

# Perioperative Anesthetic Management for Recipients of Orthotopic Liver Transplant Undergoing Nontransplant Surgery

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**Objectives:** The number of organ transplant recipients who present for nontransplant surgery has increased annually. The aim of this study was to evaluate the perioperative anesthetic management of recipients of an orthotopic liver transplant who have undergone nontransplant surgery at Baskent University Hospital.

**Patients and Methods:** The medical records of 22 recipients of an orthotopic liver transplant who had undergone a total of 32 nontransplant elective surgeries between December 1988 and February 2006 were retrospectively reviewed. Demographic information, including the anesthetic management and the results of perioperative liver and renal function tests, was recorded.

**Results:** The mean age of the patients at the time of transplant was  $20.2 \pm 17.9$  years. The mean interval from liver transplant to the first surgery was  $739.1 \pm 502.2$  days. The most frequent type of surgery was abdominal (28.1%). The types of anesthetic techniques used were general (75%), regional (9.4%), local (9.4%), and sedoanalgesia (6.3%). General anesthesia was induced with thiopental, propofol, or ketamine, and was maintained with isoflurane and nitrous oxide. Endotracheal intubation was performed in 43.8% of the patients. Spinal anesthesia was induced in 3 patients, and peripheral neural blockage was used in 2 patients. Prothrombin time, activated partial thromboplastin time, international normalized ratio, and levels of serum alanine transaminase, aspartate transaminase, total

bilirubin, blood urea nitrogen, and creatinine were similar preoperatively and on the first day after surgery ( $P > .05$ ).

**Conclusions:** In this study, neither regional nor general anesthesia was associated with a deterioration of liver function. We suggest that recipients of orthotopic liver transplant can undergo nontransplant surgery without postoperative graft dysfunction if hepatic perfusion is maintained with appropriate anesthetic management.

**Key words:** General anesthesia, organ transplantation, Regional anesthesia, Local anesthesia, Liver grafting

The number of organ transplants performed and the improved survival rates that result from well-established surgical techniques and effective immunosuppressive and supportive therapy have led to an increase in the number of patients who present for elective or emergency surgery unrelated to their transplant (1,2). Although in many respects, the perioperative anesthetic management of an organ transplant recipient is similar to the standard practice for any patient, the physiologic and pharmacologic problems of allograft denervation, the adverse effects of immunosuppression, the risk of infection, and the potential for rejection are essential considerations. There is no ideal anesthetic for use in organ transplant recipients. However, certain principles can be applied to all transplant patients who undergo anesthesia and surgery (3). In this study, we review our experiences with 22 recipients of orthotopic liver transplant who underwent nontransplant surgery in our hospital between 1988 and 2006.

## Patients and Methods

One hundred eighty-two liver transplants were performed at Baskent University Ankara Hospital in Ankara, Turkey, between December 1988 and February 2006. The medical records of 22 recipients of

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an orthotopic liver transplant who underwent nontransplant surgery during that period were retrospectively evaluated. We recorded each patient's demographic information and the results of perioperative liver and renal function tests, including those for levels of serum alanine transaminase, aspartate transaminase, total bilirubin, blood urea nitrogen, and creatinine, as well as the prothrombin time, activated partial thromboplastin time, and international normalized ratio. The data analyzed included the types and numbers of procedures performed and the anesthetic techniques and agents used. Intraoperative complications and mortality were also noted.

All data were analyzed with SPSS software (Statistical Package for the Social Sciences, version 11.0, SPSS Inc, Chicago, IL, USA). The chi-square and paired *t* tests were used where appropriate. Data are expressed as mean values  $\pm$  standard deviations (mean  $\pm$  SD). A *P* value  $<$  .05 was considered statistically significant.

## Results

Twenty-two patients underwent a total of 32 nontransplant elective surgeries. The patients' demographic information and perioperative data are provided in Table 1. The types of anesthetic techniques used were general (75%), regional (9.4%), local (9.4%), and sedoanalgesia (6.3%).

Intraoperative monitoring was performed by means of electrocardiography, pulse oximetry, and noninvasive surveillance of the blood pressure level. General anesthesia was induced with thiopental (54.5%), propofol (22.7%), ketamine (13.6%), or

sevoflurane (9.1%). Fentanyl was used in 91.7% of the patients. Anesthetic maintenance was achieved with isoflurane and nitrous oxide. Endotracheal intubation was required in 43.8% of the patients studied. To provide muscle relaxation and to facilitate intubation, either vecuronium (76.9%) or atracurium (23.1%) was given. In addition to immunosuppressive therapy, additional doses of a steroid (methylprednisolone) were administered according to the preference of the attending anesthesiologist in 46.9% of the patients. The immunosuppressive protocols consisted of a combination of drugs including prednisolone, cyclosporine, tacrolimus, sirolimus, and/or mycophenolate mofetil, which were chosen according to the patient and protocol used. Midazolam and fentanyl were used in patients who were under sedation. Spinal anesthesia was induced in 3 patients, and peripheral neural blockage was used in 2 patients.

Crystalloids were administered as maintenance fluids. Intraoperative blood loss in 4 patients was compensated for by transfusions of  $425.0 \pm 236.3$  mL (range, 100-600 mL) of packed red blood cells. No intraoperative complications occurred, and vasopressors were not needed in any patient. After thoracotomy and stereotaxic biopsy, 2 patients (9.1%) were admitted to the intensive care unit to treat an intracranial abscess. Serum levels of alanine transaminase, aspartate transaminase, prothrombin time, activated partial thromboplastin time, international normalized ratio, total bilirubin, blood urea nitrogen, and creatinine were similar preoperatively and on the first day after surgery (*P*  $>$  .05) (Table 2). Graft rejection occurred in 3 patients before

**Table 1.** Demographic and perioperative data of the study subjects

Mean age at the time of transplant (y)	20.2 $\pm$ 17.9
Sex (male/female)	15/7
Mean interval from liver transplant to first surgery (d)	739.1 $\pm$ 502.2
Type of surgery (%)	
Abdominal	28.1
Orthopedic	18.8
Gynecologic	18.8
Ear, nose, and throat	9.4
Pediatric	9.4
Neurologic	9.4
Duration of surgery (min)	104.8 $\pm$ 57.4
Intraoperative	
Fluid requirement (mL)	1228.0 $\pm$ 1099.7
Need for transfusions (%)	12.1 (4/33)
Duration of hospital stay (d)	9.6 $\pm$ 14.5

Values are expressed as means  $\pm$  SD.

**Table 2.** Laboratory values of the study subjects

Laboratory analyses performed	Preoperative values	Postoperative values (day 1)	<i>P</i> value
ALT ( $\mu$ kat/L)	1.087 $\pm$ 1.261	1.047 $\pm$ 1.535	.711
AST ( $\mu$ kat/L)	1.042 $\pm$ 0.736	0.890 $\pm$ 0.768	.154
PT (s)	17.0 $\pm$ 5.4	18.2 $\pm$ 5.5	.245
aPTT (s)	30.6 $\pm$ 10.6	32.3 $\pm$ 3.4	.758
INR	1.6 $\pm$ 0.7	1.5 $\pm$ 0.4	.518
Total bilirubin ( $\mu$ mol/L) (normal range, 5.1 $\pm$ 32.5 $\mu$ mol/L)	30.78 $\pm$ 23.94	29.07 $\pm$ 27.36	.551
BUN (mmol/L) (normal range, 2.5 $\pm$ 7.1 mmol/L)	8.21 $\pm$ 2.14	7.60 $\pm$ 2.92	.166
Creatinine ( $\mu$ mol/L) (normal range, 4.2 $\pm$ 106.1 $\mu$ mol/L)	79.56 $\pm$ 35.36	88.4 $\pm$ 44.2	.539

ALT, Alanine transaminase; aPTT, activated partial thromboplastin time; AST, aspartate transaminase; BUN, blood urea nitrogen; INR, international normalized ratio; PT, prothrombin time. Values are expressed as means  $\pm$  SD.

their nontransplant surgery was performed. No patient died while hospitalized for nontransplant surgery.

## Discussion

Orthotopic liver transplant is defined as the surgical removal of a liver damaged by irreversible end-stage hepatic disease and its replacement with a liver allograft. Because the 1-year survival rates are greater than 90%, anesthesiologists may need to anesthetize recipients of a liver transplant for reasons related or unrelated to the transplant procedure in the months and years after the procedure (3).

The most common needs for surgical intervention in our patient population were abdominal (incisional or inguinal hernia), orthopedic (hip replacement), or gynecologic (cesarean section). At our center, a general anesthetic was preferred by all patients for most of the surgeries except for the orthopedic interventions, for which a regional anesthetic was used. Oral endotracheal intubation was performed in all patients. Conventional induction agents and opioids such as fentanyl were administered to patients who required a general anesthetic. Isoflurane and nitrous oxide were used to maintain anesthesia, because there is no evidence of an increased risk of hepatitis after the administration of an inhaled anesthetic (1,3). The use of muscle relaxants that are metabolized independent of liver and renal function has been suggested. However, vecuronium, which is excreted by the biliary route, has been successfully used more often than atracurium without a prolonged effect (3). It has been stated that when hepatic and renal functions are within normal limits, the use of any anesthetic in patients with a transplant history is not contraindicated (4,5). The safest approach in such patients, however, involves titration of the drug to the desired effect, because the effect may be unpredictable.

The use of supplemental stress dose steroids is not routinely recommended (5,6). Nevertheless, half of our patients received a steroid intraoperatively. Regional anesthesia was induced without complication in 5 patients. Patients treated with azathioprine or antithymocyte globulin may have thrombocytopenia, and if such individuals exhibit no co-

agulopathy, the use of regional anesthesia should be considered (3). Abdominal operations in recipients of orthotopic liver transplant can cause bleeding, and adequate volume replacement is important in maintaining perfusion of the transplanted organ. Crystalloids were administered to maintain adequate urine output (> 0.5 mL/h), and intraoperative blood loss was compensated for by transfusing packed red blood cells to maintain a hematocrit level higher than 30%. However, none of our patients required massive fluid administration or transfusion during their nontransplant surgery.

In transplant recipients, treatment with immunosuppressive drugs can compromise renal function, which should be assessed perioperatively (1). Standard liver and renal function tests were performed in our patients before and after surgery. During the immediate postoperative period, there was no change in liver enzyme levels or renal function. In our study, neither regional nor general anesthetic techniques were associated with deterioration of liver function.

In conclusion, little data regarding the anesthetic management of patients who undergo nontransplant surgery after liver transplant exist. In this report, we have summarized our experiences with the perioperative anesthetic management of recipients of orthotopic liver transplant who had undergone nontransplant surgery at our medical center. Our results suggest that recipients of an orthotopic liver transplant can undergo nontransplant surgery without postoperative graft dysfunction if hepatic perfusion is maintained with appropriate anesthetic management.

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