerves (T10 and L1) and the vagus nerve. Pain after renal transplantation is usually mild to moderate. There are two options for analgesia; systemic or epidural analgesia methods. Since systemic analgesia may impair graft function, epidural analgesia can be alarming, especially due to dysfunction of platelet functions or residual heparin in dialysis patients. Currently, the most preferred method for pain control after renal transplantation is seen as intravenous opioid administration with HKA. It should be remembered that side effects such as respiratory depression, hypoxia, and even plicosis may be observed in patients with renal transplantation due to the use of morphine, one of the postoperative analgesia methods

[25]. For postoperative analgesia, intravenous morphine is avoided in most centers due to the possible effects of active metabolites to be released as a result of renal dysfunction, and fentanyl or tramadol is a more preferable option for the postoperative HKA method. Patients with renal insufficiency usually have platelet dysfunction, which creates a relative contraindication in choosing epidural analgesia to perform postoperative analgesia [26].

Nonsteroidal anti-inflammatory drugs should be avoided as they are nephrotoxic and cause gastrointestinal system erosions. Paracetamol and COX inhibitors should also be avoided in patients with post-transplant due to their potential nephrotoxic effects [27]. Thoracic paravertebral block can be made by applying 5 mL for each segment from the level of thoracic 7-9 [28]. In the literature, it has been shown in the following years that intercostal and ilioinguinal –iliohipogastric nerve blocks are used both to reduce postoperative analgesia and morphine consumption [29]. TAP blocks have also taken their place in the literature as a very popular method in renal transplant recipients [30,31]. Nowadays, it is also included in the guidelines that the administration of 20 mL of 0.375% ropivacaine with a classical or subcostal approach provides sufficient analgesia [28]. Quadratus lumborum blocks, on the other hand, are another technique performed in the lateral position with ultrasound guidance and applied 20-30mL of 0.375% ropivacaine or bupivacaine for the abdominal and lower thoracic segmental nerves (located between the psoas

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