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Effect of different positive end-expiratory pressures in donor liver transplantation patients on hemodynamics and ICU admission period: A Prospective, randomized, double-blind study

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Abstract

Donors are generally volunteers without any sanitary problems. For this reason, security of the anesthesia practice and ICU admission period is significant. The goal of present study was to determine whether there was any important coalition among different positive end-expiratory pressure (PEEP) level hemodynamics and ICU admission in donor patients. This study was performed with 40 patients who underwent general anesthesia. Patients were divided into two groups by their PEEP as 0 cm H₂O in the first group (group Z), and 10 H₂O in the second group (group H). We investigated the data concerning demographical data, perioperative values, hemodynamic parameters, intraoperative blood loss, and ICU admission. Patient characteristic, characteristics and perioperative values were similar among the groups ($P < .05$). Intraoperative bleeding remained statistically unchanged in both groups. The median ICU admission after surgery was longer in group Z versus the group H (2 and 1 days per patient, respectively; $P > .05$). We have concluded that our data pool is low and single-centered, we determined that PEEP values (10 cm H₂O) may be a decisive element for the ICU admission after donor patients.

Keywords: Positive end-expiratory pressure, donors, liver transplantation, ICU admission

Introduction

Donor patients are generally volunteers without any sanitary problems. For this reason, safety of the patients is the foremost topic in anesthesia practice [1]. The intensive care unit (ICU) shows a crucial act in the application of donor liver transplantation. An extended ICU admission increases health expenses.

Gas replacement inconvenience are extensive in patients with donors surgery [2]. Therefore, ventilatory assistance with positive end-expiratory pressure (PEEP) is frequently performed and increases functional residual capacity and decreases intrapulmonary shunt [3].

The aim of the present study was to determine the impact of different PEEP levels on ICU admission period in donors with hemodynamics.

Material and Methods

Institutional ethics board of the Inonu University Medical School (2013/19) approved the study, and written informed permissions were received from each patient before the study. We prospectively examined 40 patients whose ages ranged from 18 to 65 years and who passed right hepatectomy surgery between August 2013 and January 2014.

In the surgery room, the hemodynamic levels of the patients were recorded. BIS was used to define the depth of anesthesia. Patients received 100% oxygen for 3 minutes before initiation of anesthesia. Anesthesia was induced 2 mg/kg propofol (1% propofol; Fresenius) and 1 µg/kg remifentanyl with 0.6 mg/kg atracurium. Anesthesia maintenance was continued to ensure an isoflurane concentration of 0.5%–1.5% that the BIS value remained between 40 and 60. Ventilation was controlled with a tidal volume of 7–10 mL/kg and ventilator rate adjusted to maintain an end-tidal CO₂ of 35–40 mmHg. Concentrations of isoflurane were measured with the use of an anesthesia device (Dräger Primus, Germany). A constant fresh gas flow of 3 L/min (60% air and 40% oxygen) was used during the maintenance of anesthesia. Both groups received remifentanyl (0.25 µg/kg/min) and atracurium (0.5 mg/kg/h) infusions (Life Care 5000 Infusion System; Abbott, Sligo, Ireland). A radial arterial

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cannula was inserted into the patient's nondominant hand. Three-way 7.5-Fr Central venous pressure (CVP) was monitored from the internal jugular vein via a central catheter. In addition, we inserted nasogastric tube and a nasopharyngeal heat probe. Neuromuscular conduction was monitored via a train-of-four device. All patients were monitored to maintain normothermia during surgery and body temperature was monitored. Patients were followed in supine position during surgery. The patients were randomly divided into 2 groups with the use of a computer-generated random number table. Forty patients were included in the study and randomly divided into two groups considering their PEEP as 0 cm H₂O in the first group (group Z) and 10 H₂O in the second group (group H). The anesthesia was ensured with BIS levels between 45 - 60. The same surgical team performed all operations using the Pringle maneuver routinely. Pringle maneuver was recorded. The centers' protocol for total portal occlusion is 15-minute occlusion alternated with 5-minute reperfusion for patients with normal liver parenchyma. All donors were extubated at the end of the operation and subsequently transferred to the intensive care unit. Observed complications were recorded during the operation. We investigated the demographical data, hemodynamics (mean arterial pressure [MAP], central venous pressure [CVP], and heart rate [HR]), intraoperative blood loss, ICU admission period.

Statistical Analyses

SPSS 16.0 package program was used in the statistical analyses of the characteristics. With Kolmogorov-Smirnov normality test, characteristics concerning the quantitative variables were defined to demonstrate normal distribution ($P > .05$). Paired t-test was used to test the change in characteristics throughout the process. Independent t-test was used in the intergroup comparisons. A point of $P < .05$ was considered statistically significant. The scores are shown as mean values, standard deviation (SD), or numbers and percentages.

Results

No differences were detected among the groups in respect to demographical data ($P > .05$; Table 1). We detected no differences in terms of surgery period, percentage of liver remnant, graft gravity and quantity of blood loss among groups (Table 2). Important variables in the MAP and CVP values were monitored in cases aerated with PEEP 0 or 10 cm H₂O ($P < .05$; Table 3). When groups were checked for ICU admission, it was longer in group Z versus group H ($P > .05$; Table 3).

Table 1 Demographic Characteristics

	Range	Mean $\pm$ std	n
Age (years)	7 – 61	38.90 $\pm$ 13.75	
Sex (male/female)	-	-	29/11
Weight (kg)	23 – 104	64.80 $\pm$ 17.25	
Cadaveric/living	-	-	8/32
ASA III/IV	21 – 30	24.95 $\pm$ 2.85	38/2
Hemoglobin (mg/dL)	6.3 – 10.3	8.02 $\pm$ 1.06	
Need for additional analgesics			8
Comorbidity			
None	-	-	22
Hypertension	-	-	12
Diabetes +Hypertension	-	-	3
Diabetes	-	-	2
FVII Deficiency	-	-	1
Sleep Apnea	-	-	1
Complications			
none			36
hemorrhage			1
thrombosis			1
mortality			1

ASA; American Society of Anesthesiology, n: number of cases, Range: min-max

Table 2. Procedure Datas

	Range	Mean $\pm$ std
Duration of anesthesia (min)	180-360	298.50 $\pm$ 32.22
Duration of surgery (min)	170-320	253.50 $\pm$ 30.93
Total crystalloid (mL)	600-4000	3062.50 $\pm$ 833.80
Mannitol (mL)	30-150	93.75 $\pm$ 26.57
Furocemid (mg)	80-180	131.50 $\pm$ 18.05
Bupivacain (mg)	15-25	24.5 $\pm$ 0.44
Blood Transfusions	-	-
Duration of cold ischemia (min)	67-1116	275.82 $\pm$ 379.14
Duration of hot ischemia (min)	1.11-4	2.27 $\pm$ 0.78
Duration of urinary flow (min)	3-34	7.96 $\pm$ 8.81
Length of hospital stay (day)	5-35	10.95 $\pm$ 10.38

Discussion

The key point of the present study was that 10 H₂O PEEP was associated with reduced median ICU admission in postoperative period. In this trial, a PEEP of 0 or 10 during donor transplantation did not affect intraoperative bleeding. We have monitored that MAP and CVP levels were significantly different in ventilated 10 H₂O PEEP donors. In former trials, PEEP at physiologic values did not have a practical impact until 10-15 cm H₂O; also, it disturbed hepatic function (4). Established affinity of 5 to the physiologic PEEP value, we select 10 cm H₂O for the high level of PEEP- at 15 cm H₂O- disturbed hepatic missions. Saner et al. (5) showed that dissimilar PEEP values on MAP, and CVP in hepatic transplant patients; CVP levels were showed to be high at a significant level at PEEP levels of 5 and 10 cm H₂O checked with a PEEP of 0 cm H₂O. We have showed that there were no differences among patients for HR; however, there were significant differences for CVP, and MAP. In a prior trial of dissimilar PEEP levels in cases with hepatic resection, cardiac flow was showed to be decreased at a significant level at a PEEP of 10 cm H₂O and venous pressures were showed to be high at a significant level in these locations, checked with a supine location (6). In previous trials by Saner et al. (7) in hepatic transplant patients, they showed differences at a significant level at a PEEP of 15 cm H₂O in CVP. In the present trial, we showed that there were no differences at a significant level among MAP (low in group Z). Also, we built our trial in fully healthy patients. Moreover, decreases in MAP are harmonious with former trials. Further, there were minimal differences in blood loss with rises in CVP and PEEP value. This is more prominent in situations in which PEEP level is ≥ 10 cm H₂O.

There are a few limitations to the present trial. The present trial included a small sampling. Further trials with a huge size of donors can be built to confirm present outcomes. Finally, the present data showed that different PEEP values might be definitive in cases who are probably to demand an extended median ICU admission. Present results might have inclusions for both intraoperative PEEP administration strategies in donor patients.

Competing interests

The authors declare that they have no competing interest.

Financial Disclosure

All authors declare no financial support.

Ethical approval

Consent of ethics was approved by the local ethics committee.

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