

## **AIM OF THE WORK**

To compare between target-controlled infusion of propofol-fentanyl versus desflurane based anaesthesia in major liver resection for cirrhotic patients as regards subclinical hepatic injury, renal affection, haemodynamic parameters and postoperative course.



ETHICS COMMITTEE  
FACULTY OF MEDICINE  
ALEXANDRIA UNIVERSITY

IRB NO: 00007555- FWA NO: 00015712  
<http://www.hhs.gov/ohrp/assurances/index.html>

### Review report

Serial number: 020431

Date of monthly meeting: 01 / 02 / 2012

Name of the researcher: عمرو فاروق إسماعيل الصفتى

Name of Department: التخدير

Type of research: MS  MD  Promotion research

Title of the research:

تأثير التسريب الهداف لعقارى البروفول والفتنانيل مقارنة بإستنشاق الديسفلورين على الكفاءة  
الحوية لخلايا الكبد فى مرضى التليف الكبدى أثناء جراحات الإستئصال الجزئى للكبد.

#### Reviewer report:

Accepted according to ethical standard of scientific research

Accepted  not accepted

Accepted after correction

**The Protocol Is Accepted And To Be Approved.**

Chief of Ethics Committee  
Prof. Dr. Maha Ghanem



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Menoufiya University  
National Liver Institute  
IRB

The Institution Review Board of the National Liver Institute (NLI), Menoufiya University, Egypt is constituted and operating according to ICH GCP guidelines and applicable local and institutional regulations and guidelines which govern IRB operation for the last 4 years. It has FWA till 2013. It is comprised of 7 members with a non-institutional society representative. It reviewed more than 80 national and international proposals with one rejection.

<b><u>The Title of the Research:</u></b>	Effect of Target- Controlled Infusion Of propofol- fentanyl versus Desflurane On Hepatocellular Integrity In Cirrhotic patients Undergoing Major Hepatic Resection
<b><u>NLI IRB Protocol Number:</u></b>	0079/2014
<b><u>Type of Review:</u></b>	Domestic Protocol Submitted for Review of anonymous archival material for FULL BOARD REVIEW
<b><u>Name, Title and Address of Applicant:</u></b>	KHALED YASSEN, NLI, Menoufiya University Email: Khaledyaseen61@hotmail.com Tel: 01063080170
<b><u>Name of the Site:</u></b>	Department of Anaesthesia NLI
<b><u>Date and Place of Decision:</u></b>	February 1st 2014 Menoufiya University ( One Year )
<b><u>Name of the IRB:</u></b>	NLI IRB 00003413 FWA0000227
<b><u>PDDecision (one year period):</u></b>	Approved for a group of 20 volunteers renewed till completion of the total number of patients with submission of a report for each group.

Menoufia University  
National Liver Institute  
Institutional Review Board  
IRB

Chairman of the NLI IRB  
  
Prof. Dr. Mohamed EL-Guindi



## SOUTH AFRICAN COCHRANE CENTRE

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5 February 2014

To Whom It May Concern:

**RE: Target-controlled infusion of propofol-fentanyl vs desflurane on hepatocellular integrity in cirrhotic patients undergoing major hepatic resection.**

As project manager for the Pan African Clinical Trial Registry ([www.pactr.org](http://www.pactr.org)) database, it is my pleasure to inform you that your application to our registry has been accepted. Your unique identification number for the registry is **PACTR201402000759256**

Please be advised that your trial is registered under an initiative within our system that allow us to capture data of trials that are already in progress or completed. As such, your trial registration may not adhere to the mandates set forth by the International Committee of Medical Journal Editors for registration requirements, and it is your duty to be transparent to any journal that may ask about the retrospective status of your registration.

Please note you are responsible for updating your trial, or for informing us of changes to your trial. Additionally, please provide us with copies of your ethical clearance letters as we must have these on file (via email, post or fax) at your earliest convenience if you have not already done so.

Please do not hesitate to contact us at +27 21 938 0835 or email [epenaar@mrc.ac.za](mailto:epenaar@mrc.ac.za) should you have any questions.

Yours faithfully,

Elizabeth D Pienaar  
[www.pactr.org](http://www.pactr.org) Project Manager  
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STOCKHOLM, SWEDEN

# Euroanaesthesia 2014

The European Anaesthesiology Congress

MAY 31 - JUNE 3

12 June 2014

To whom it may concern

**SUBJECT:** Confirmation of Abstract presentation Euroanaesthesia 2014

The ESA hereby certifies that the following abstract was presented at Euroanaesthesia 2014 (Stockholm, Sweden, May 31 – June 3) at the Stockholm Messe.

Please find below the abstract information – as submitted – and the date and time of the presentation:

<b>Presenter:</b>	El-Attar Ahmed
<b>Affiliation:</b>	Faculty of Medicine, Alexandria University, Dept of Anaesthesiology & Intensive Care, Alexandria, Egypt
<b>Co-Authors:</b>	El-Attar A., Al-Safty A., Abdullah M., Beltagy R., Mahmoud F., Yasin K.
<b>Abstract Title:</b>	Effect of target-controlled infusion of Propofol-Fentanyl versus Desflurane in cirrhotic patients undergoing major hepatic resection
<b>Accepted Abstract Number:</b>	9AP3-2
<b>Date:</b>	01.06.2014

The abstract has been published in the e-Supplement of the European Journal of Anaesthesiology (Volume 31, Supplement 52, June 2014) under the Accepted Abstract Number reference.

Kind regards,

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## PATIENTS AND METHODS

### Patients

The study involved fifty adult cirrhotic (Child A) patients admitted to the National Liver Institute, Menoufiya University, undergoing major liver resection and they were categorized into two equal groups, Target controlled infusion group (TCI) and Desflurane group (Des).

Using a closed opaque envelope in this double blinded prospective hospital based randomized controlled study, a written informed consent was obtained.

### Study registration:

1. Alexandria Research and Ethics Committee approval from Faculty of Medicine, Alexandria University, Egypt. (020431) .
2. Institutional Research and Ethics Committee approval from National Liver Institute, Menoufiya University, Egypt. (0079/2014) .
3. Cochrane research data base of South Africa (PACTR201402000759256), ([www.pactr.org](http://www.pactr.org)).
4. Euroanaesthesia 2014 (poster presentation).

### Inclusion criteria:

- Child A.
- Age 21-73 years old.
- Major liver resection(right or left hepatectomy or more than three segments hepatectomy)

### Exclusion criteria:

- Patients with a history of oesophageal disease.
- Patients undergoing re-operation.
- Patients with a history of allergic reactions to drugs.
- Those who had undergone a recent anaesthesia (within the previous week).
- Patients who bled profusely during their operation, who are haemodynamically unstable, or who need inotropic support.
- Sepsis.
- Patients with preoperative renal dysfunction.

## Methods

### **Anaesthesia monitoring includes:**

- Five leads Electrocardiography.
- Continuous invasive arterial blood pressure via radial artery (mmHg).
- Continuous central venous pressure via right internal jugular vein catheter (cmH<sub>2</sub>O).
- Peripheral pulse oxymetry (%).
- Capnography to monitor end tidal (ET) CO<sub>2</sub>(mmHg).
- Fraction inspired oxygen concentration (%).
- Urine output (ml/hour).
- Neuromuscular blockade (Train of four).
- Oesophageal temperature (degree centigrade).
- Entropy to monitor depth of anaesthesia.  
(Anaesthesia Workstation, General Electric, Helsinki, Finland)
- Trans-oesophageal Doppler (cardio Q) haemodynamic monitoring. (Deltex Medical, Chichester, UK).

### **Anaesthetic technique:**

A 20 gauge intravenous cannula was inserted in the non dominant hand and used for induction of anaesthesia. Afterwards, at least two large peripheral venous lines (16 gauge or larger), multi-lumen central venous catheter in the right internal jugular vein and an arterial catheter also in the non dominant hand (radial artery will be used after doing Allen test) were inserted.

In group Des general anaesthesia was induced with Fentanyl in a dose of (1microgram/kg), Propofol (2 mg/kg) and Rocuronium (1 mg/kg). End-tidal Desflurane concentrations during the induction were limited to 1 MAC. Endotracheal intubation was done after complete muscle relaxation is confirmed by nerve stimulator and anaesthesia was maintained with a mixture of air, oxygen and Desflurane at a fresh gas flow of 1 litre/min. Ventilation was controlled to maintain end tidal carbon dioxide ETCO<sub>2</sub> between 32 and 36 mmHg (Anaesthesia Workstation, General Electric GE, Helsinki, Finland).

In group TCI immediately before induction of anaesthesia with Propofol, all subjects received Fentanyl 3 µg/kg for 30 seconds and followed by a continuous infusion of Fentanyl 2 µg/kg/hr for 30 min, 1.5 µg/kg/h from 31–150 min, and 1 µg/kg/hr until 30 min before skin closure and this is adjusted according to the navigator pharmacokinetics. Propofol was administered with a syringe pump integrated with (controller and software) GE Healthcare Finland (Datex-Ohmeda, Helsinki, Finland). The Propofol venous blood target concentration (C<sub>t</sub>). for induction of anaesthesia was set at 4 µg/ml for the younger patients( less than fifty years) and 3 µg/ml for the elderly (more than fifty years). If anaesthesia was not induced within 5 min, the C<sub>t</sub> will be increased sufficiently to complete

the induction of anaesthesia. When consciousness was lost, Rocuronium 1mg/kg, was given and trachea was intubated.

During maintenance of anaesthesia, the anaesthetist was able to increase or decrease end tidal Desflurane concentration by 1% increments in (group Des), or the Propofol ( $C_t$ ) by 0.5  $\mu\text{g/ml}$  and fentanyl by 0.25  $\mu\text{g/kg/hr}$  in (group TCI) at any time according to Entropy and patients haemodynamics.

In both groups, Entropy was kept between 40-60. If MAP or HR remained increased after 5 min supplemental dose of Fentanyl (0.5  $\mu\text{g/kg}$ ) was given. Atropine 0.5 mg was given intravenously if heart rate drops below 45 beats/min.

#### **Navigator software (GE, Helsinki, Finland)**

A soft ware that collects data from the anaesthesia machine, incorporated syringe pumps and monitoring system. This data together with a previously available collected data base of predictive pharmacokinetics and pharmacodynamics of the drugs will help to guide towards appropriate dosing and would also be able to predict the effect of these drugs, these effects are based on models and do not represent actual measurements from the patient.

The navigator system displays modeled pharmacokinetic effects for select anaesthesia related drugs. Visualizes modeled pharmacodynamic effects and synergies of sedation (such as propofol) and analgesia (remifentanyl, alfentanil, fentanyl, sufentanyl) drugs. Navigator analyzes information to models and uses this data to predict the effect of anaesthetic drugs and interactions and helps towards a balanced anaesthesia management. Navigator screen displays pharmacokinetic and pharmacodynamic models of several previously studied intravenous anaesthetics, analgesics, muscle relaxant drugs and inhaled agents. Navigator, GE Healthcare Finland PK/PD model is used in conjugation with monitoring of hypnotic level of depth by spectral entropy, calculates appropriate drug doses and predicts the synergistic effects of the anaesthetic drugs and on the feedback of brain electrical activity from the available and continuously monitored processed electroencephalogram (Entropy).

Martorano P *et al.*<sup>(133)</sup> in his case study was able to use the Navigator system to anaesthetize a Brugada syndrome patient undergoing a neurosurgery procedure for the removal of a large tumor of the cerebellopontine angle and was able to maintain adequate hypnosis and rapid recovery using the system.

#### **Transoesophageal Doppler (TED):**

Replacement of intraoperative fluid loss was guided with the transoesophageal Doppler parameters. TED can also allow early recognition of hypovolemia and guides intravascular volume replacement.

The TED (Cardio QP) cardiac output (CO) monitor (EDM™; Deltex Medical, chichester, UK) is a continuous, beat to beat, minimally invasive CO monitor measuring blood flow velocity in the descending aorta by oesophageal Doppler technique. Continuous point-to-point measurement of stroke distance is performed by the TED for the calculation of stroke volume (mean of five cycles) using aortic diameter from a nomogram based on the patient's age, weight and height. CO ( $\text{l}\cdot\text{min}^{-1}$ ) is then calculated as the product of stroke

volume and the heart rate, which is also measured by the CardioQP. The TED monitor displays blood flow velocity waveforms that represent the velocity of blood flow within the descending thoracic aorta. A nomogram incorporated in the monitor was used to estimate the aortic cross-sectional area, enabling calculation of the left ventricular stroke volume from the area of the velocity–time waveform. This nomogram includes the patient's height, weight, and age. The time needed for blood to flow in a forward direction within the aorta is the systolic flow time. This is corrected for heart rate to give the FTc. The FTc has been shown to be a good index of systemic vascular resistance and is sensitive to changes in left ventricular preload. Following induction of anaesthesia, patient data (age, weight, height) were registered in the monitor in the doppler monitor. An oesophageal doppler probe was greased with a lubricating gel and passed nasally into the mid-esophagus till aortic blood flow signals were identified.

Oesophageal doppler monitor parameters includes (FTc) which is the systolic flow time corrected for heart rate (330-360 ms), Stroke volume (SV); Volume of blood ejected from left ventricle/beat (50-100 cc/beat), Cardiac output (COP) (4-8 l/min) and Systemic vascular resistance (SVR) (1900-2400 dynes.sec/cm<sup>5</sup>).

**In both groups** boluses of colloid were administered, guided by an algorithm depending on the doppler estimations of stroke volume and FTc. This algorithm was similar to that used by Sinclair et al.<sup>(134)</sup> Post-resection 200-ml of 6% hydroxyethyl starch in saline (6% HES 130/0.4 Voluven<sup>®</sup>; Fresenius-Kabi, Bad Homburg, Germany) was given when the FTc reached less than 0.35 s. If the SV was maintained or increased by the fluid challenge and the FTc remained below 0.35 s, the fluid challenge was repeated. If the stroke volume increased by more than 10% and the FTc exceeded 0.35 s, the fluid challenge was repeated until no further increase in stroke volume occurred. If the FTc increased above 0.40 s with no change in stroke volume, further colloids was not then administered until the stroke volume decreased by 10% of the last value. The procedure was started immediately after probe placement and continued every 15 min until maximum stroke volume and targeted FTc values had been reached. This protocol was applied post-resection and on first day post-operative

Anaesthetics were decreased also in response to hypotension not responsive to replacement of intraoperative fluid loss or treatment of bradycardia. Additional rocuronium was administrated as appropriate in bolus doses and guided by nerve stimulator.

Intravenous crystalloids in the form of ringer's acetate were infused at a rate of 6 ml/kg/hr to replace fluid deficit and basal fluid requirements. Packed red blood cells RBCs were administered to keep haematocrit more than 25%. Blood products are given, if at all, guided by the coagulation laboratory intraoperative findings. Urine output was maintained at least 1 mL/kg/hour. Rapid infusion device was available for emergency use. Intraoperative normothermia was maintained using a forced air-warming blanket (Bair Hugger; Arizant, United Kingdom), in addition to a warm intravenous fluid device.

Prophylaxis against deep venous thrombosis includes the use of elastic stockings and a sequential compression device for both lower limbs until early ambulation. Daily administration of subcutaneous low molecular weight heparin from the first postoperative day was practiced.

All patients are extubated on table at the end of surgery unless decided otherwise according to the operative circumstances. At the end of surgery (whether extubated or not), all patients of both groups were transferred to the ICU.

Postoperative complications including bleeding, sepsis, nausea, vomiting, chest infection, and renal dysfunction were monitored closely and dealt with appropriately.

## **Measurements**

1) Haemodynamic parameters were monitored continuously and recorded before induction ( $t_0$ ), immediately after induction before intubation ( $t_1$ ), 15 min after the intubation ( $t_2$ ), during dissection ( $t_3$ ), during hepatic resection ( $t_4$ ), near the end of surgery ( $t_5$ ), 24 hours postoperatively ( $t_6$ ) and 48 hours postoperatively ( $t_7$ ).

- Heart rate (beat/min).
- Mean arterial blood pressure (mmHg).
- Central venous pressure (cmH<sub>2</sub>O).
- (CO) cardiac output (L/min).
- (SV) stroke volume (ml)
- (SVR) systemic vascular resistance (dyn.sec.cm<sup>-5</sup>).
- (FTc) corrected flow time (msec).

In addition, in the last four haemodynamic parameters:  $t_0$  was measured 15 min after intubation,  $t_1$  30 min after intubation and  $t_2$  45 min after intubation.

2) Laboratory investigations :

a. Liver function tests included:

- Aspartate transferase and alanine transferase (AST&ALT), (U/L), total bilirubin (mg/dl), albumin (gm/dl), prothrombin (%).
- Glutathione S transferase (GST), (IU/ml).

b. Kidney functions tests included serum urea & creatinine (mg/dl) and microalbumin in urine ( $\mu$ gm/ml).

c. Metabolic parameters and electrolytes included:

- Serum electrolytes as sodium and potassium (meq/l).

Samples of GST were kept at room temperature for almost one hour, then serum was separated by centrifugation for five minutes at 3000 r/min and 1ml aliquots were frozen at -80 degree centigrade until analysis.

This is measured by Cayman's Glutathione –S-transferase Assay Kit item No 703302. Cayman Chemical Company. USA. This Cayman's GST kit measures total GST by measuring the conjugation of 1-chloro-2,4-dinitrobenzene (CDNB) with reduced glutathione. The conjugation is accompanied by an increase in absorbance at 340 nm. The rate of increase of absorbance is directly proportional to GST activity in the

sample. One unit of the enzyme will conjugate one nmol of CDNB with reduced glutathione per minute. These activities were measured using the spectrophotometer model Slim +, Serial 32762, SEAC RADIM company Italy as described by Habig et al.<sup>(135)</sup> (Reference range 0.01-0.03 IU/ml in healthy individuals).<sup>(136)</sup>

Microalbumin is a competitive solid phase enzyme immunoassay (ELISA) for the quantitative measurement of human albumin in urine using kits DRG Microalbumin enzyme linked immunosorbent assay ELISA (EIA-3881). DRG International Inc., USA. (Reference range in urine 0-25 microgram/ml Albumin).

All laboratory samples were collected preoperatively, immediately postoperative and 48 hours postoperatively.

- 3) Fluid balance (intake and output), intraoperatively and 24 hours postoperatively.
- 4) Time from discontinuation of inhalational agent until the trachea was extubated was recorded.
- 5) Modified Aldrete Scoring system for recovery score.
- 6) Postoperative course was assessed as follow:
  - a) The amount of transfused blood and blood products (fresh frozen plasma and/or platelets) in ml needed intraoperatively and during first 48 hours postoperatively.
  - b) Postoperative complications were recorded.
  - c) Duration of ICU and hospital stay was recorded.
- 7) The total amount of inhalational agent in (ml) used intraoperatively was calculated automatically by using the Aisys® GE Healthcare Finland (Datex-Ohmeda, Helsinki, Finland) anaesthesia machine and then was recorded.

The amount of propofol (ml) used in TCI group and the anaesthetic cost in Egyptian pounds (LE) and United states of America Dollars (US Dollars) in both groups according to the current international prices of the British National Formulary BNF 2014\* were recorded.<sup>(137)</sup>

British Medical Association and Royal Pharmaceutical Society. British National Formulary BNF66, March 2014;bnf.org:831-39.

## **References citation:**

References were cited in the present study using Reference Manager 12 software, and all the references were listed in the Vancouver style.<sup>(138)</sup>

## **Statistics Methodology**

### **Design:**

Double-blinded randomized controlled comparative experimental study.

**Classification of the Methods of Blinding:** We classified how blinding was achieved for participants (level 1), health care providers (level 2), and the main outcome assessor (level 3): in the present study blindness was only carried out for participants (level 1), and the main outcome assessor (level 3).<sup>(139)</sup>

### **Sample size and power of the study:**

- In the present study  $\alpha$  was set to 0.05, and maximum  $\beta$  accepted = 20% with a minimum power of the study of 80%. Primary outcome of this RCT was extubation time (min) between the two groups after discontinuation of the agent which showed a mean difference of 1.65 min and standard deviation of 2.35 min and 1.23 min in TIVA and desflurane groups respectively.<sup>(140)</sup> Calculation of sample size was done using (IBM SPSS Sample power) software and was also confirmed using Lenth Java Applets for Power and Sample Size [Computer software].

### **Statistical procedure**

Data were collected and entered to the computer using SPSS (Statistical Package for Social Science) program for statistical analysis. Data were entered as numerical or categorical, as appropriate.

Kolmogorov-Smirnova test was carried out and revealed no significance in the distribution of variables, so all variables included in the study are normally distributed and parametric statistics was carried out.

- Exploration of the data: This yielded complete descriptive statistics including the minimum and maximum, range, mean, standard deviation, median and inter-quartile range for each variable.
- Data were described using minimum, maximum, mean and standard deviation.
- Comparisons were carried out between the two studied groups using independent t test (t test).
- Within group comparison was carried out using repeated measures ANOVA.
- Box and Whiskers graph was done.
- Chi- square test and fisher exact test were used to measure association between qualitative variables.

Correction of p value for multiple testing was set p to 0.01 to detect significance (Bonferroni correction of multiple comparisons).<sup>(141)</sup> So, in the present study an alpha level was set to 1% with a significance level of 99%, and a beta error accepted up to 20% with a power of study of 80%.

## RESULTS

Fifty five patients were enrolled; five patients were excluded due to extension of the tumor beyond the surgical treatment. Patient characteristics in both groups were comparable regarding age and weight as shown in Table 3. In Des group age ranged from 21 to 72 years with a mean of  $53.64 \pm 10.47$  years, while in TCI group the age ranged from 26 to 73 years with a mean of  $55.24 \pm 12.11$  years. There was no significant difference between both groups ( $t=0.499$ ,  $P=0.620$  NS).

In Des group the weight ranged from 63 to 94 kg with a mean of  $76.48 \pm 10.32$  kg, while in TCI group weight ranged from 63 to 96 kg with a mean of  $79.72 \pm 9.020$  kg. There was no significant difference between both groups ( $t=1.181$ ,  $P=0.243$  N S).

Male/female ratio was 17/8 in Des group and 24/1 in TCI group as demonstrated in Table 3 ( $X^2=6.640$ ,  $P=0.010$ ). Surgical and anaesthesia related data are summarized in table 4. Operative time were comparable, in Des group was  $220 \pm 26.49$  min Vs,  $222.60 \pm 10.42$  min in TCI group ( $t=0.457$ ,  $P=0.651$  NS).

### Haemodynamics changes:

#### a. Heart rate (HR, beat/min):

On Comparing the heart rate readings between these two groups, there was no significant difference during the following time measurements T0-T4, T6 and T7 but at T5 a significant difference was reported ( $P=0.005$ ) (table 5, figure 8a). Figure 8b demonstrates the changes over time in both groups TCI group and Des group, these changes were found to be significant in Des group ( $P=0.000$ ) and in TCI group ( $P=0.000$ ).

#### b. Mean arterial blood pressure (MABP, mmHg):

On Comparing the mean arterial blood pressure readings between these two groups, there was no significant difference at T0, but a significant difference was reported through all the measurements from T1-T7,  $P=0.000$  (table 6, figure 9a).

Figure 9 b demonstrates the changes over time in both groups TCI and Des, these changes in arterial blood pressure were found to be significant with time intraoperatively and postoperatively when tested statistically  $P < 0.01$ .

The changes in MABP were significant in Des group ( $P=0.000$ ) and in TCI group ( $P=0.000$ ).

#### c. Central venous pressure (CVP, cmH<sub>2</sub>O):

Table 7 demonstrates the comparison between both groups with no significant differences in all readings ( $P > 0.05$ ) (figure 10a).

In Des group, there was a decrease in mean CVP from  $9.12 \pm 1.129$  before induction in T0 to  $7.80 \pm 1.322$  in T1 with increase to  $8.52 \pm 1.194$  in T2 and in T3 to  $6.44 \pm 0.71$  and with a gradual further increase to  $6.84 \pm 0.746$ ,  $8.20 \pm 0.70$ ,  $10.28 \pm 1.13$  and  $10.80 \pm 1.32$  at T4, T5, T6 and T7 respectively. All these changes were significant, ( $P=0.000$ ) (figure 10 b).

In TCI group, there was a decrease in mean CVP from  $9.08 \pm 1.187$  in T0 to  $7.64 \pm 1.113$  in T1, and then an increase to  $9.08 \pm 1.288$  in T2. This was followed by a decrease to  $6.80 \pm 0.645$  and  $6.80 \pm 0.866$  in T3 and T4 respectively. Then increase to  $7.76 \pm 0.723$ ,  $10.96 \pm 1.135$  and  $10.28 \pm 1.275$  at T5, 6 and 7 respectively. All these changes were significant, ( $P=0.000$ ) (figure 10 b).

#### **d. Cardiac output (COP, L/min.):**

Table 8 demonstrates the comparison between the two groups, the results revealed no significant difference all readings except at T3 a significant difference  $P < 0.01$  (figure 11a).

In Des group, there is increase in mean COP from  $5.94 \pm 1.524$  in T0 to  $6.00 \pm 1.318$ ,  $6.69 \pm 1.268$ ,  $7.17 \pm 1.192$  in T1, 2 & 3 respectively. Then decrease to  $6.27 \pm 0.956$  and increase to  $6.63 \pm 0.914$  in T5. All these changes are significant ( $P=0.000$ ). (figure 11b).

In TCI group, there is decrease in mean COP from  $6.19 \pm 0.546$  in T0 to  $6.02 \pm 0.614$  in T1. Then increase to  $6.17 \pm 0.534$  &  $6.11 \pm 0.573$  in T2&3 respectively. This is followed by decrease to  $5.97 \pm 0.448$  in T4 and increase to  $6.09 \pm 0.370$  in T5. All these changes are significant ( $P=0.000$ ) (figure 11b).

#### **e. Stroke volume( SV, ml):**

Comparison between the two groups revealed significant difference in all readings where  $P < 0.01$  except in T0 is not significant where  $P > 0.05$  (Table 9, figure 12a).

In Des group, there is a decrease in mean SV from  $84.24 \pm 4.186$  in T0 to  $83.72 \pm 3.736$  in T1, followed by an increase to  $85.72 \pm 2.951$  &  $86.64 \pm 4.405$  in T2&3 respectively. Then decrease to  $85.68 \pm 3.815$  in T4 and increase to  $86.92 \pm 2.340$  in T5. All these changes are significant ( $P=0.000$ ) (Figure 12b).

In TCI group, there is decrease in mean SV from  $83.76 \pm 1.640$  in T0 to  $75.08 \pm 6.244$  in T1, then gradual increase to  $76.16 \pm 6.523$ ,  $76.20 \pm 7.664$ ,  $76.44 \pm 6.34$  and  $78.40 \pm 5.605$  in T2, 3, 4&5 respectively. All these changes are significant ( $P=0.000$ ) (Figure 12b).

#### **f. Systemic vascular resistance(SVR, dyn.sec.cm<sup>-5</sup>):**

Comparison between the two groups revealed no significant difference in T0,  $P > 0.05$  and a significant difference all other readings where  $P < 0.01$  (Table 10, figure 13a).

In Des group, there is decrease in mean SVR from  $879.28 \pm 14.181$  in T0 to  $872.72 \pm 23.728$  and  $835.04 \pm 12.022$  in T1 and T2 respectively. This is followed by an increase to  $836.72 \pm 8.314$  and  $858.16 \pm 84.016$  in T3 and T4 respectively and a decrease to  $842.88 \pm 8.192$  in T5. All these changes were found to be significant ( $P=0.000$ ) (Figure 13b).

In TCI group, there was a decrease in mean SVR from  $871.96 \pm 14.208$  in T0 to  $777.12 \pm 15.243$  in T1, then a gradual increase to  $778.16 \pm 11.967$ ,  $779.56 \pm 36.666$  and  $787.28 \pm 56.182$  in T2, T3 and T4 respectively followed by a decrease to  $784.42 \pm 43.596$  in T5. All these changes are significant, ( $P=0.000$ ) (Figure 13b).

### g. Corrected flow time of transoesophageal doppler (FTc msec):

Comparison between the two groups revealed no significant differences where  $P > 0.05$  (Table 11, figure 14a).

In Des group, there is gradual increase in mean FTc from  $355.76 \pm 6.697$  in T0 to  $357.64 \pm 10.908$ ,  $358.28 \pm 6.655$  &  $361.04 \pm 6.419$  in T1, 2 & 3 respectively. Then decrease to  $360.48 \pm 6.898$  in T4 and increase to  $364.60 \pm 6.448$  in T5. All these changes are significant where ( $P = 0.000$ ) (Figure 14b).

In TCI group, there is increase in mean FTc from  $354.44 \pm 11.78$  in T0 to  $358.80 \pm 8.455$  in T1, then decrease to  $357.36 \pm 6.575$  in T2. This is followed by gradual increase to  $358.60 \pm 8.246$ ,  $362.68 \pm 5.595$  &  $363.16 \pm 4.988$  in T3, 4 & 5 respectively. All these readings are significant ( $P = 0.000$ ) (Figure 14b).

### Laboratory tests and changes:

Table 12 demonstrates in a collective manner the results of the various laboratory tests performed during liver resection and after. The comparison between the two groups was demonstrated clearly with indicators of significance when available. The table involves various conventional laboratory tests to more specific tests to reflect the liver and kidney injury if any associated with the process of liver resection.

The laboratory variables in Table 12 includes: Aspartate aminotransferase (AST, U/L), Alanine aminotransferase (ALT, U/L), International Normalized Ratio (INR), Glutathione S Transferase (GST, IU/ml), Urea mg/dl, creatinine mg/dl and Microalbumin ( $\mu\text{gm/ml}$ ).

Figures 15-22 demonstrate the same laboratory variables in Table 12.

### Total bilirubin (TB) (mg/dl):

Comparison between the two groups revealed no significant difference where  $P > 0.05$  (table 13, figure 23a).

In Des group, there was a significant increase in mean TB from  $1.04 \pm 0.219$  in T1 to  $1.60 \pm 0.649$  and  $2.03 \pm 0.456$  respectively ( $P = 0.000$ ) (Figure 23b).

In TCI group there was also a significant increase in mean TB from  $1.05 \pm 0.137$  in T1 to  $1.78 \pm 0.065$  and  $2.09 \pm 0.251$  in T2 and T3 respectively ( $P = 0.000$ ) (Figure 23b).

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**Serum Albumin (Alb, gm/dl.):**

Comparison between the two groups revealed only significant changes in T2 where  $P=0.003$  (table 14, Figure 24a)

In Des group, there is slight decrease in mean Alb. from  $4.01\pm 0.281$  in T1 to  $3.83\pm 0.295$  in T2 and then increase to  $3.95\pm 0.281$  in T3. All these changes are significant ( $P=0.000$ ) (Figure 24b).

In TCI group there is slight decrease in mean Alb. from  $4.16\pm 0.135$  in T1 to  $4.04\pm 0.143$  in T2 then increase to  $4.10\pm 0.113$  in T3. All these changes are significant ( $P=0.000$ ) (Figure 24b).

**Electrolytes:****a. Serum sodium (Na, meq/l):**

Comparison between the two groups revealed no significant difference where  $P > 0.05$  (table 15, Figure 25a).

In Des group, there is decrease in mean Na from  $136.64\pm 3.039$  in T1 to  $136.00\pm 2.972$  in T2 to  $135.76\pm 2.296$  in T3. All these changes are significant ( $P=0.000$ ) (Figure 25b).

In TCI group, there is increase in mean Na from  $136.76 \pm 2.402$  in T1 to  $137.36 \pm 3.695$  in T2 and decrease to  $136.84 \pm 3.337$  in T3. All these changes are significant ( $P=0.000$ ) (Figure 25b).

**b. Serum potassium (K, meq/l):**

Comparison between the two groups revealed no significant difference where  $P > 0.05$  (Table 15, Figure 26a).

In Des group, there is a significant decrease in mean K from  $3.87\pm 0.136$  in T1 to  $3.78\pm 0.180$  in T2 and then to  $3.74\pm 0.168$  in T3 ( $P=0.000$ ) (Figure 26b).

In TCI group, there is decrease in mean K from  $3.93\pm 0.266$  in T1 to  $3.90 \pm 0.260$  in T2 then increase to  $3.93\pm 0.316$  in T3. All these changes are significant where  $P=0.000$  (Figure 26b).

**Fluids intake and output:****a. Crystalloids (ml):**

Comparison between the two groups revealed only significant difference in 24 hours postoperative crystalloids where  $P = 0.007$  (Table 16, Figure 27a).

In Des group, there is a decrease in mean volume infused from  $2990.00\pm 391.843$  ml intraoperatively to  $2292.00\pm 225.341$  ml 24 hours postoperatively to  $1492.00\pm 195.618$  ml 48 hours postoperatively. All these changes revealed significant difference ( $P=0.000$ ) (Figure 27b).

In TCI group, there is a decrease in mean volume infused from  $2772 \pm 703.870$  ml intraoperatively to  $2028 \pm 404.68$  ml 24 hours postoperatively to  $1412 \pm 194.336$  ml 48 hours postoperatively. All these changes revealed significant difference ( $P=0.000$ ) (Figure 27b).

#### **b. Urine output (UOP, ml/hr):**

Comparison between the two groups revealed no significant difference where  $P > 0.05$  (Table 16, Figure 28a).

In Des group, there is a decrease in mean UOP from  $124.72 \pm 11.869$  ml/hr intraoperatively to  $99.64 \pm 13.789$  ml/hr 24 hours postoperatively to  $71.08 \pm 4.999$  ml/hr 48 hours postoperatively. All these changes revealed significant difference ( $P=0.000$ ) (Figure 28b).

In TCI group, there is a decrease in mean UOP from  $121.92 \pm 11.604$  ml/hr intraoperatively to  $95.80 \pm 8.093$  ml/hr 24 hours postoperatively to  $73.64 \pm 7.233$  ml/hr 48 hours postoperatively. All these changes revealed significant difference ( $P=0.000$ ) (Figure 28b).

#### **Extubation time (min):**

In (Des) group, the mean extubation time was  $9.76 \pm 1.507$  and in (TCI) group, was  $15.2 \pm 2.629$  with a high significant difference between both groups where  $t=8.972$ ,  $P=0.000$  (Table 17, Figure 29).

#### **Intensive care and hospital stay (days):**

##### **a. ICU stay:**

In (Des) group was  $1.44 \pm 0.506$  and in (TCI) group was  $1.6 \pm 0.500$  with no significant difference between both groups where  $t=1.124$ ,  $P=0.267$  (Table 17, Figure 30).

##### **b. Hospital stay:**

In (Des) group was  $6.08 \pm 1.077$  and in (TCI) group was  $6.12 \pm 1.129$  with no significant difference between both groups where  $t=0.128$ ,  $P=0.899$  (Table 17, Figure 31).

#### **Anaesthesia time (minutes):**

In Des group was  $220 \pm 26.496$  and in TCI group was  $222.60 \pm 10.420$  with no significant difference between both groups where  $t=0.457$ ,  $P=0.651$  (Table 18).

#### **Anaesthesia cost:**

In Des group was  $235.92 \pm 26.496$  Egyptian pounds and in TCI group was  $438.60 \pm 57.563$  Egyptian pounds with a significant difference between both groups where  $t=15.954$ ,  $P=0.000$ . With US Dollars was  $33.70 \pm 3.836$  in Des group and in TCI group was  $62.65 \pm 8.233$  with a significant difference between both groups where  $t=2.27$ ,  $P=0.000$  (Table 18, Figure 32&33).

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**Fentanyl intake ( $\mu\text{g}$ ):**

In (Des) group was  $270.00 \pm 29.860$  and in (TCI) group was  $584.82 \pm 126.322$  with a significant difference between both groups where  $t=12.126$ ,  $P=0.000$  (Table 19, Figure 34).

**Blood Loss (ml):**

In Des group was  $578.2 \pm 79.72$  and in TCI group was  $583.2 \pm 77.28$  with no significant difference between both group,  $P>0.05$  (Figure 35).

**Modified Aldrete Score:**

In Des group was  $7.56 \pm 0.87$  on arrival and was  $8.8 \pm 0.76$  after 5 minutes and in TCI group was  $7.16 \pm 1.14$  on arrival and was  $8.04 \pm 0.78$  after 5 minutes.

Significant difference between both groups after 5 minutes where  $P=0.217$  on arrival and  $P=0.001$  after 5 minutes (Figure 36).

**Table 3: Demographic data and patient characteristics:**

	TCI group (n=25)	Des group (n=25)	Statistics (p value)
Age(years)	55.24±12.111	53.64±10.479	t=0.499 p=0.620 NS
Gender (M/F)	24/1	18/7	X <sup>2</sup> =6.640 p=0.010*
Height (cm)	165.3±7.2	167.2±5.8	
Weight (kg)	79.72±9.020	76.48±10.328	t=1.181 p=0.243NS
Liver disease:			
HCV	22	23	
HBV	2	1	
HCV+HBV	0	1	
Alcoholic	1	0	

TCI; Target controlled infusion, Des; Desflurane group. Data are presented as mean±SD or number of patients. There is no significant differences between the two groups (P=0.620 in age and 0.243 in weight ), (HCV);Hepatitis C virus,(HBV);Hepatitis B virus.

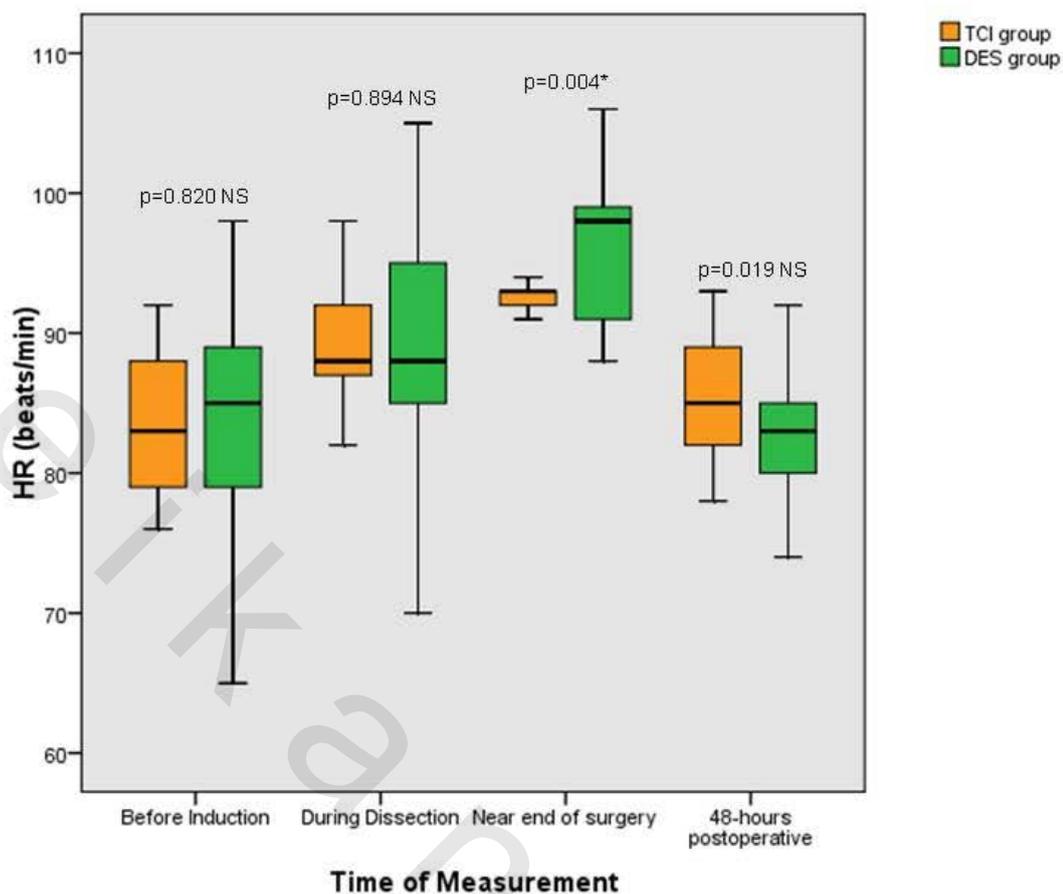
**Table 4: Surgical and Anaesthetic Data**

Variables	Groups	Mean $\pm$ SD	t- test	p- value
Intraop Crystalloid (ml)	TCI	2772 $\pm$ 703.87	1.353	0.184 NS
	DES	2990 $\pm$ 391.84		
Intraop UOP (ml/hr)	TCI	121.92 $\pm$ 11.6	0.843	0.403NS
	DES	124.72 $\pm$ 11.8		
Extubation time (minutes)	TCI	15.20 $\pm$ 2.629	8.972	0.000*
	DES	9.76 $\pm$ 1.507		
ICU stay (days)	TCI	1.60 $\pm$ 0.50	1.124	0.267NS
	DES	1.44 $\pm$ 0.51		
Hospital stay (days)	TCI	6.12 $\pm$ 1.129	0.128	0.899NS
	DES	6.08 $\pm$ 1.077		
Anaesth time (min)	TCI	222.60 $\pm$ 10.42	0.457	0.651NS
	DES	220 $\pm$ 26.496		
Anaesth. cost (US Dollars)	TCI	62.65 $\pm$ 8.233	15.95	0.000*
	DES	33.70 $\pm$ 3.836		

All data presented as mean  $\pm$ standard deviation. TCI, Target controlled infusion. Des, Desflurane. Intraop, Intraoperative. UOP, Urine Out Put. ICU, Intensive Care Unit  
\*significance compared with the other group ( $p < 0.01$ ). NS, non significant.

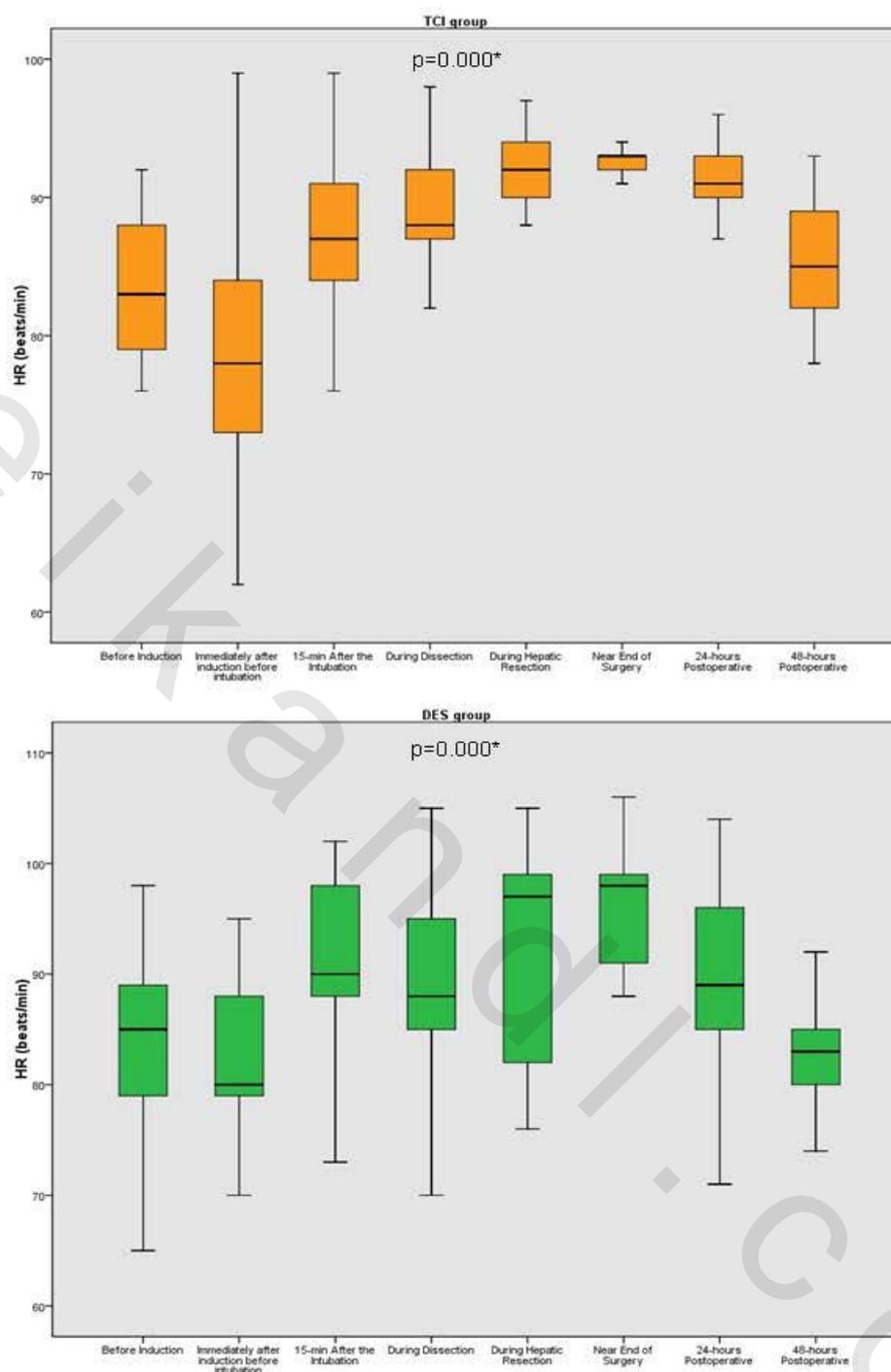
**Table 5: Differences between groups regarding heart rate (beat/min). HR, heart rate; TCI, Target Control Infusion of Propofol/Fentanyl; DES, Desflurane; T0, Before induction; T1 immediately after induction before intubation; T2, 15 min after the intubation; T3, during dissection; T4, during hepatic resection; T5; near the end of surgery; T6, 24 hours postoperatively and T7, 48 hours postoperatively.**

Variables	Groups	Mean $\pm$ SD	t- test	p- value
<b>T0</b>	<b>TCI</b>	83.76 $\pm$ 5.441	0.228	0.820NS
	<b>DES</b>	84.20 $\pm$ 7.952		
<b>T1</b>	<b>TCI</b>	79.32 $\pm$ 9.231	0.679	0.501NS
	<b>DES</b>	81.00 $\pm$ 8.241		
<b>T2</b>	<b>TCI</b>	87.08 $\pm$ 5.964	1.937	0.059NS
	<b>DES</b>	90.88 $\pm$ 7.785		
<b>T3</b>	<b>TCI</b>	89.32 $\pm$ 3.848	0.133	0.894NS
	<b>DES</b>	89.08 $\pm$ 8.133		
<b>T4</b>	<b>TCI</b>	92.08 $\pm$ 2.644	0.040	0.968NS
	<b>DES</b>	92.16 $\pm$ 9.719		
<b>T5</b>	<b>TCI</b>	92.60 $\pm$ 2.466	2.996	0.005*
	<b>DES</b>	96.16 $\pm$ 5.404		
<b>T6</b>	<b>TCI</b>	91.72 $\pm$ 2.731	1.182	0.247NS
	<b>DES</b>	89.64 $\pm$ 8.361		
<b>T7</b>	<b>TCI</b>	85.76 $\pm$ 4.502	2.419	0.019NS
	<b>DES</b>	82.08 $\pm$ 6.129		



**Figure 8-a:** Box and Whisker plot of Heart rate (HR) (beats/min) in TCI group and Des group in patients undergoing hepatic resection.

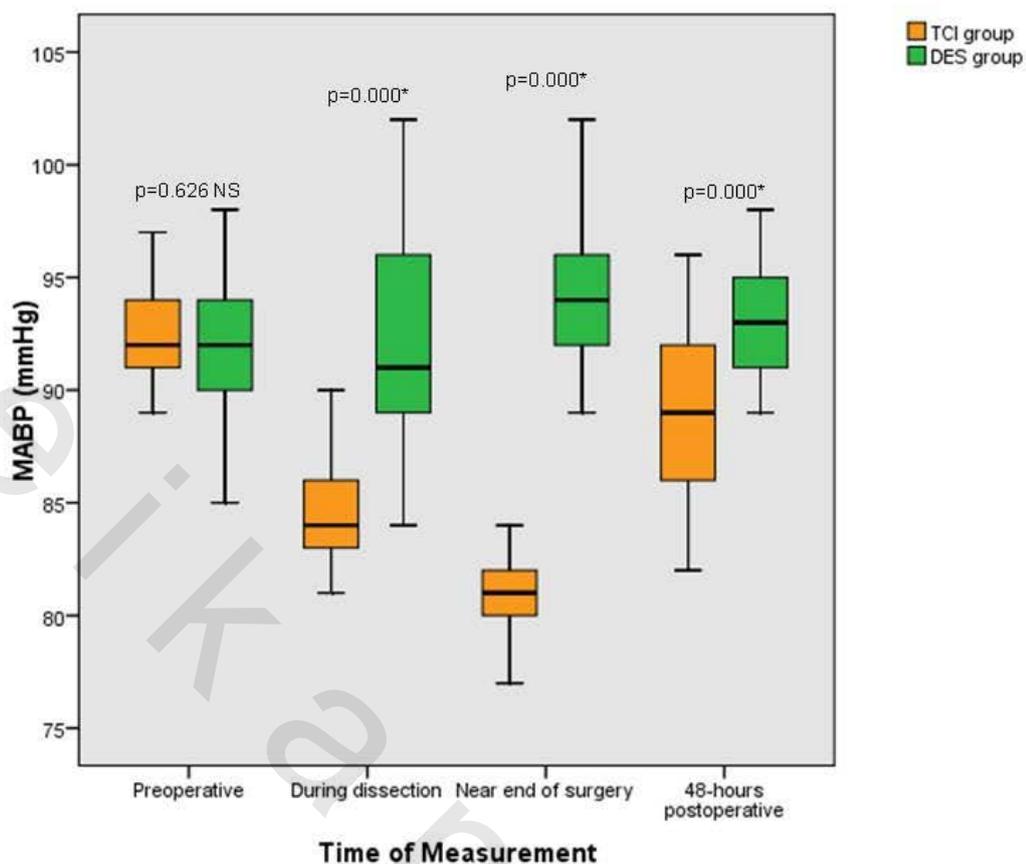
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 8-b:** Box and Whisker plot of Heart rate (HR) (beats/min) in TCI group (Top) and Des group (bottom) in patients undergoing hepatic resection. Minimum to maximum (error bar), median (thick line in the middle of the box) and 25th and 75th percentiles (the box) are shown at selected time points. Repeated measure ANOVA is significant  $p < 0.01$ .

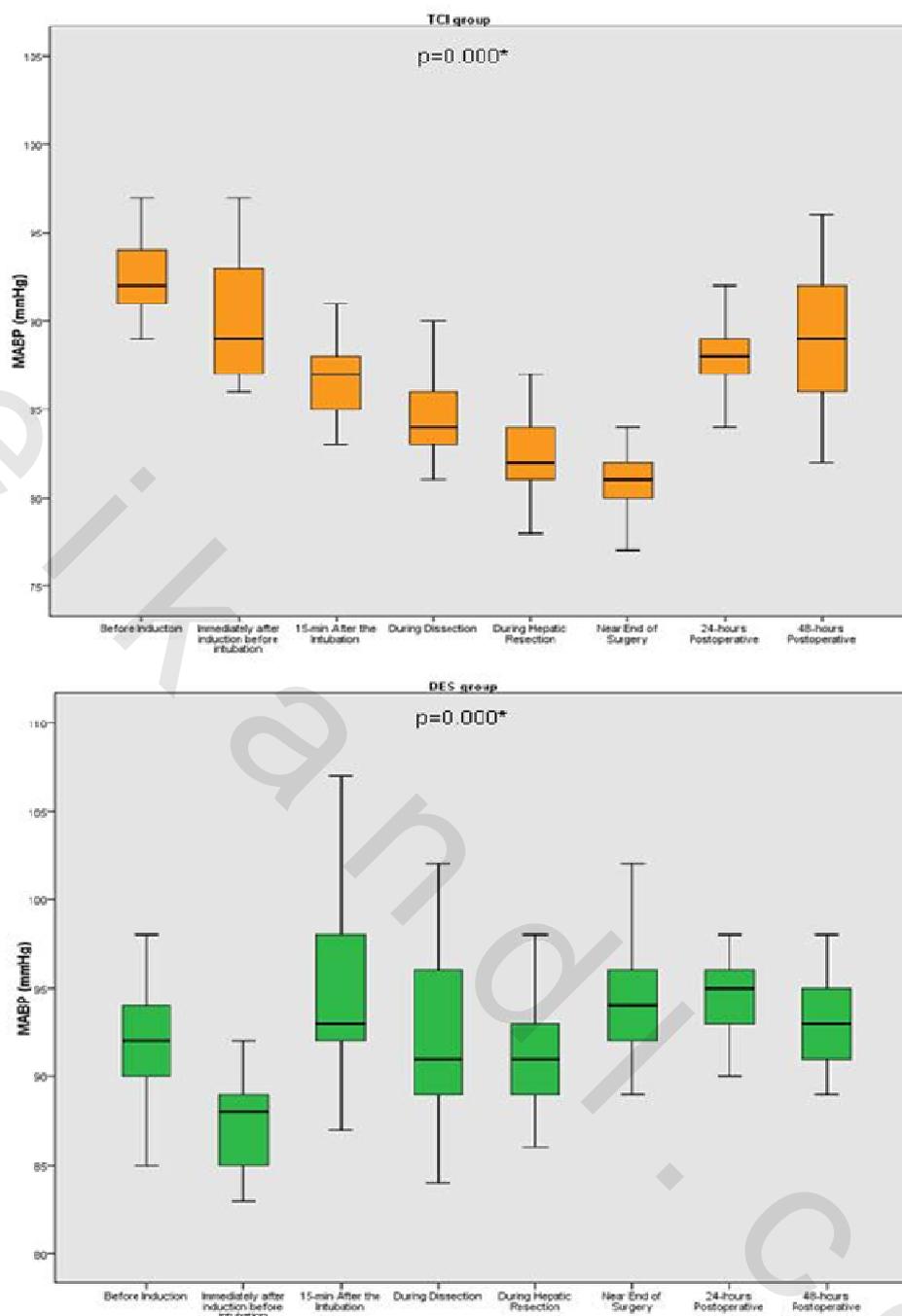
**Table 6: Differences between groups regarding mean arterial blood pressure (MABP) in mmHg. TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane. T0, before induction; T1, immediately after induction before intubation; T2, 15 min after the intubation ; T3, during dissection (liver mobilization); T4, during hepatic resection ; T5, near the end of surgery; T6, 24 hours postoperatively and T7, 48 hours postoperatively.**

Variables	groups	mean±SD	t - test	p-value
T0	TCI	92.40±2.236	0.491	0.626
	DES	92.00±3.403		NS
T1	TCI	89.96±3.207	3.367	0.002*
	DES	87.24±2.454		
T2	TCI	87.28±3.182	6.447	0.000*
	DES	94.76±4.850		
T3	TCI	85.08±3.639	5.897	0.000*
	DES	91.96±4.559		
T4	TCI	82.12±2.278	11.624	0.000*
	DES	91.08±3.108		
T5	TCI	81.44±5.204	10.633	0.000*
	DES	94.48±3.241		
T6	TCI	88.60±2.449	9.008	0.000*
	DES	94.44±2.122		
T7	TCI	88.92±3.627	5.269	0.000*
	DES	93.40±2.217		



**Figure 9-a:** Box and Whisker plot of Mean arterial blood pressure (mmHg) (beats/min) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 9-b:** Box and Whisker plot of Mean arterial blood pressure (mmHg) (beats/min) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

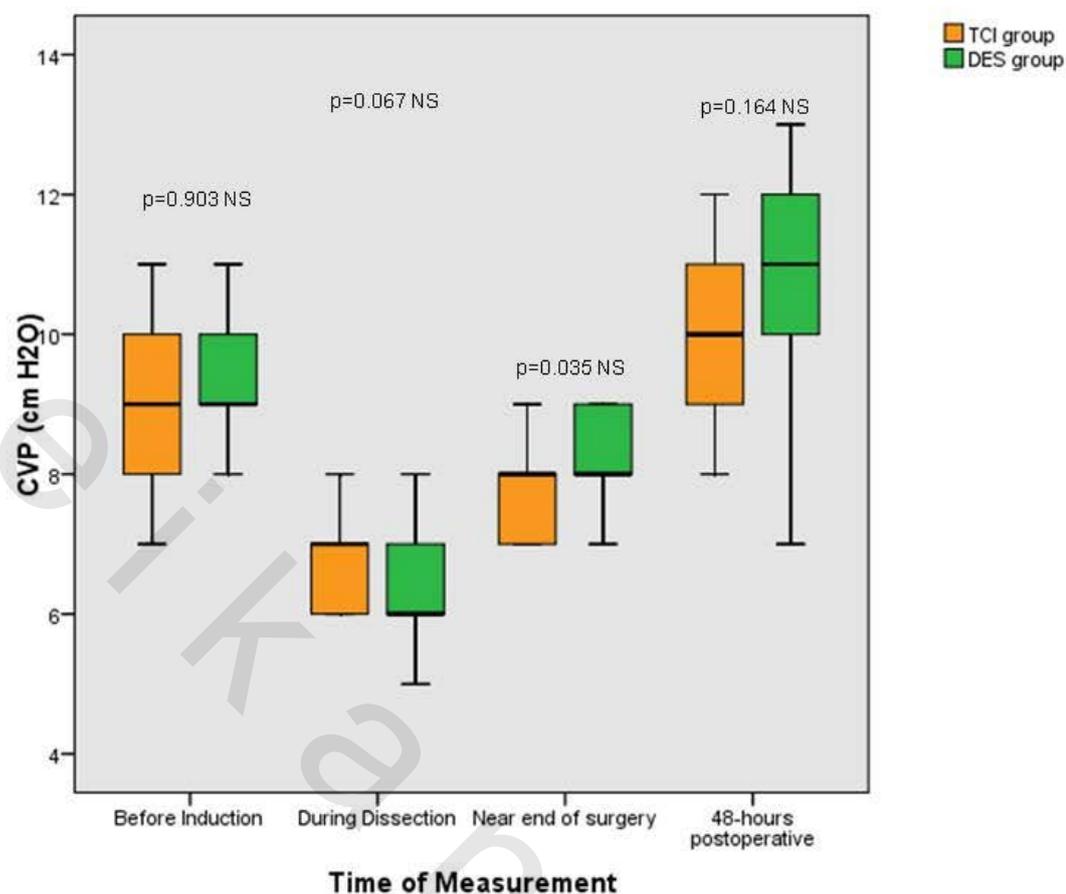
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 7: Differences between groups regarding central venous pressure (CVP). TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane. T0, before induction; T1, immediately after induction before intubation; T2, 15 min after the intubation ; T3, during dissection (liver mobilization); T4, during hepatic resection ; T5, near the end of surgery; T6, 24 hours postoperatively and T7, 48 hours postoperatively.**

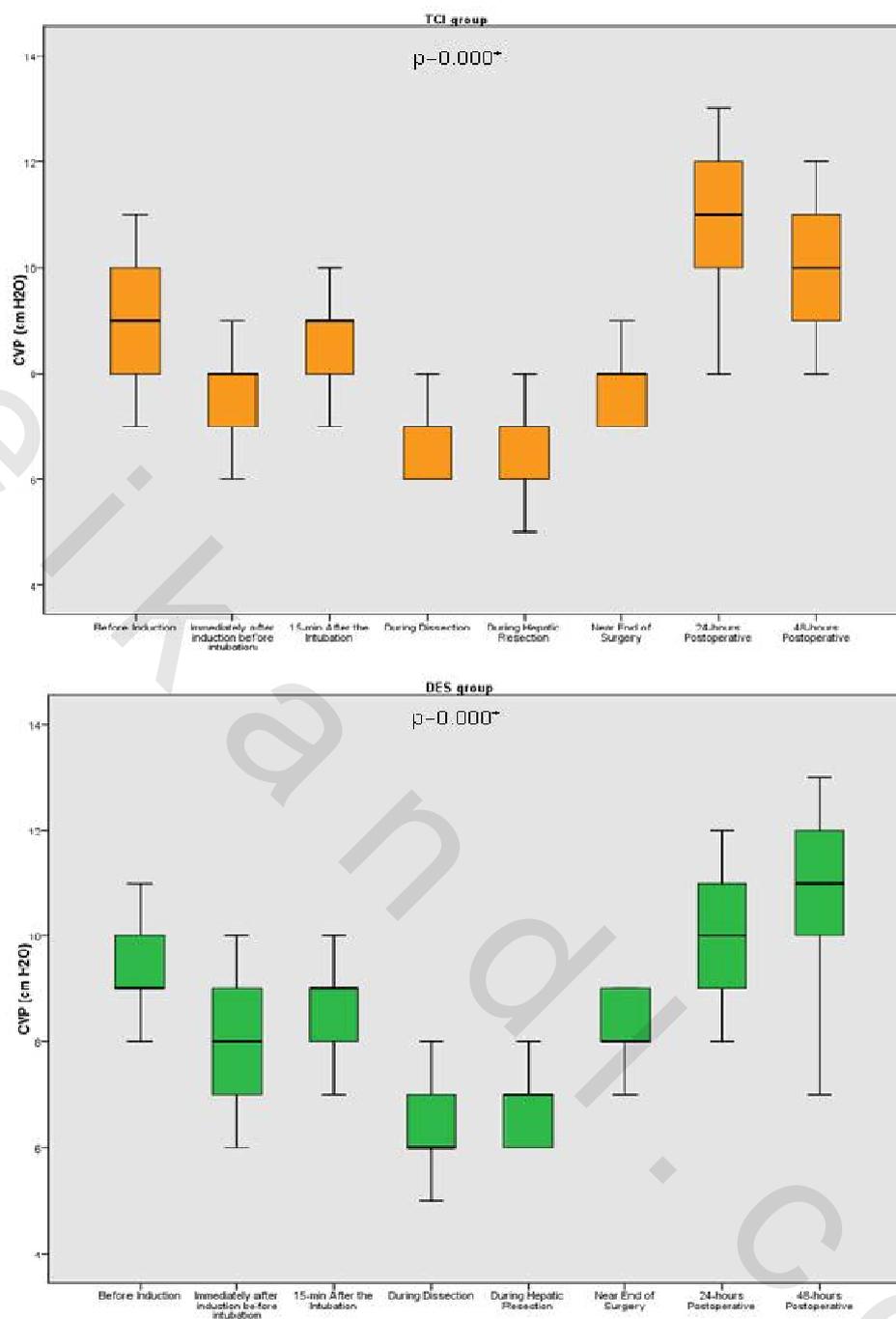
Studied variables	Groups	Mean $\pm$ SD	t- test	p- value
T0	TCI	9.08 $\pm$ 1.187	0.122	0.903 NS
	DES	9.12 $\pm$ 1.129		
T1	TCI	7.64 $\pm$ 1.113	0.463	0.646 NS
	DES	7.80 $\pm$ 1.322		
T2	TCI	9.08 $\pm$ 1.288	1.594	0.118 NS
	DES	8.52 $\pm$ 1.194		
T3	TCI	6.80 $\pm$ 0.645	1.873	0.067 NS
	DES	6.44 $\pm$ 0.711		
T4	TCI	6.80 $\pm$ 0.866	0.175	0.862 NS
	DES	6.84 $\pm$ 0.746		
T5	TCI	7.76 $\pm$ 0.723	2.175	0.035 NS
	DES	8.20 $\pm$ 0.707		
T6	TCI	10.96 $\pm$ 1.135	2.115	0.040 NS
	DES	10.28 $\pm$ 1.137		
T7	TCI	10.28 $\pm$ 1.275	1.415	0.164 NS
	DES	10.80 $\pm$ 1.322		

NS: Non-significant \* Significant at  $p < 0.01$



**Figure 10-a:** Box and Whisker plot of Central venous pressure (CVP) (cm H<sub>2</sub>O) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 10-b:** Box and Whisker plot of Central venous pressure (CVP) (cm H<sub>2</sub>O) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

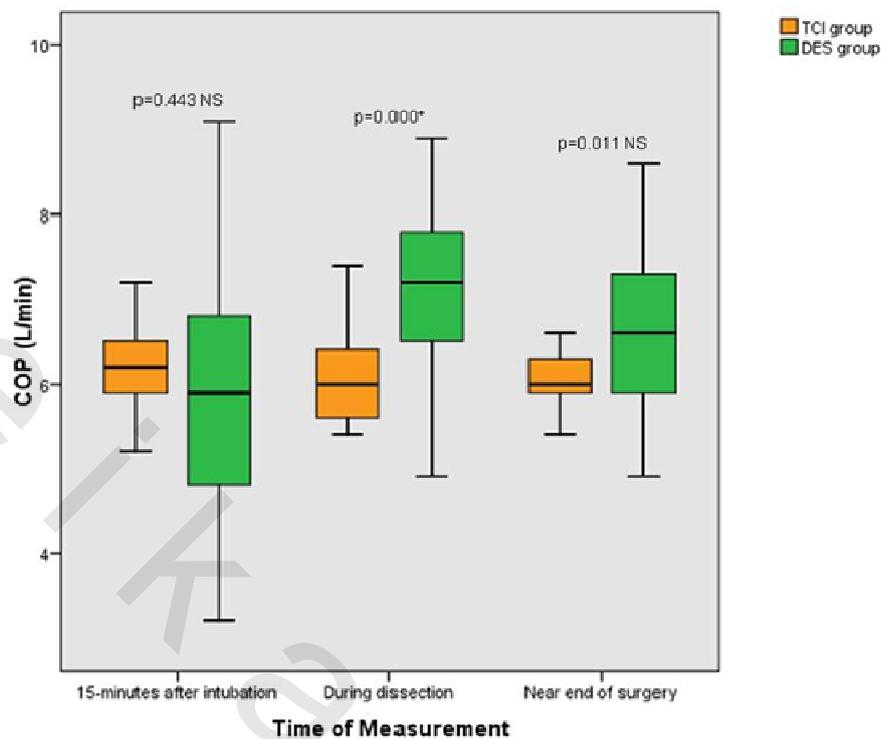
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 8: Differences between groups regarding cardiac output (COP) in L/min. TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane. T0, 15 min after intubation; T1, 30 min. after intubation; T2, 45 min after intubation ; T3, during dissection (liver mobilization); T4, during hepatic resection ; T5, near the end of surgery.**

Studied variables	groups	mean±SD	t – test	p- value
<b>T0</b>	<b>TCI</b>	6.19±0.546	0.778	0.443 NS
	<b>DES</b>	5.94±1.524		
<b>T1</b>	<b>TCI</b>	6.02±0.614	0.069	0.946 NS
	<b>DES</b>	6.00±1.318		
<b>T2</b>	<b>TCI</b>	6.17±0.534	1.888	0.068 NS
	<b>DES</b>	6.69±1.268		
<b>T3</b>	<b>TCI</b>	6.11±0.573	4.020	0.000*
	<b>DES</b>	7.17±1.192		
<b>T4</b>	<b>TCI</b>	5.97±0.448	1.438	0.157 NS
	<b>DES</b>	6.27±0.956		
<b>T5</b>	<b>TCI</b>	6.09±0.370	2.716	0.011 NS
	<b>DES</b>	6.63±0.914		

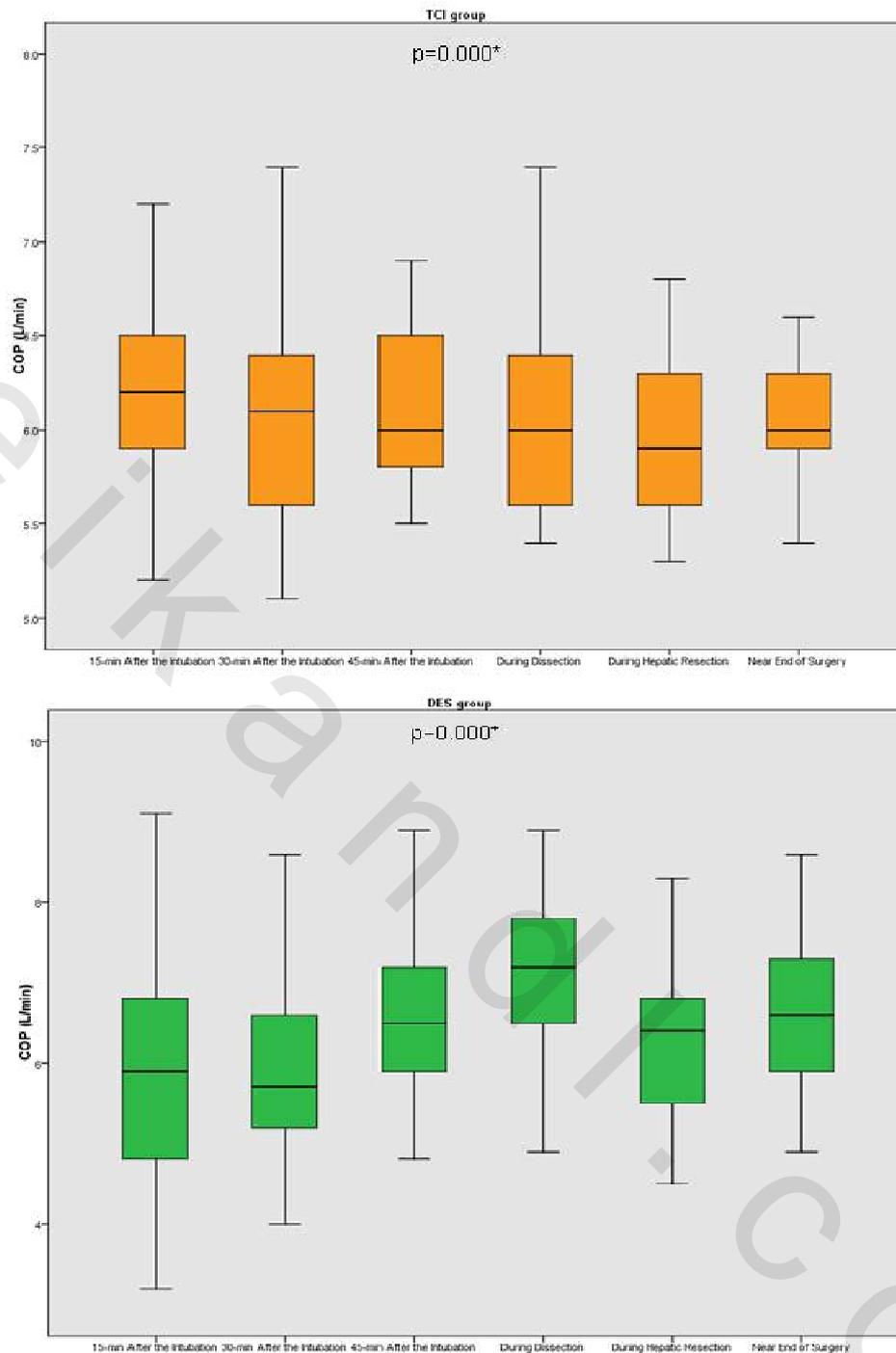
NS: Non-significant \* Significant at  $p < 0.01$



**Figure 11-a:** Box and Whisker plot of Cardiac output (COP) (L/min) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

$p < 0.01$  is significant.

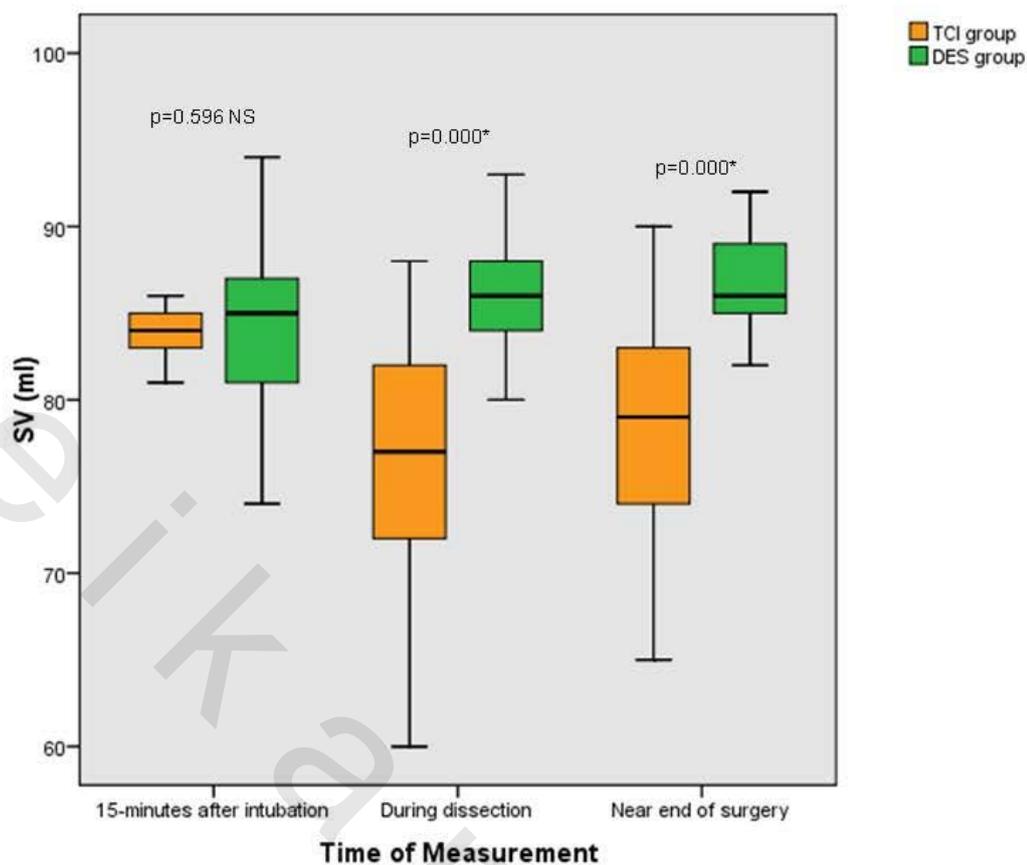


**Figure 11-b:** Box and Whisker plot of Cardiac output (COP) (L/min) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection. Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points. Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 9:** Differences between groups regarding stroke volume (SV). TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane. T0, 15 min after intubation; T1,30 min after intubation; T2, 45 min after intubation ; T3, during dissection (liver mobilization); T4, during hepatic resection ; T5, near the end of surgery.

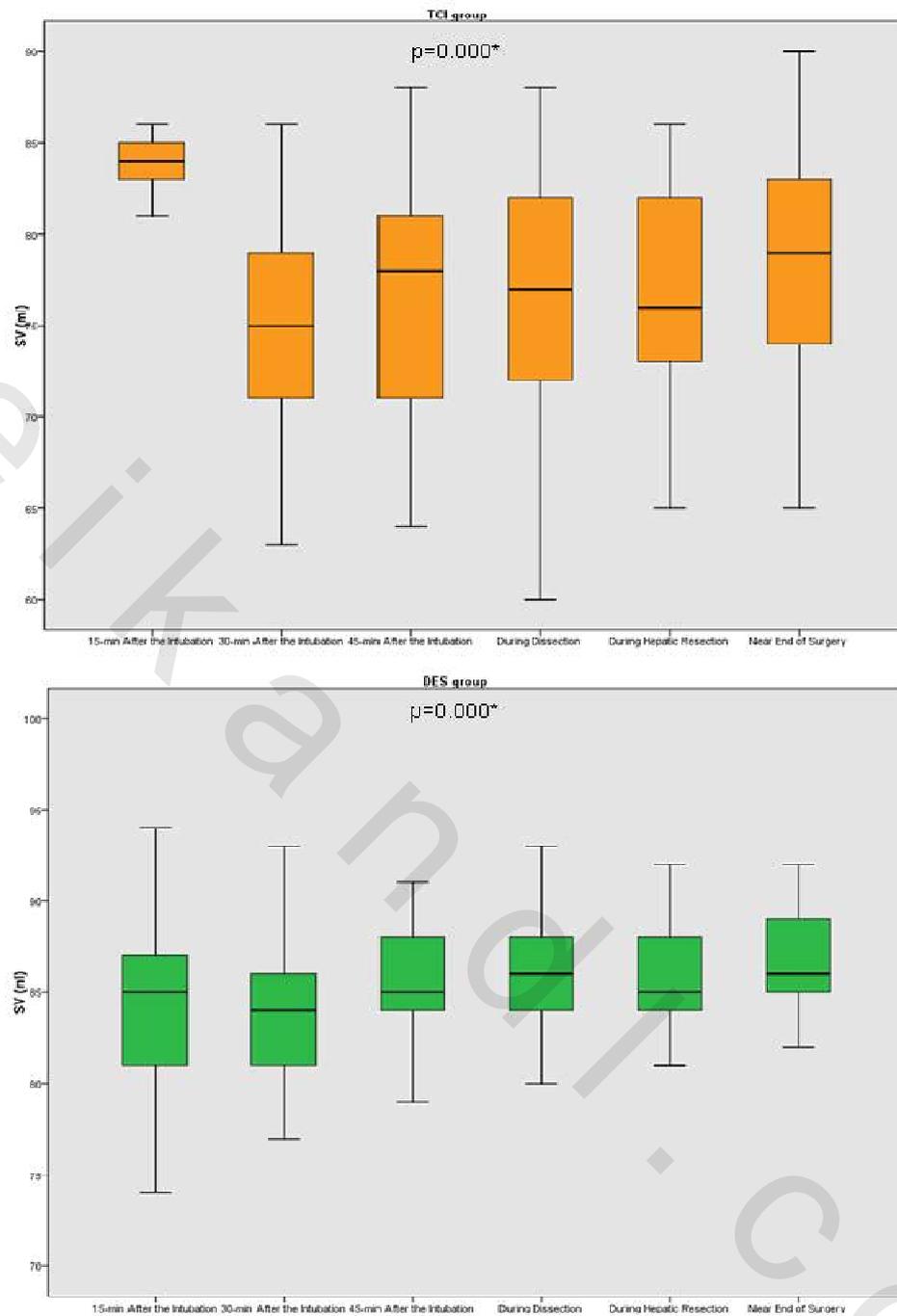
Studied variables	groups	Mean $\pm$ SD	t-test	p- value
<b>T0</b>	<b>TCI</b>	83.76 $\pm$ 1.640	0.534	0.597 NS
	<b>DES</b>	84.24 $\pm$ 4.186		
<b>T1</b>	<b>TCI</b>	75.08 $\pm$ 6.244	5.937	0.000*
	<b>DES</b>	83.72 $\pm$ 3.736		
<b>T2</b>	<b>TCI</b>	76.16 $\pm$ 6.523	6.676	0.000*
	<b>DES</b>	85.72 $\pm$ 2.951		
<b>T3</b>	<b>TCI</b>	76.20 $\pm$ 7.664	5.905	0.000*
	<b>DES</b>	86.64 $\pm$ 4.405		
<b>T4</b>	<b>TCI</b>	76.44 $\pm$ 6.344	6.240	0.000*
	<b>DES</b>	85.68 $\pm$ 3.815		
<b>T5</b>	<b>TCI</b>	78.40 $\pm$ 5.605	6.529	0.000*
	<b>DES</b>	86.92 $\pm$ 3.340		

NS: Non-significant \* Significant at  $p < 0.01$



**Figure 12-a:** Box and Whisker plot of Stroke volume (SV) (ml) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.

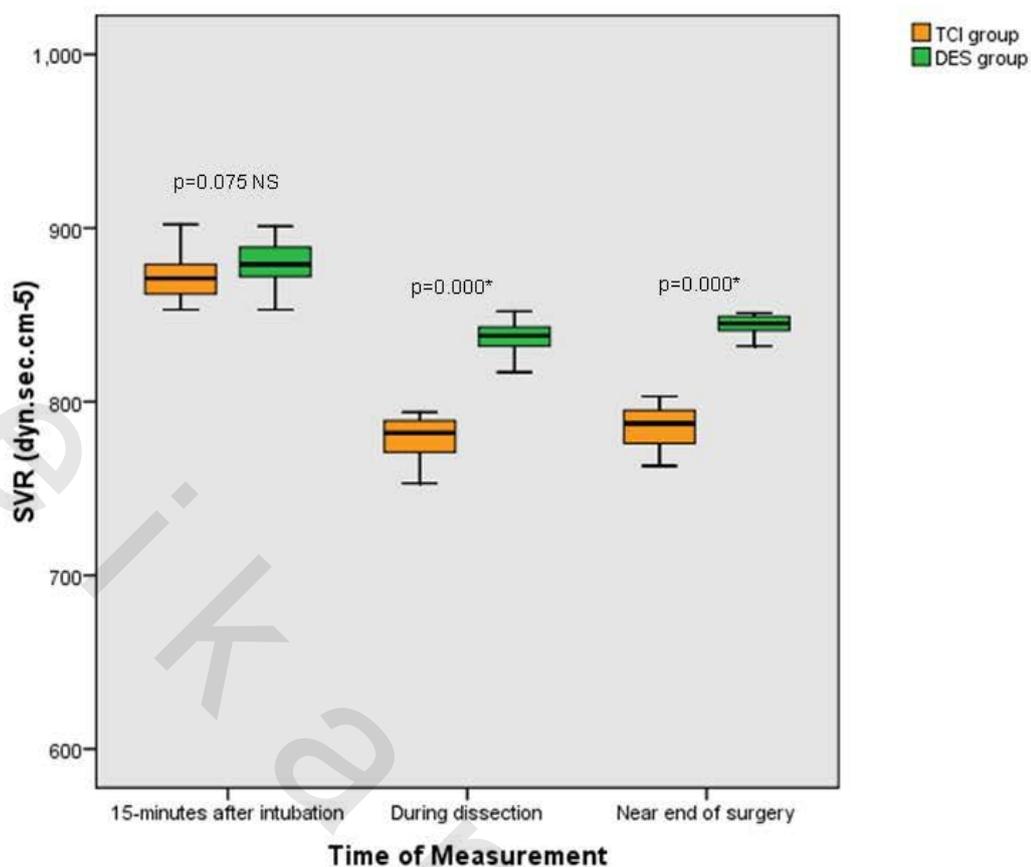


**Figure 12-b:** Box and Whisker plot of Stroke volume (SV) (ml) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection. Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points. Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 10: Differences between groups regarding systemic vascular resistance (SVR). TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane. T0,15 min after intubation; T1, 30 min after intubation ;T2,45 min after intubation ; T3, during dissection (liver mobilization); T4, during hepatic resection ; T5, near the end of surgery**

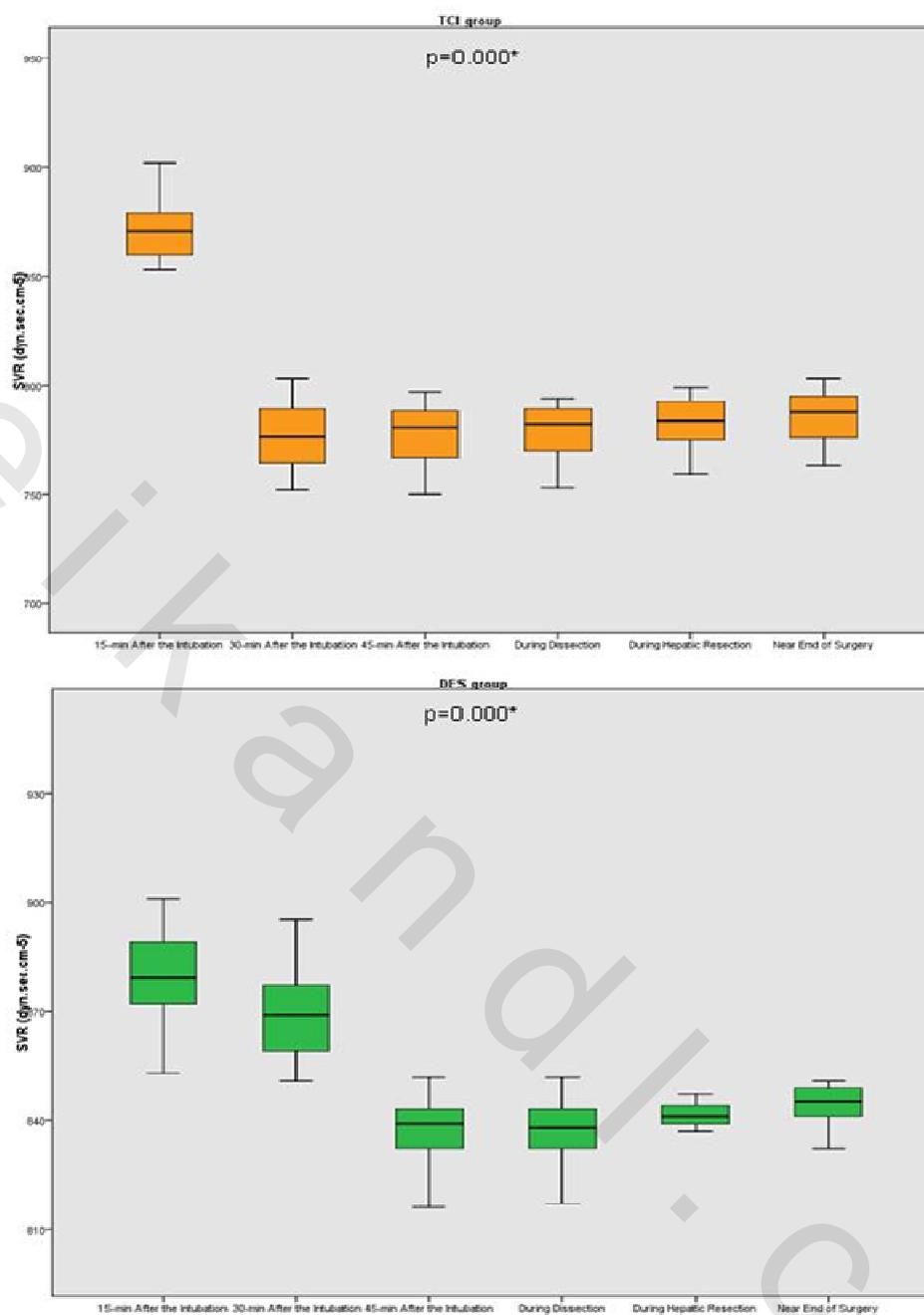
Studied variables	Groups	Mean $\pm$ SD	t- test	p- value
T0	TCI	871.96 $\pm$ 14.208	1.82	0.075
	DES	879.28 $\pm$ 14.181		NS
T1	TCI	777.12 $\pm$ 15.243	16.95	0.000*
	DES	872.72 $\pm$ 23.728		
T2	TCI	778.16 $\pm$ 11.967	16.77	0.000*
	DES	835.04 $\pm$ 12.022		
T3	TCI	779.56 $\pm$ 36.666	7.6	0.000*
	DES	836.72 $\pm$ 8.314		
T4	TCI	787.28 $\pm$ 56.182	3.51	0.001*
	DES	858.16 $\pm$ 84.016		
T5	TCI	784.42 $\pm$ 43.596	6.46	0.000*
	DES	842.88 $\pm$ 8.192		

NS: Non-significant \* Significant at  $p < 0.01$



**Figure 13-a:** Box and Whisker plot of systemic vascular resistance (SVR) (dyn.sec.cm-5) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 13-b:** Box and Whisker plot of systemic vascular resistance (SVR) (dyn.sec.cm-5) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

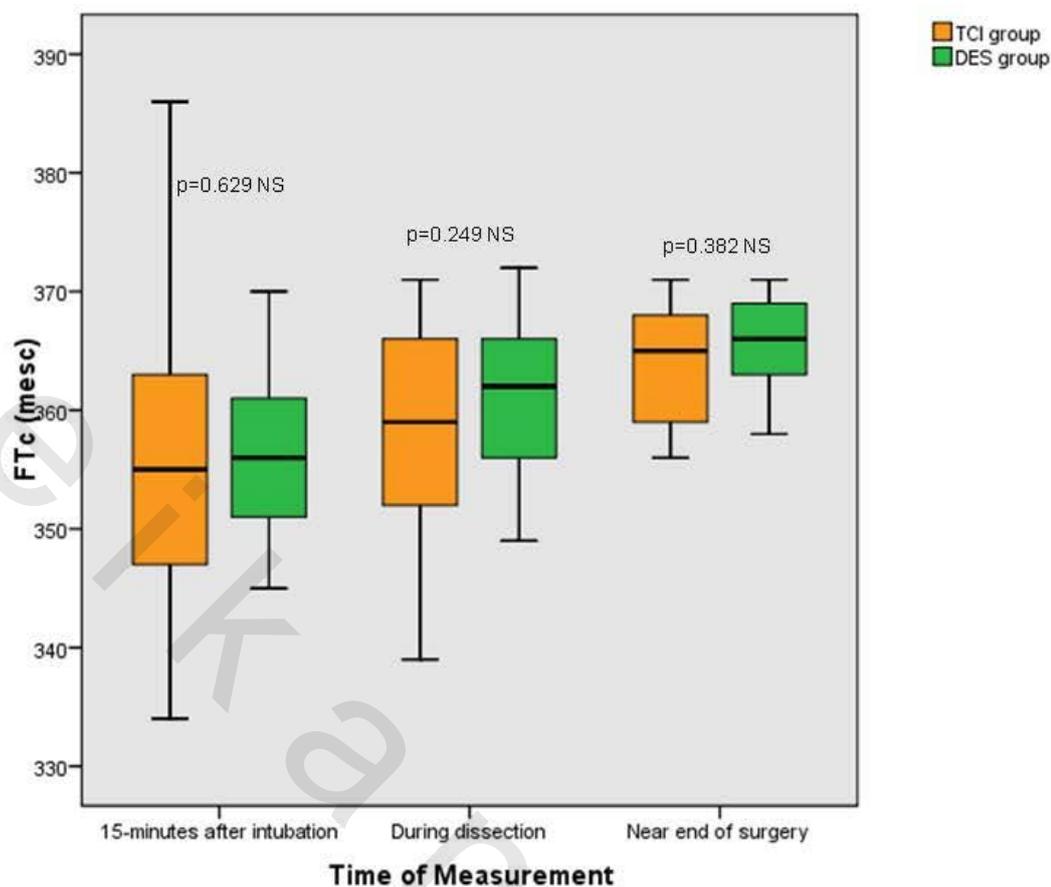
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 11: Differences between groups regarding Transesophageal Doppler corrected flow time (FTc, msec). TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane. T0,15 min after intubation; T1,30 min after intubation; T2,45 min after intubation; T3, during dissection (liver mobilization); T4, during hepatic resection ; T5, near the end of surgery.**

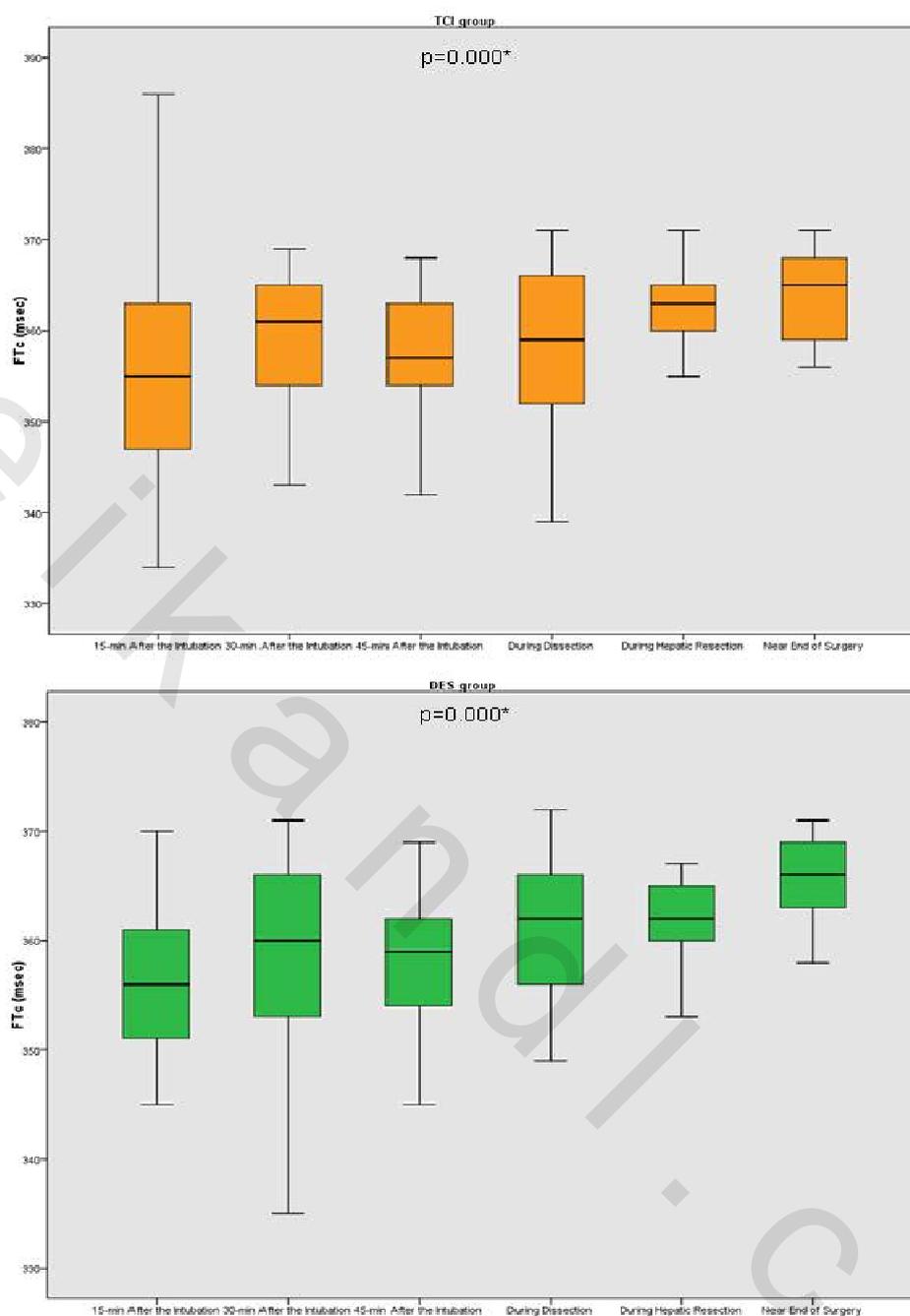
Studied variables	groups	mean±SD	t-test	p- value
<b>T0</b>	<b>TCI</b>	354.44±11.783	0.487	0.629 NS
	<b>DES</b>	355.76±6.697		
<b>T1</b>	<b>TCI</b>	358.80±8.455	0.420	0.676 NS
	<b>DES</b>	357.64±10.908		
<b>T2</b>	<b>TCI</b>	357.36±6.575	0.492	0.625 NS
	<b>DES</b>	358.28±6.655		
<b>T3</b>	<b>TCI</b>	358.60±8.246	1.167	0.249 NS
	<b>DES</b>	361.04±6.419		
<b>T4</b>	<b>TCI</b>	362.68±5.595	1.238	0.222 NS
	<b>DES</b>	360.48±6.898		
<b>T5</b>	<b>TCI</b>	363.16±4.988	0.883	0.382 NS
	<b>DES</b>	364.60±6.448		

NS: Non-significant



**Figure 14-a:** Box and Whisker plot of Transesophageal Doppler corrected flow time (FTc, msec) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



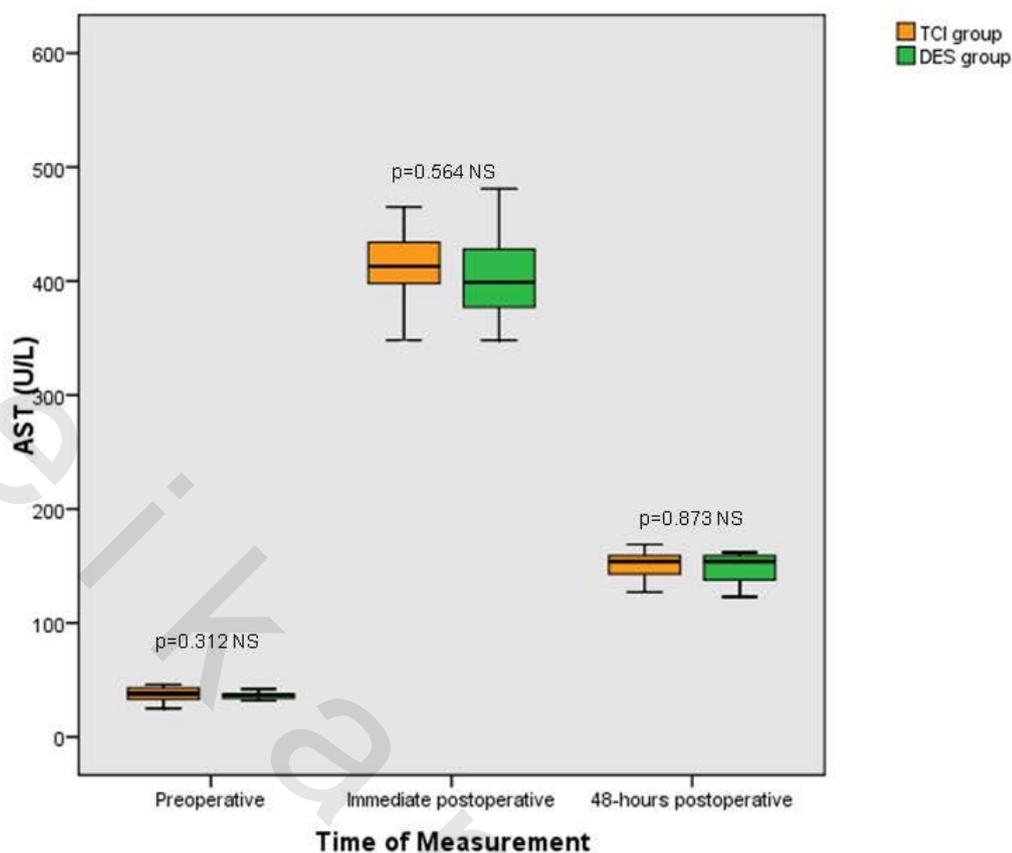
**Figure 14-b:** Box and Whisker plot of Transesophageal Doppler corrected flow time (FTc, msec) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .

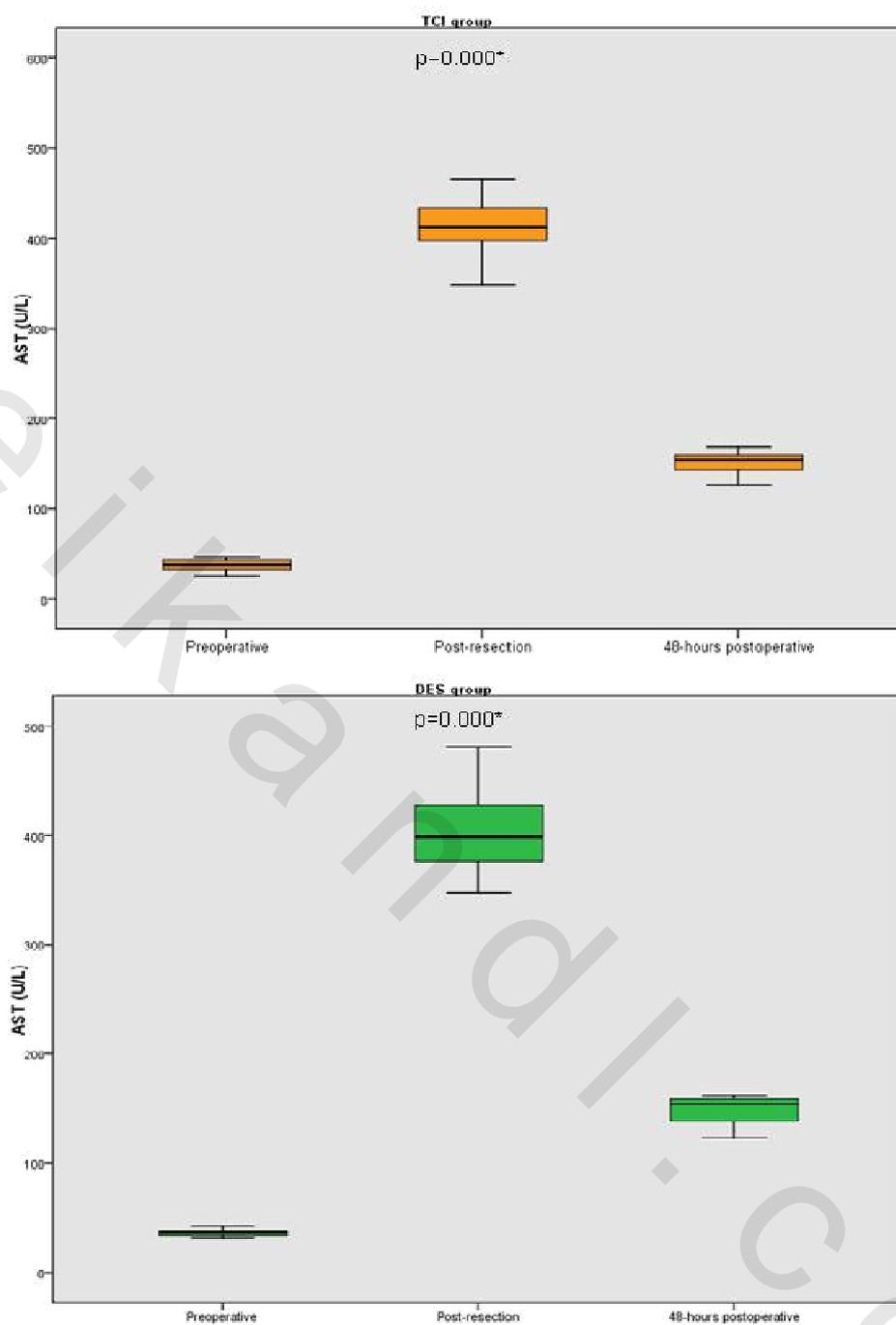
**Table 12: Laboratory investigations. T1; preoperative, T2; post-resection, T3; 48 hour postoperatively. TCI; Target controlled infusion, Des; Desflurane; AST, aspartate aminotransferase; ALT, alanine aminotransferase, INR; international normalized ratio. GST: Glutathion S transferase. \*significance with other group; ( $P<0.01$ ).**

Variables Time	Mean $\pm$ SD		
	TCI	Des	
AST (U/L)	T1	37.68 $\pm$ 6.073	36.32 $\pm$ 2.641
	T2	413.52 $\pm$ 39.686	407.32 $\pm$ 35.685
	T3	148.32 $\pm$ 17.216	147.64 $\pm$ 12.439
ALT (U/L)	T1	43.88 $\pm$ 9.820	43.36 $\pm$ 5.506
	T2	467.24 $\pm$ 38.074*	378.68 $\pm$ 80.333*
	T3	205.32 $\pm$ 39.312*	154.24 $\pm$ 14.623*
INR	T1	1.13 $\pm$ 0.022	1.12 $\pm$ 0.033
	T2	1.19 $\pm$ 0.025	1.18 $\pm$ 0.017
	T3	1.25 $\pm$ 0.020	1.26 $\pm$ 0.050
GST (IU/ml)	T1	0.029336 $\pm$ 0.001371	0.029204 $\pm$ 0.001475
	T2	0.044004 $\pm$ 0.002085	0.043756 $\pm$ 0.002223
	T3	0.031544 $\pm$ 0.001615	0.031440 $\pm$ 0.001754
Urea (mg/dL)	T1	34.68 $\pm$ 2.478	34.24 $\pm$ 1.562
	T2	32.20 $\pm$ 2.000	31.00 $\pm$ 2.020
	T3	31.96 $\pm$ 2.730	31.36 $\pm$ 1.976
Creatinine (mg/dL)	T1	1.36 $\pm$ 0.112	1.30 $\pm$ 0.093
	T2	1.30 $\pm$ 0.167	1.28 $\pm$ 0.200
	T3	1.38 $\pm$ 0.105	1.30 $\pm$ 0.144
Microalbumin ( $\mu$ gm/ml)	T1	19.16 $\pm$ 1.748	18.40 $\pm$ 2.629
	T2	18.08 $\pm$ 1.605	17.32 $\pm$ 2.154
	T3	18.64 $\pm$ 1.186	17.76 $\pm$ 2.570



**Figure 15-a:** Box and Whisker plot of AST (U/L) in TCI group and Des group in patients undergoing hepatic resection.

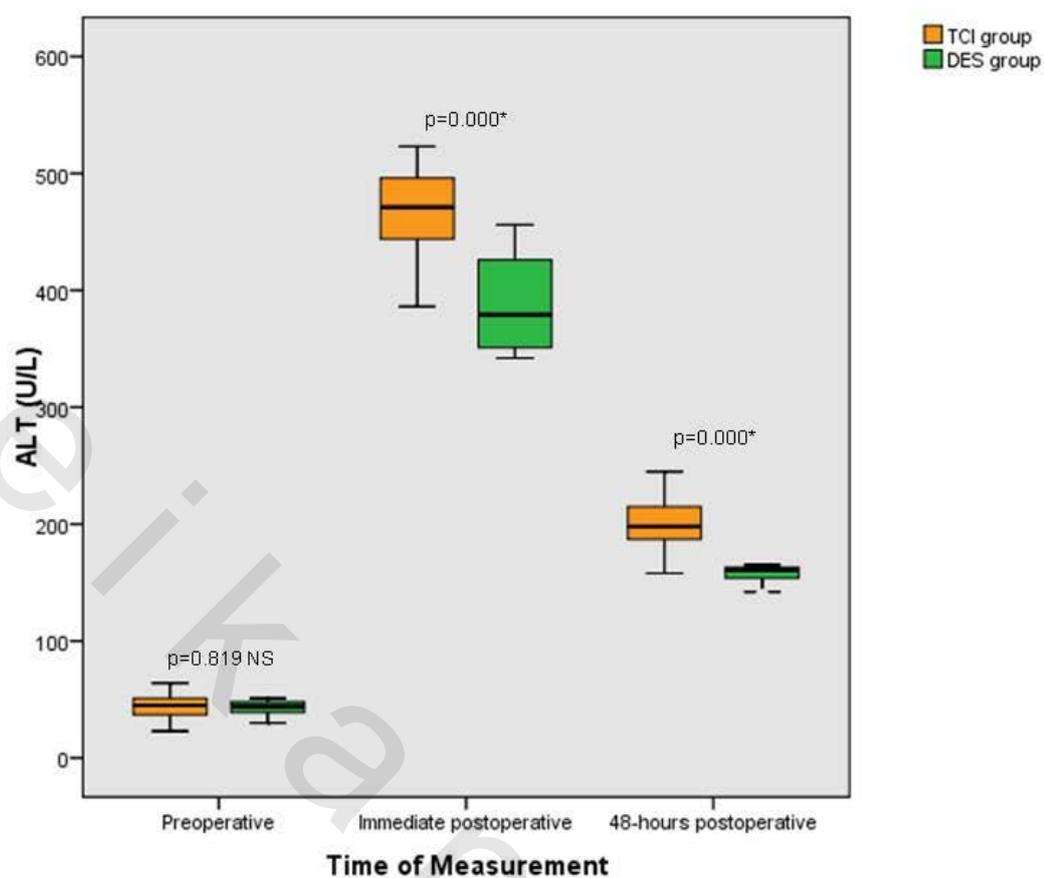
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 15-b:** Box and Whisker plot of AST (U/L) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

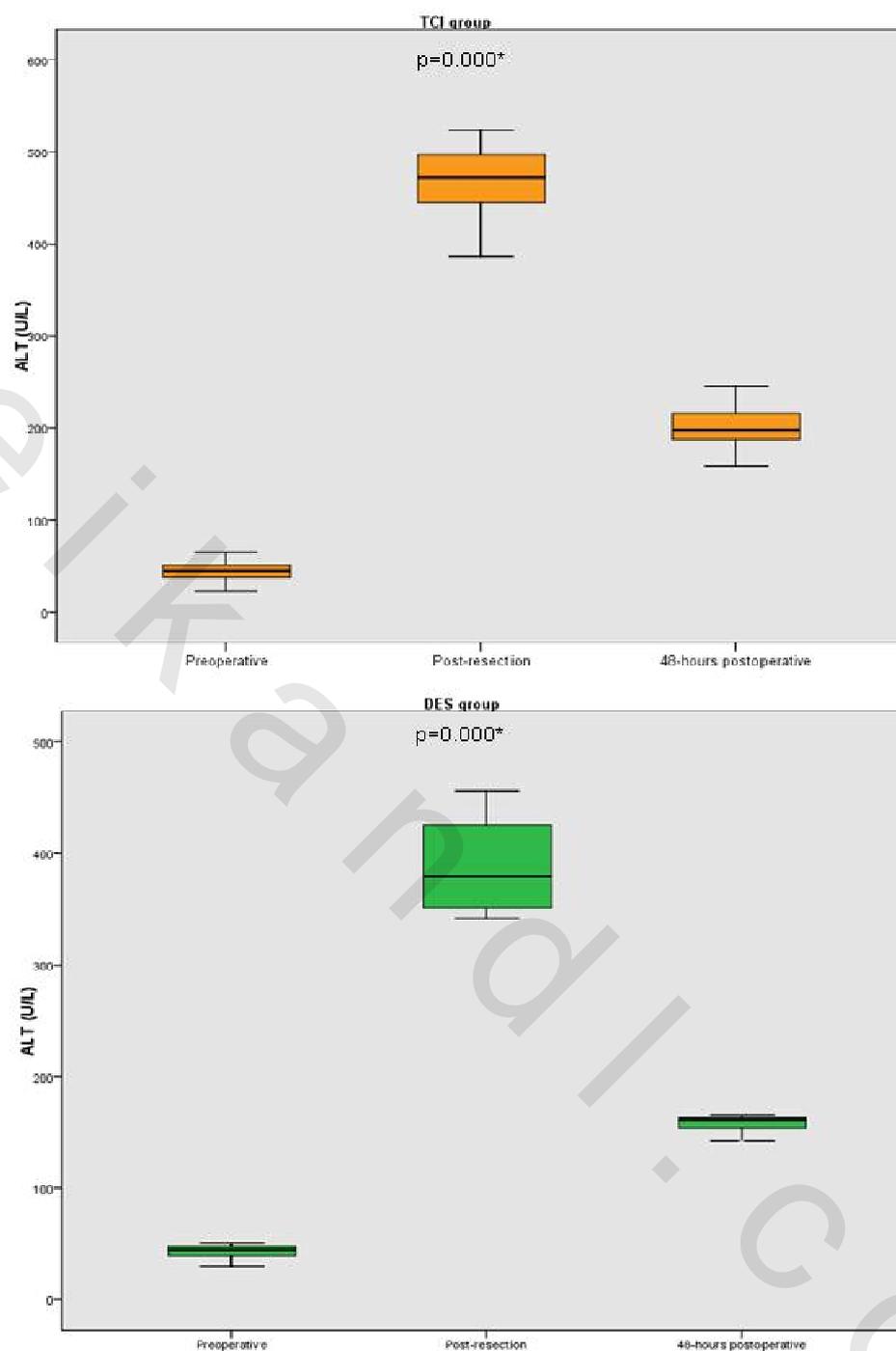
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 16-a:** Box and Whisker plot of ALT (U/L) in TCI group and Des group in patients undergoing hepatic resection.

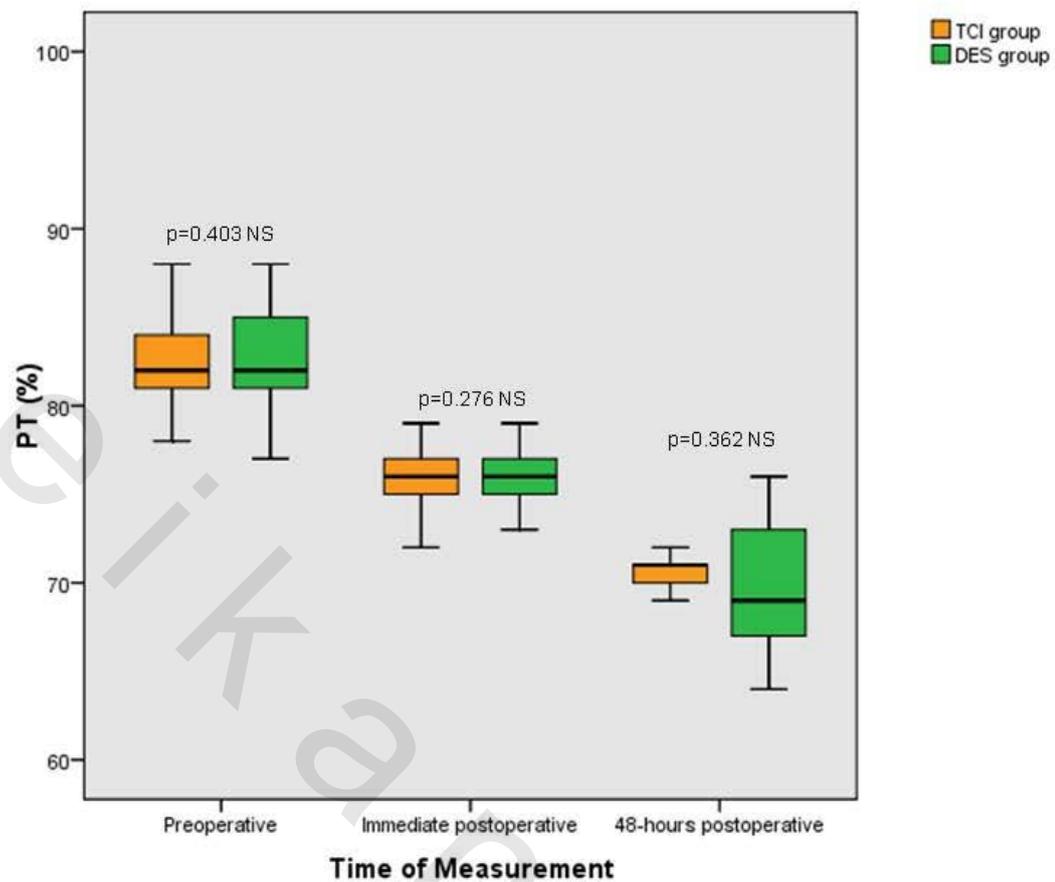
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 16-b:** Box and Whisker plot of ALT (U/L) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

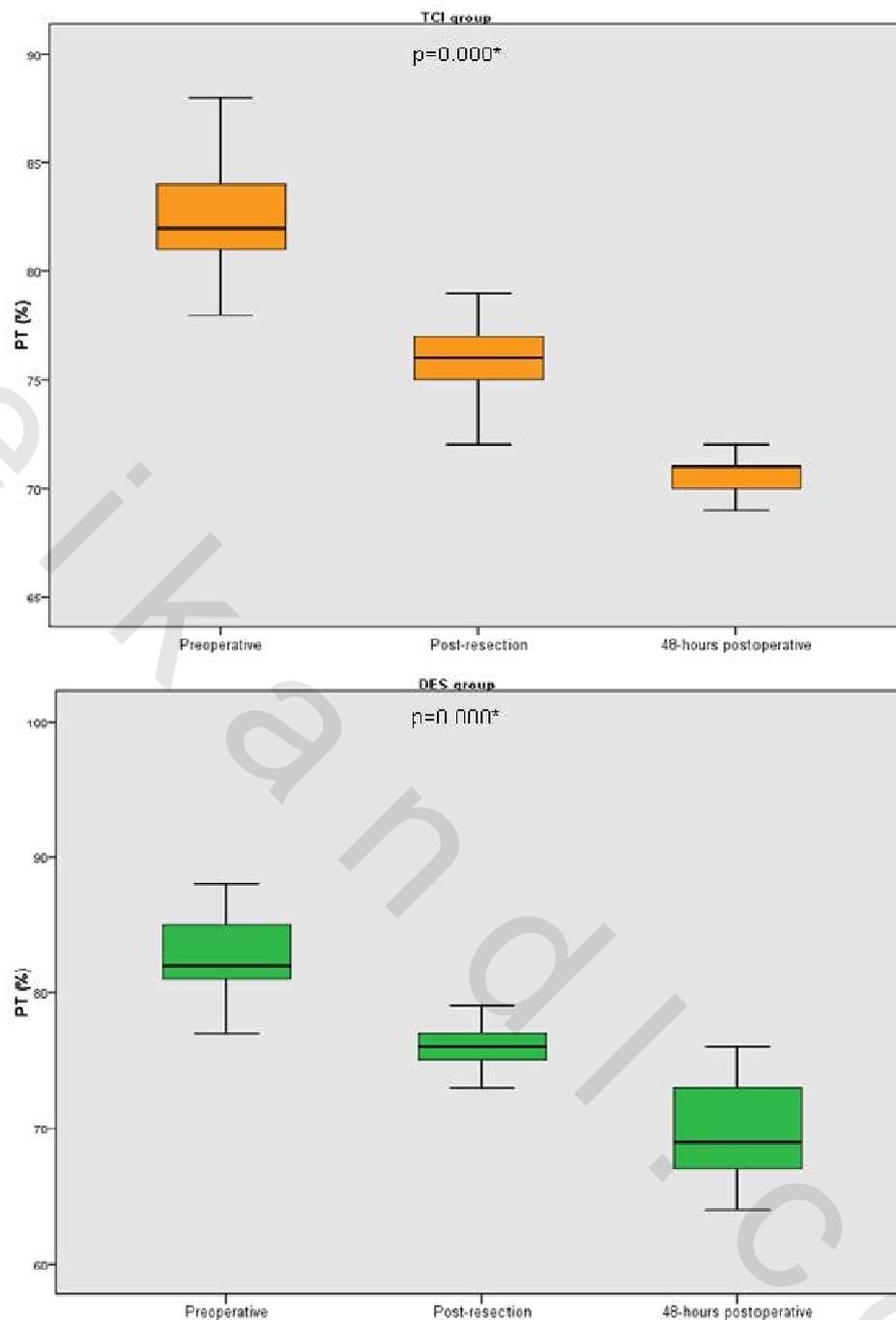
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 17-a:** Box and Whisker plot of PT (%) in TCI group and Des group in patients undergoing hepatic resection.

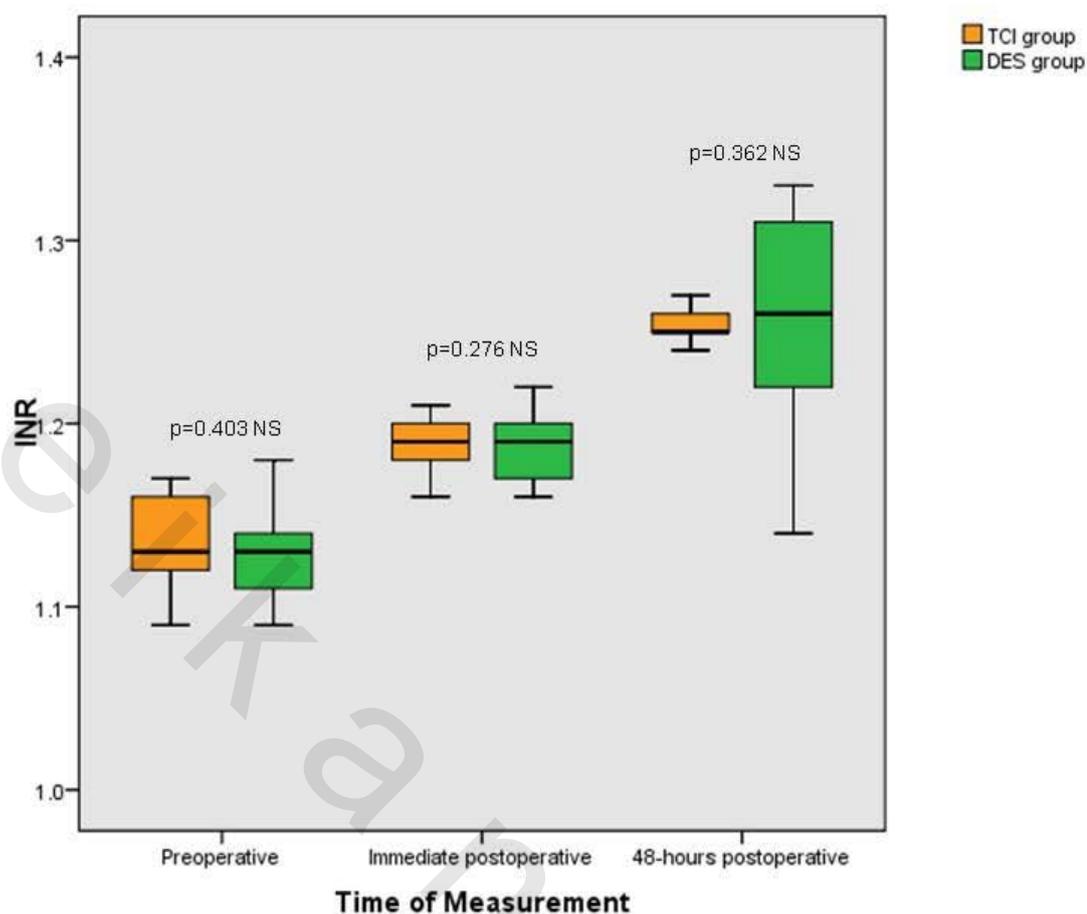
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 17-b:** Box and Whisker plot of PT (%) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

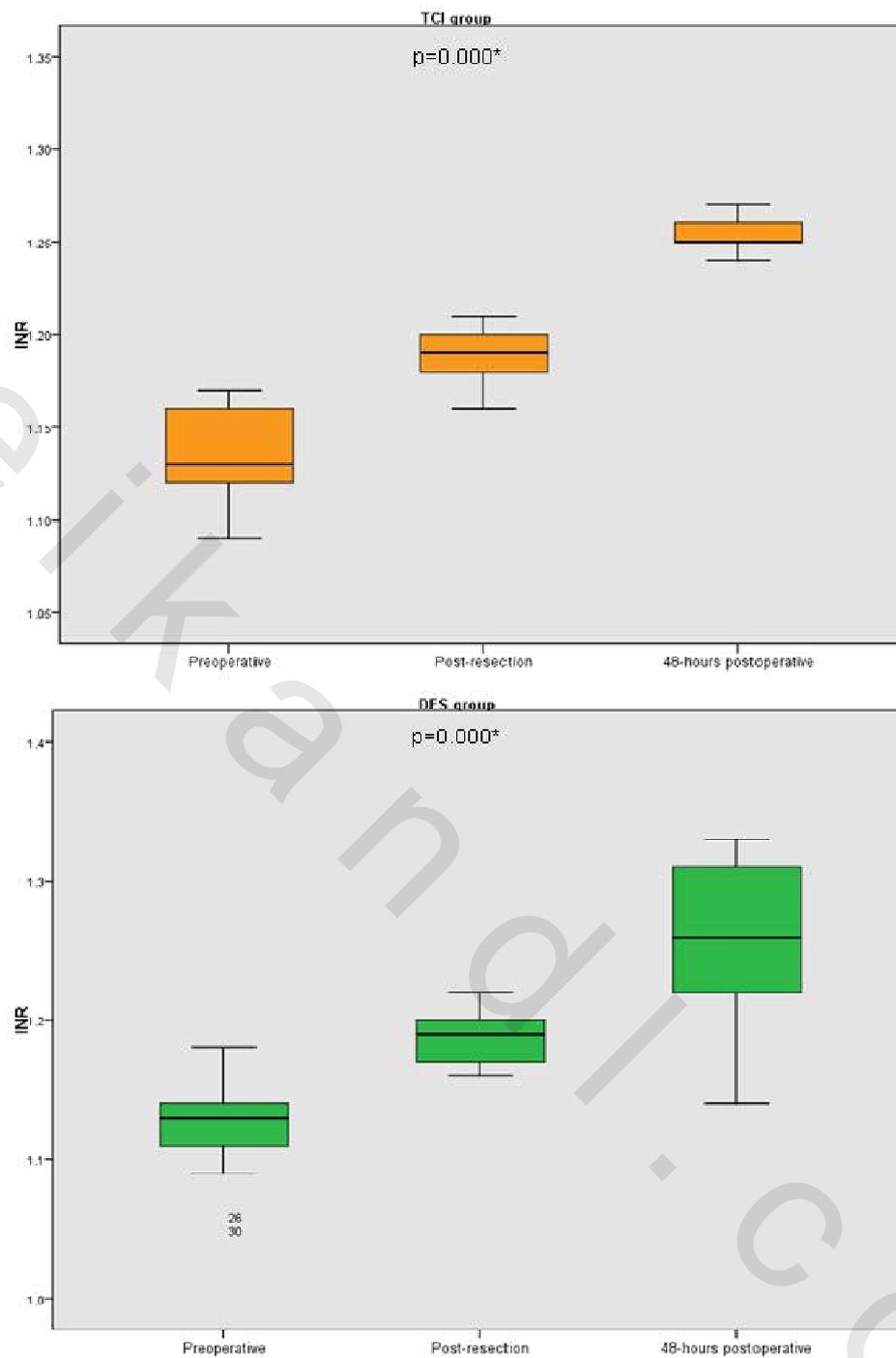
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 18-a:** Box and Whisker plot of INR in TCI group and Des group in patients undergoing hepatic resection.

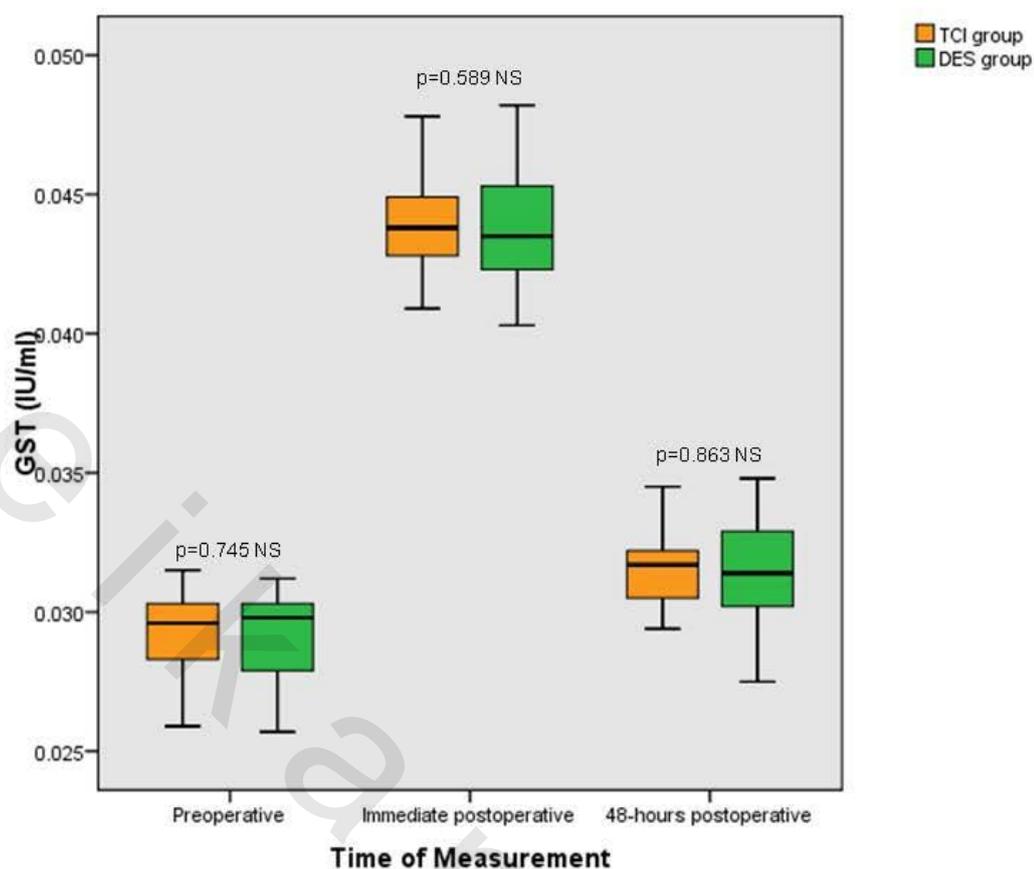
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 18-b:** Box and Whisker plot of INR in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

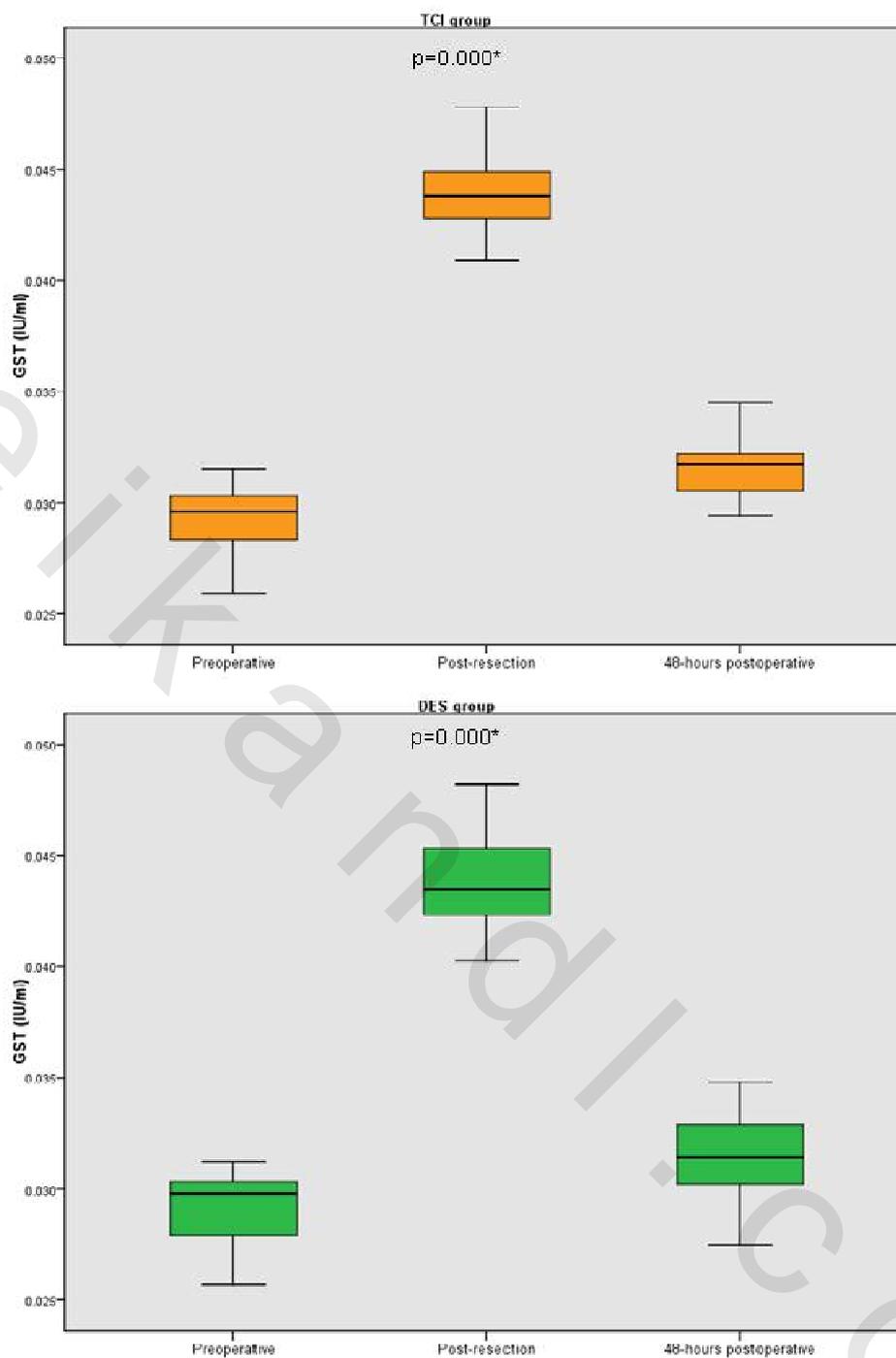
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 19-a:** Box and Whisker plot of GST (IU/ml) in TCI group and Des group in patients undergoing hepatic resection.

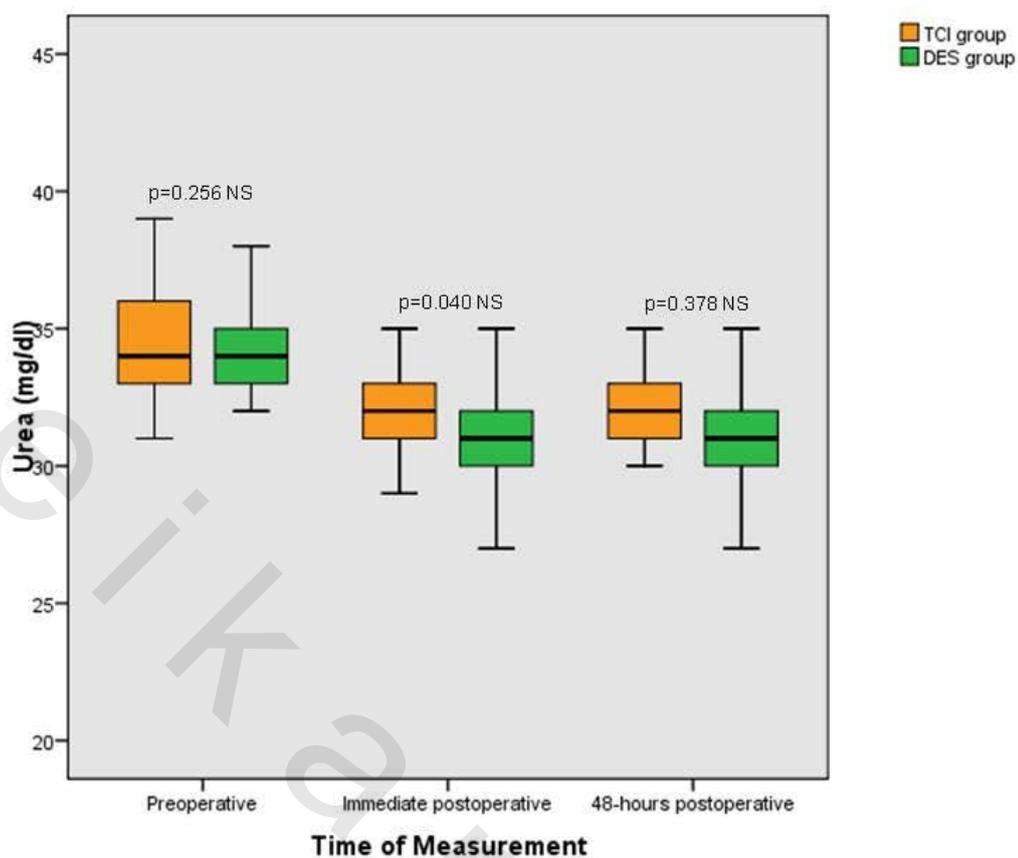
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 19-b:** Box and Whisker plot of GST (IU/ml) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

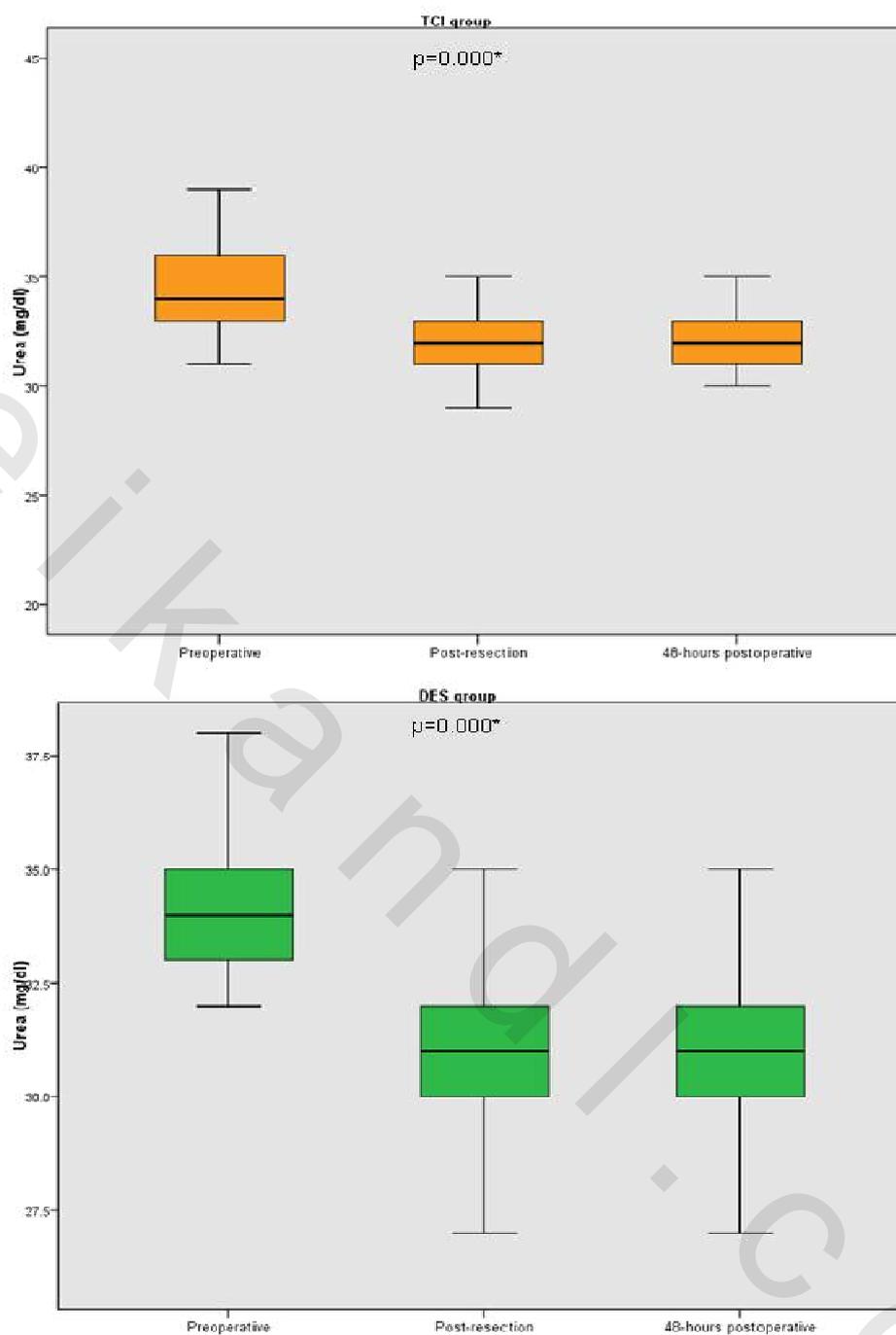
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p<0.01$ .



**Figure 20-a:** Box and Whisker plot of Urea (mg/dl) in TCI group and Des group in patients undergoing hepatic resection.

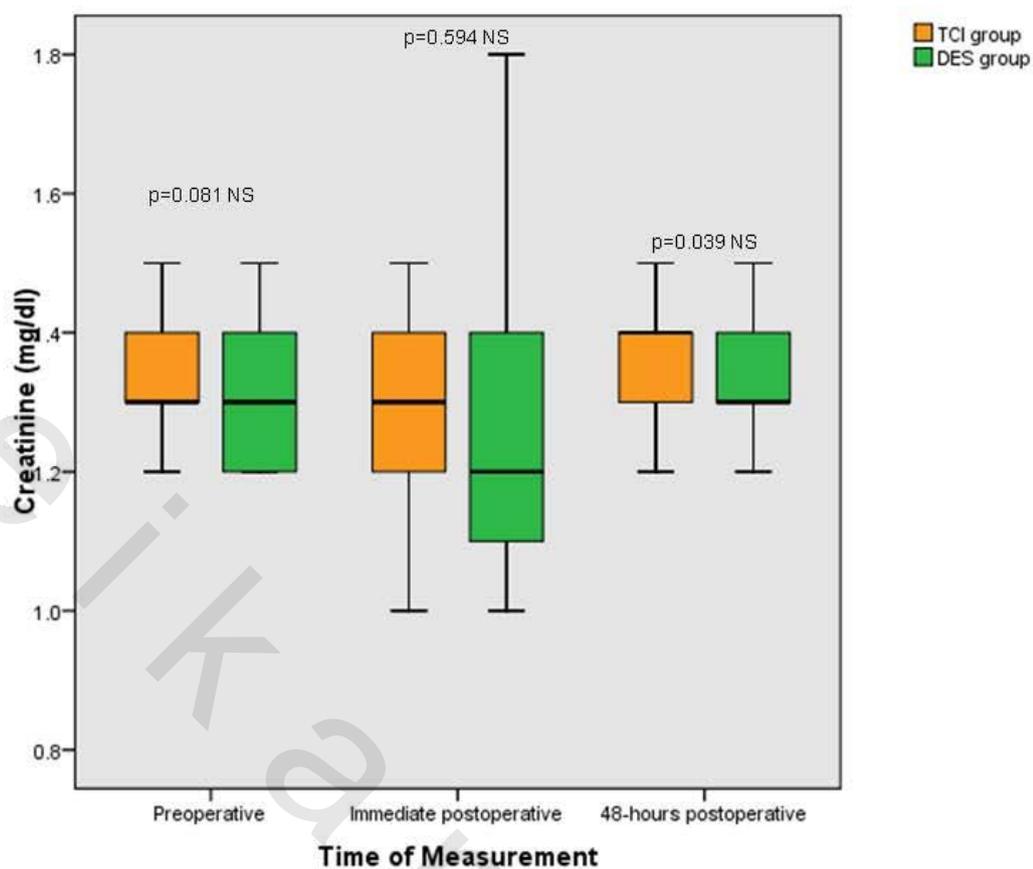
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 20-b:** Box and Whisker plot of Urea (mg/dl) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

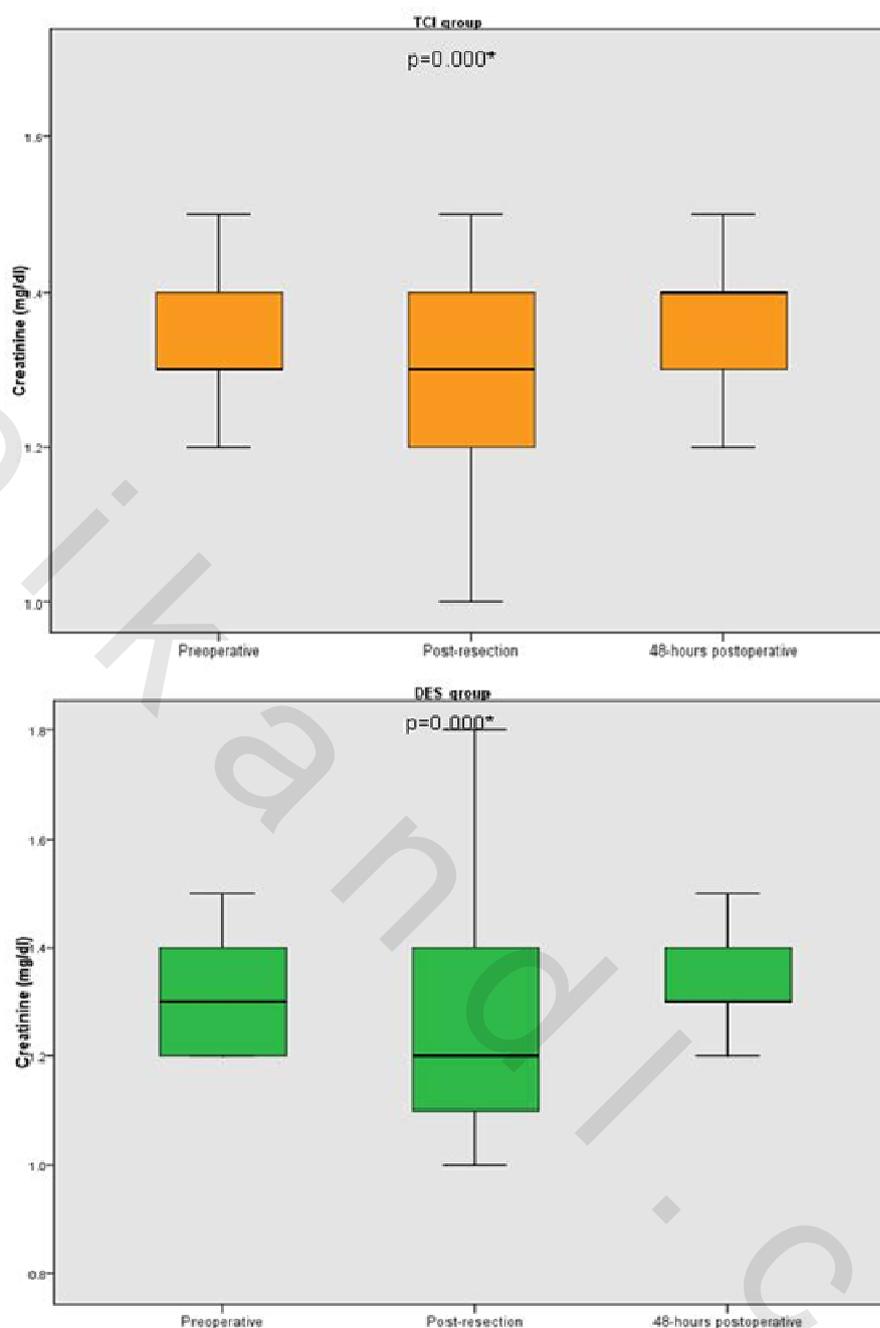
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 21-a:** Box and Whisker plot of Creatinine (mg/dl) in TCI group and Des group in patients undergoing hepatic resection.

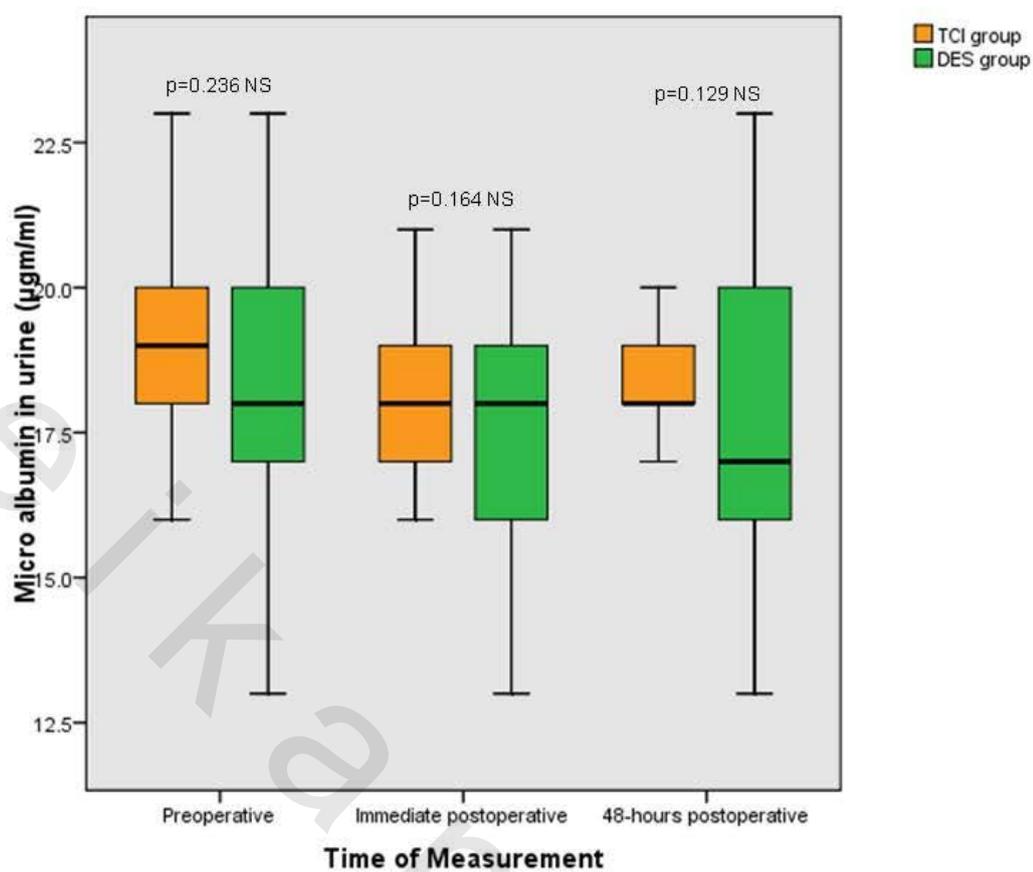
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 21-b:** Box and Whisker plot of Creatinine (mg/dl) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

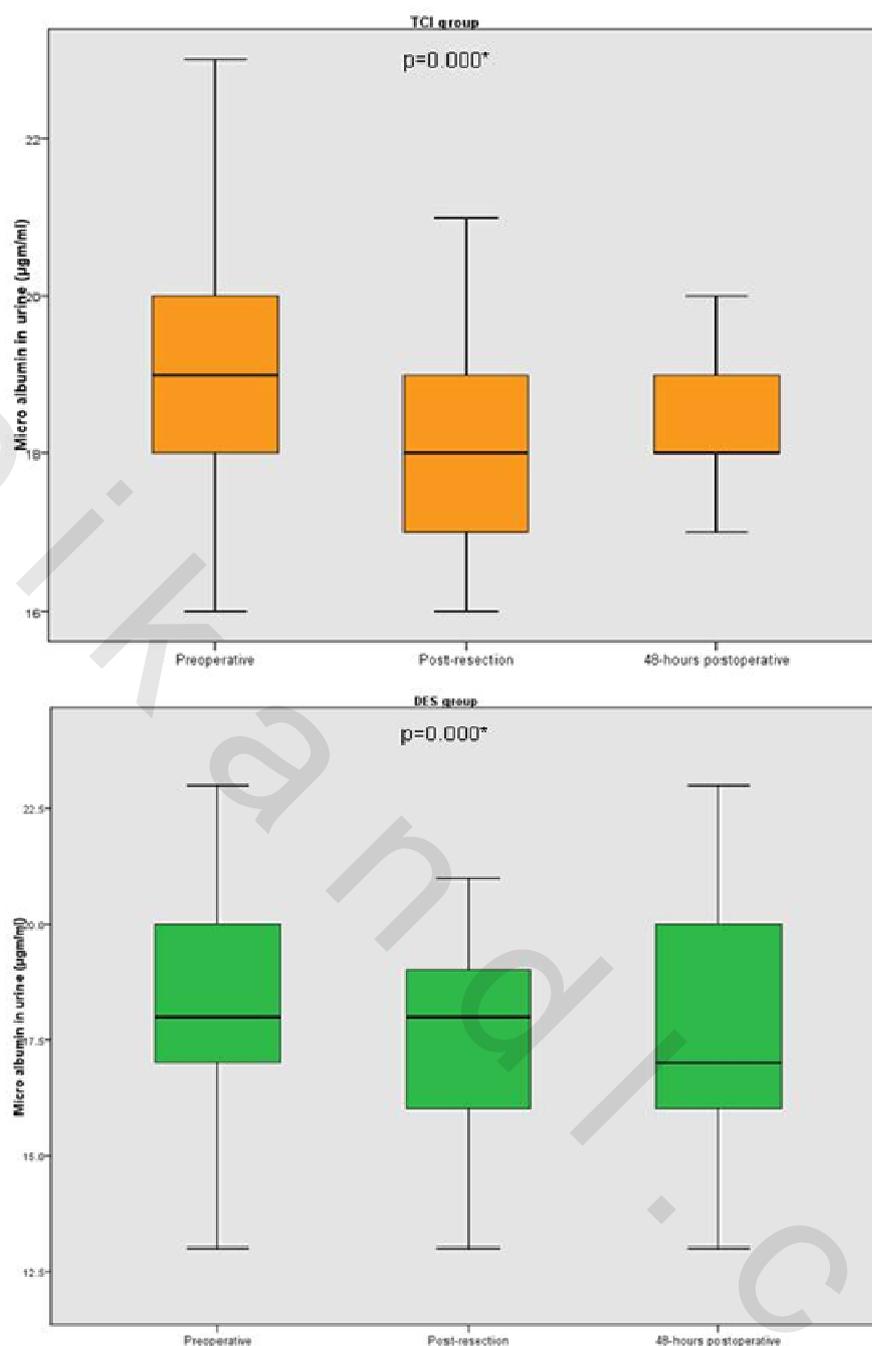
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 22-a:** Box and Whisker plot of Micro albumin in urine ( $\mu\text{gm/ml}$ ) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 22-b:** Box and Whisker plot of Micro albumin in urine ( $\mu\text{g}/\text{ml}$ ) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

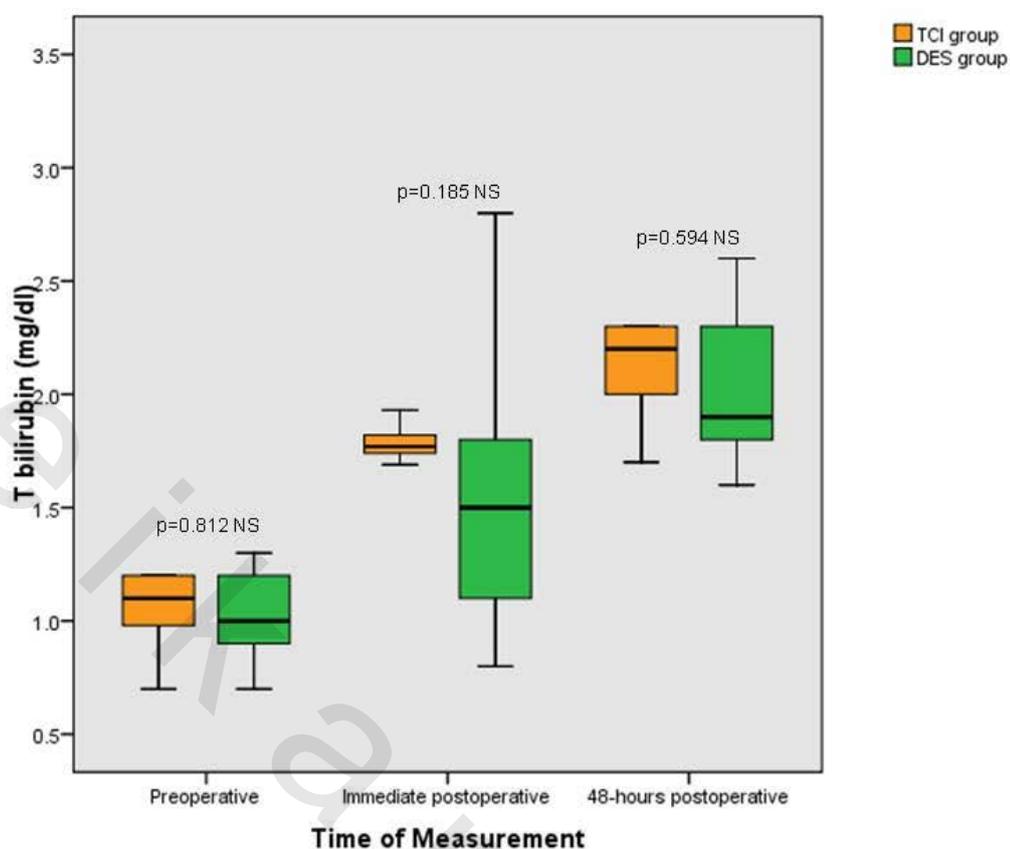
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 13: Differences between groups regarding total bilirubin. T1; preoperative, T2; immediate postoperative, T3; 48 hour postoperatively. TCI; Target controlled infusion, Des; Desflurane.**

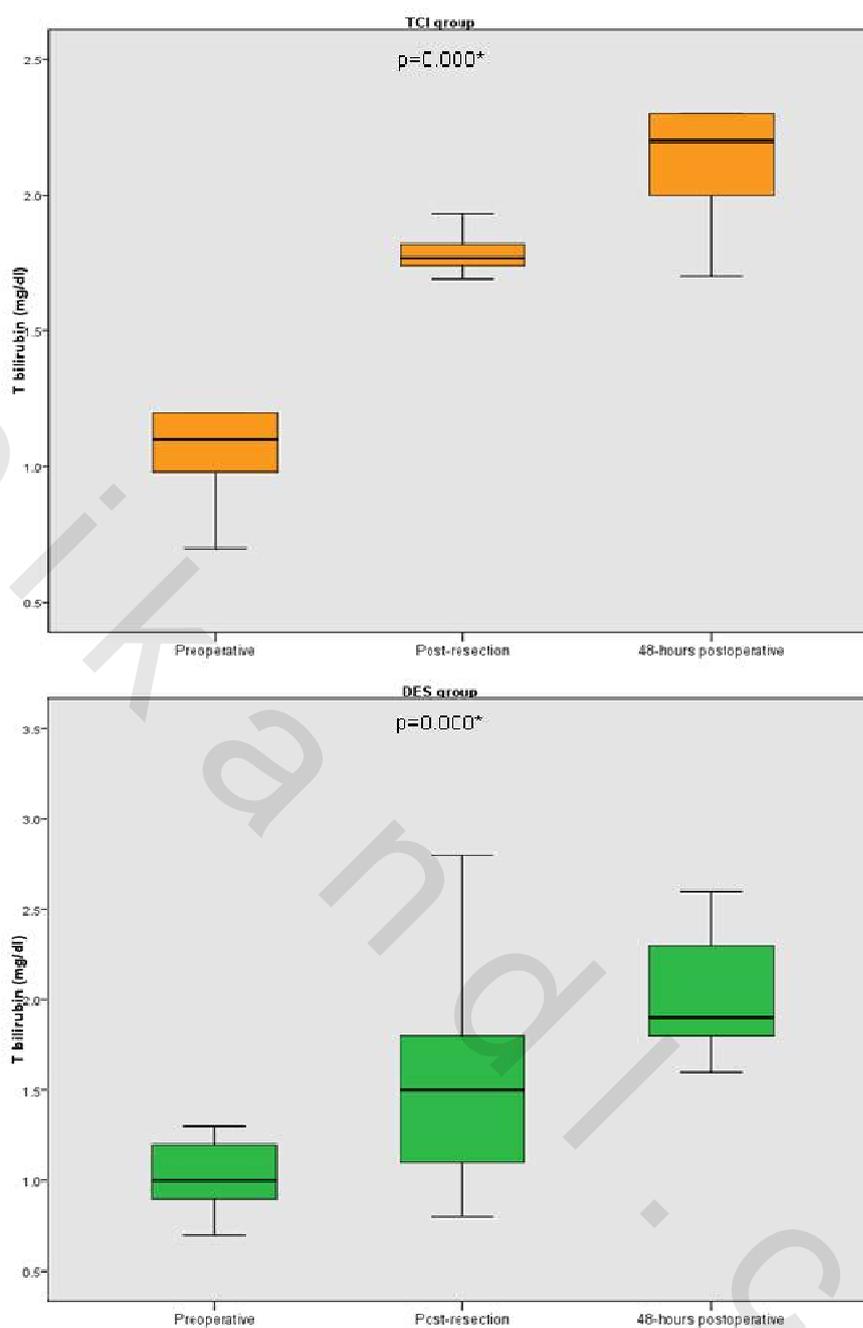
Studied variables	groups	mean±SD	t-test	p-value
<b>T1</b>	<b>TCI</b>	1.05±0.137	0.240	0.812 NS
	<b>DES</b>	1.04±0.219		
<b>T2</b>	<b>TCI</b>	1.78±0.065	1.364	0.185 NS
	<b>DES</b>	1.60±0.649		
<b>T3</b>	<b>TCI</b>	2.09±0.251	0.538	0.594 NS
	<b>DES</b>	2.03±0.456		

NS: Non-significant



**Figure 23-a:** Box and Whisker plot of T. bilirubin (mg/dl) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 23-b:** Box and Whisker plot of T. bilirubin (mg/dl) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

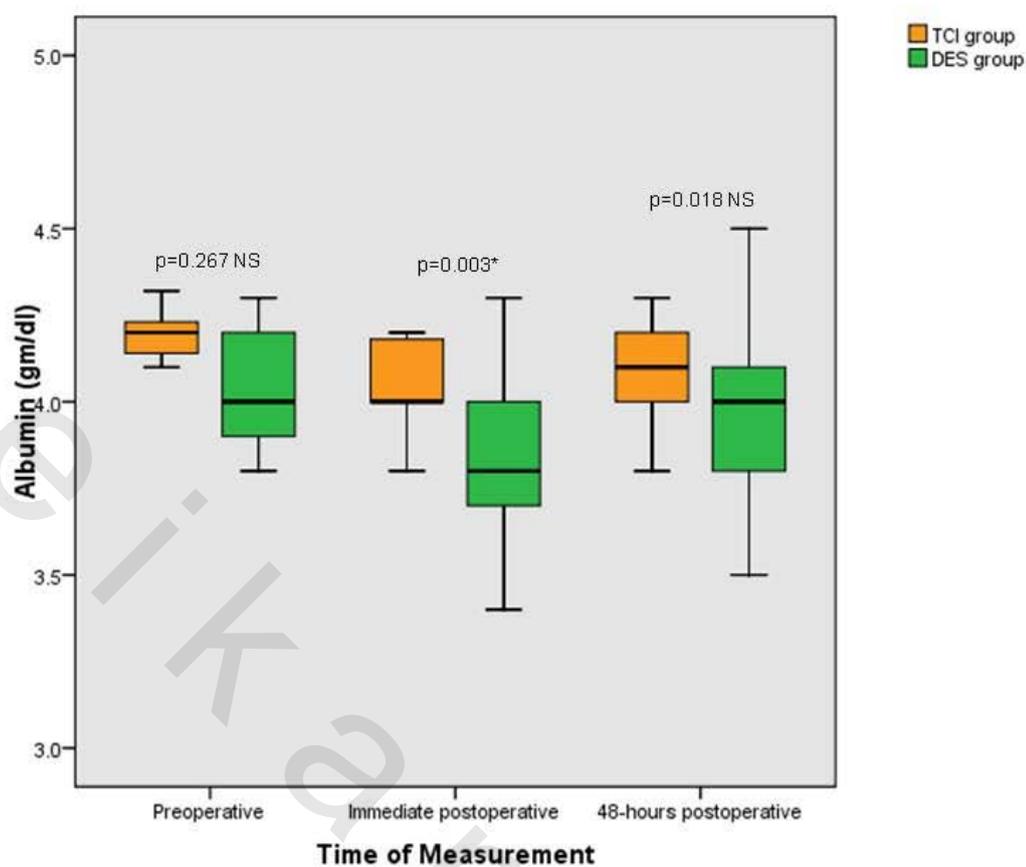
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 14: Differences between groups regarding serum Albumin. T1; preoperative, T2;immediate postoperative, T3; 48 hour postoperatively. TCI; Target controlled infusion, Des; Desflurane.**

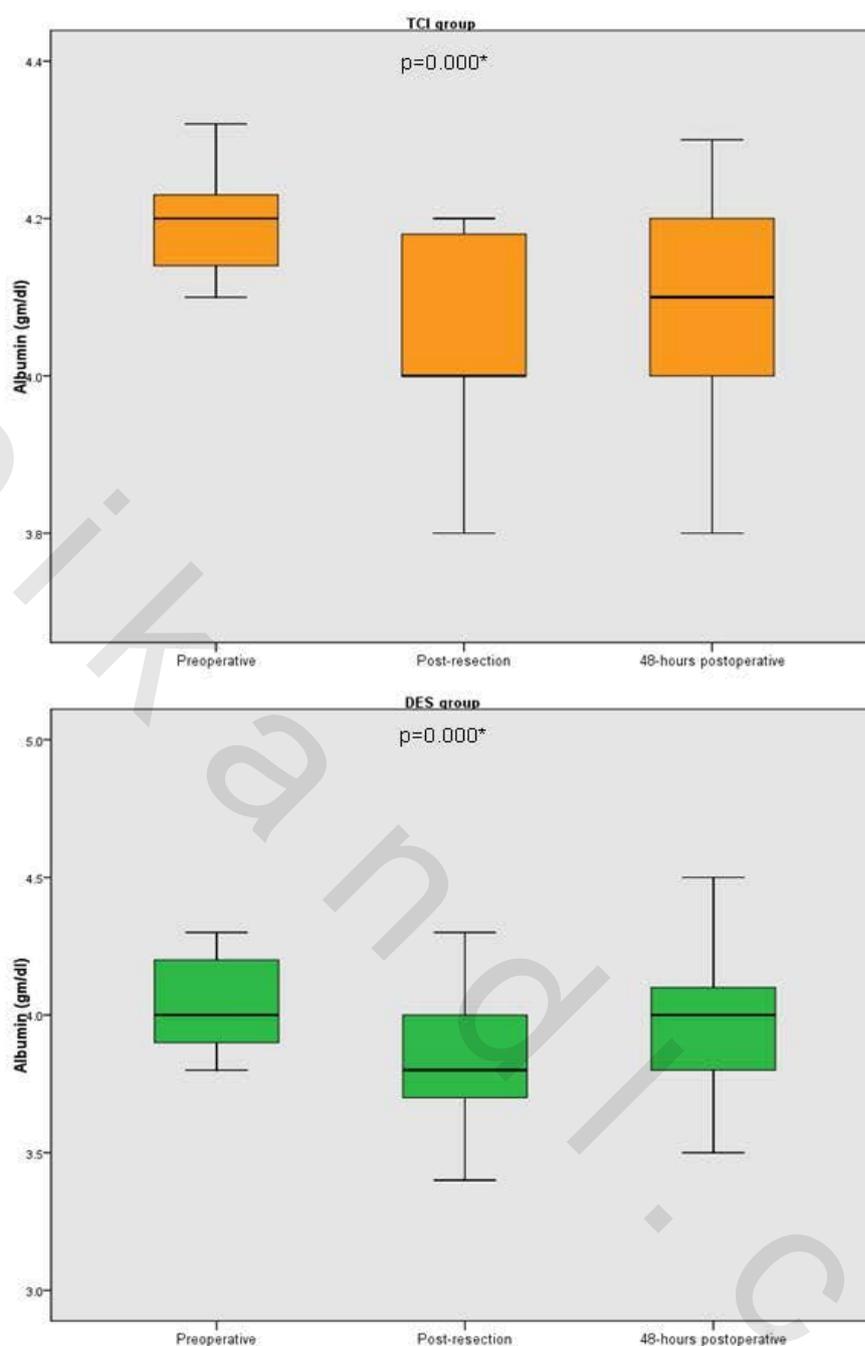
Studied variables	groups	mean±SD	t-test	p- value
<b>T1</b>	<b>TCI</b>	4.16±0.135	1.128	0.267
	<b>DES</b>	4.01±0.281		NS
<b>T2</b>	<b>TCI</b>	4.04±0.143	3.155	0.003*
	<b>DES</b>	3.83±0.295		
<b>T3</b>	<b>TCI</b>	4.10±0.113	2.503	0.018
	<b>DES</b>	3.95±0.281		NS

NS: Non-significant \* Significant at  $p < 0.01$



**Figure 24-a:** Box and Whisker plot of serum albumin (gm/dl) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 24-b:** Box and Whisker plot of serum albumin (gm/dl) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

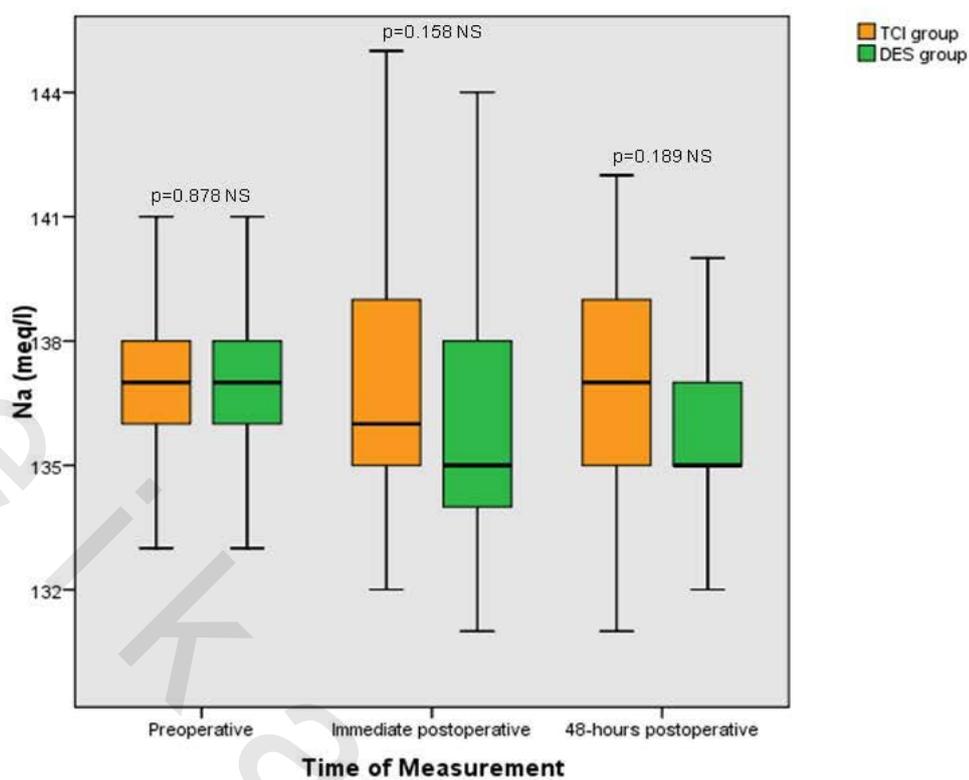
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 15: Differences between groups regarding serum electrolytes. Na;serum sodium, K; serum potassium. T1; preoperative, T2;immediate postoperative, T3; 48 hours postoperatively. TCI; Target controlled infusion, Des; Desflurane.**

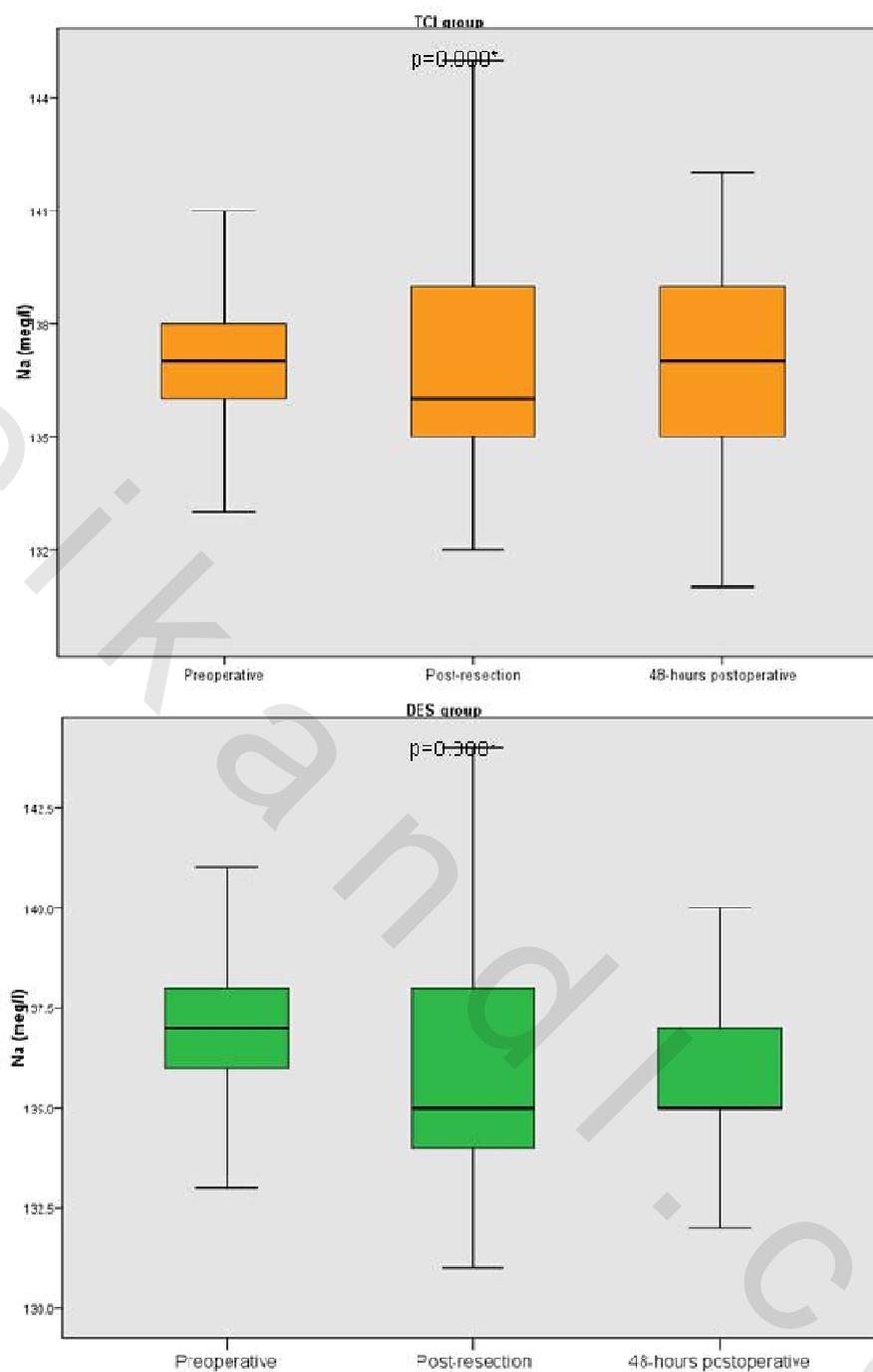
Studied variables	Groups	Mean $\pm$ SD	t- test	p- value
<b>Na -T1</b>	<b>TCI</b>	136.76 $\pm$ 2.402	0.155	0.878 NS
	<b>DES</b>	136.64 $\pm$ 3.039		
<b>Na-T2</b>	<b>TCI</b>	137.36 $\pm$ 3.695	1.434	0.158 NS
	<b>DES</b>	136.00 $\pm$ 2.972		
<b>Na-T3</b>	<b>TCI</b>	136.84 $\pm$ 3.337	1.333	0.189 NS
	<b>DES</b>	135.76 $\pm$ 2.296		
<b>K-T1</b>	<b>TCI</b>	3.93 $\pm$ 0.266	0.949	0.349 NS
	<b>DES</b>	3.87 $\pm$ 0.136		
<b>K-T2</b>	<b>TCI</b>	3.90 $\pm$ 0.260	1.957	0.057 NS
	<b>DES</b>	3.78 $\pm$ 0.180		
<b>K-T3</b>	<b>TCI</b>	3.93 $\pm$ 0.316	2.562	0.015 NS
	<b>DES</b>	3.74 $\pm$ 0.168		

NS: Non-significant



**Figure 25-a:** Box and Whisker plot of Na (meq/l) in TCI group and Des group in patients undergoing hepatic resection.

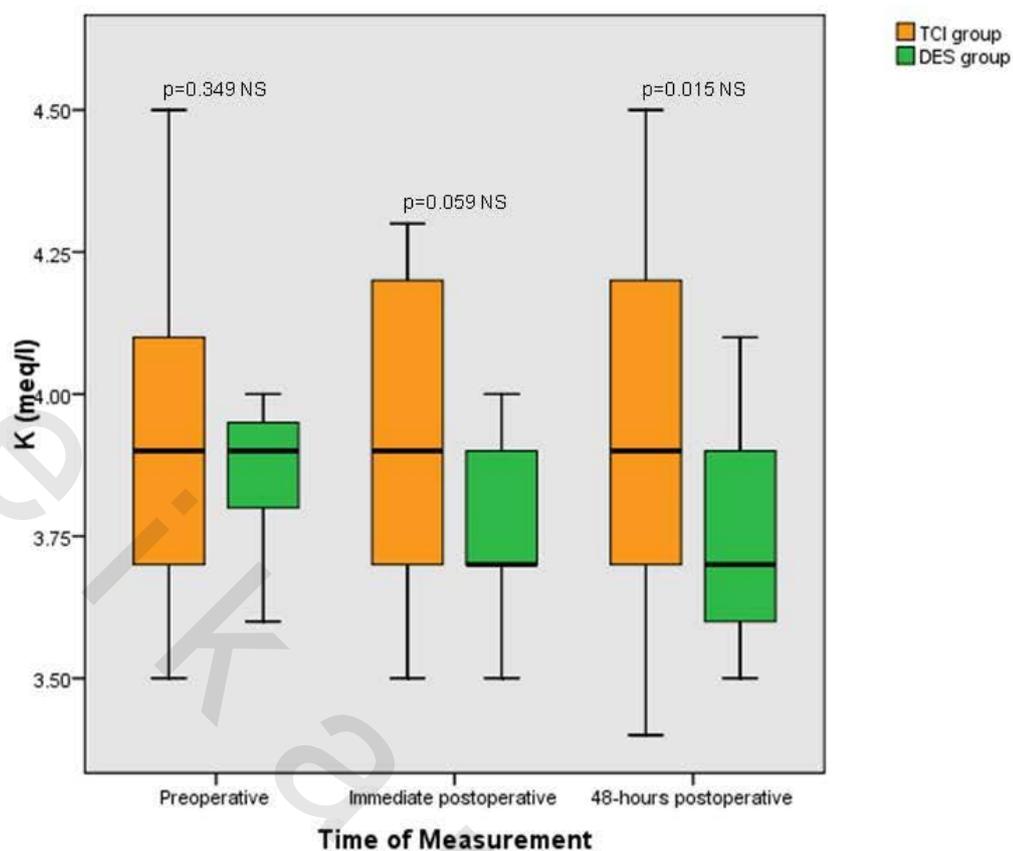
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 25-b:** Box and Whisker plot of Na (meq/l) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

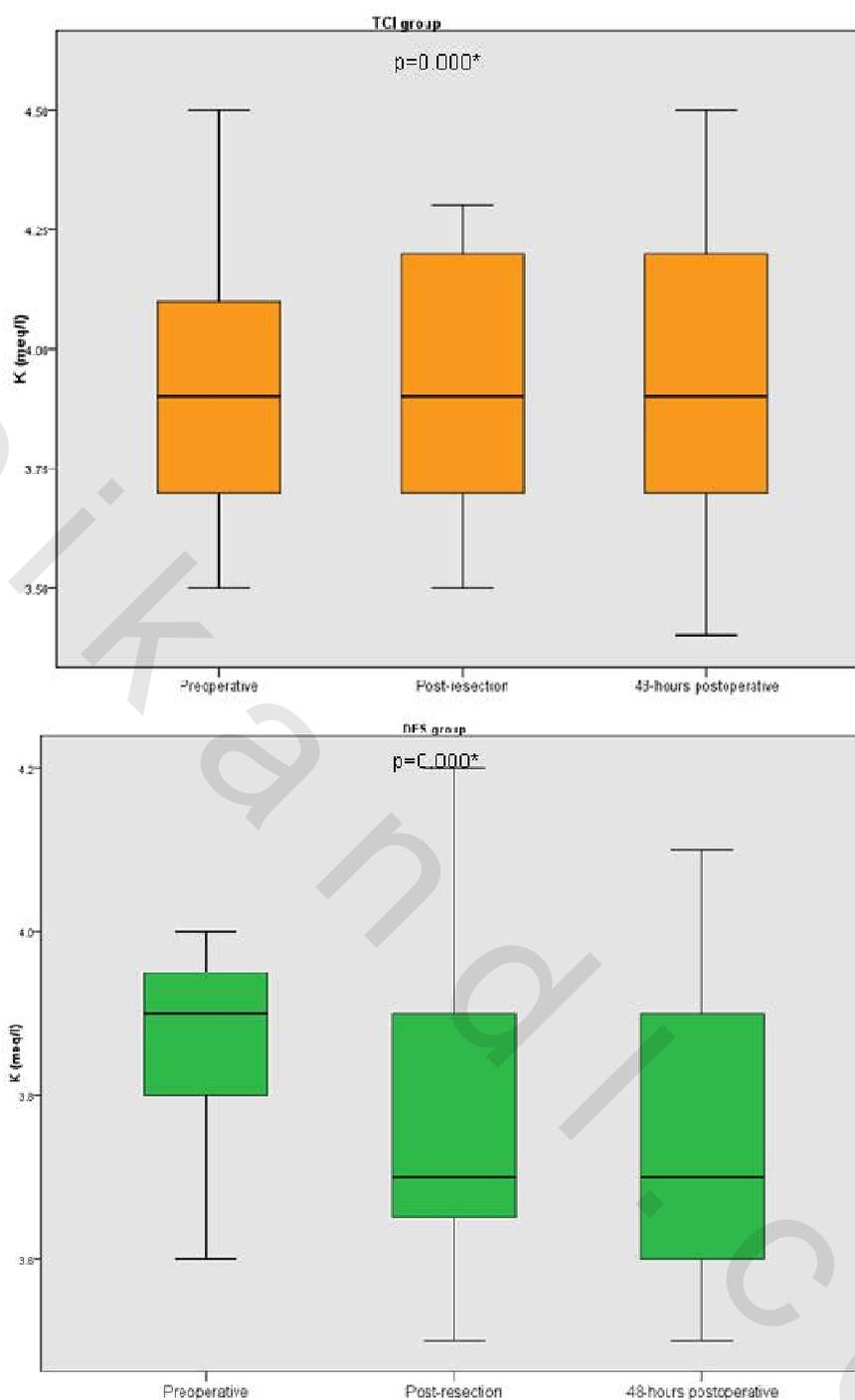
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 26-a:** Box and Whisker plot of K (meq/l) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 26-b:** Box and Whisker plot of K (meq/l) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

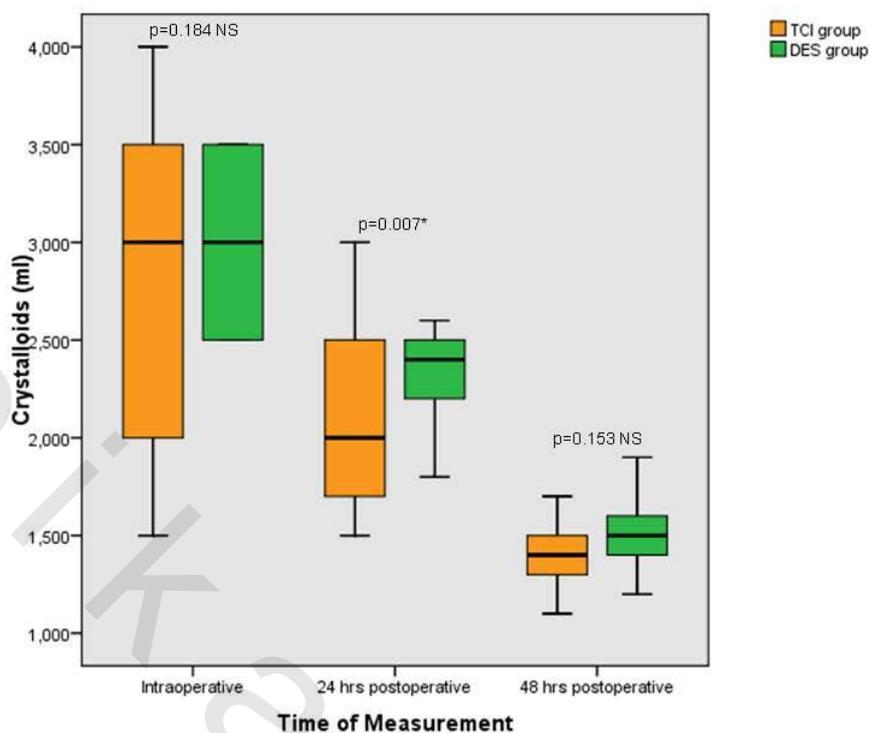
Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 16: Differences between groups regarding fluids intake and urine output, TCI, Target control Prpopofol/Fentanyl Infusion; DES, Desflurane.**

Studied variables	Groups	Mean $\pm$ SD	t- test	p- value
<b>Intraoperative crystalloids</b>	<b>TCI</b>	2772.00 $\pm$ 703.870	1.353	0.184 NS
	<b>DES</b>	2990.00 $\pm$ 391.843		
<b>Intraoperative urine output</b>	<b>TCI</b>	121.92 $\pm$ 11.604	0.843	0.403 NS
	<b>DES</b>	124.72 $\pm$ 11.869		
<b>24hrs postoperative crystalloids</b>	<b>TCI</b>	2028.00 $\pm$ 404.680	2.850	0.007*
	<b>DES</b>	2292.00 $\pm$ 225.341		
<b>24hrs postoperative urine output</b>	<b>TCI</b>	95.80 $\pm$ 8.093	1.201	0.237 NS
	<b>DES</b>	99.64 $\pm$ 13.789		
<b>48hrs postoperative crystalloids</b>	<b>TCI</b>	1412.00 $\pm$ 194.336	1.451	0.153 NS
	<b>DES</b>	1492.00 $\pm$ 195.618		
<b>48hrs postoperative urine output</b>	<b>TCI</b>	73.64 $\pm$ 7.233	1.456	0.152 NS
	<b>DES</b>	71.08 $\pm$ 4.999		

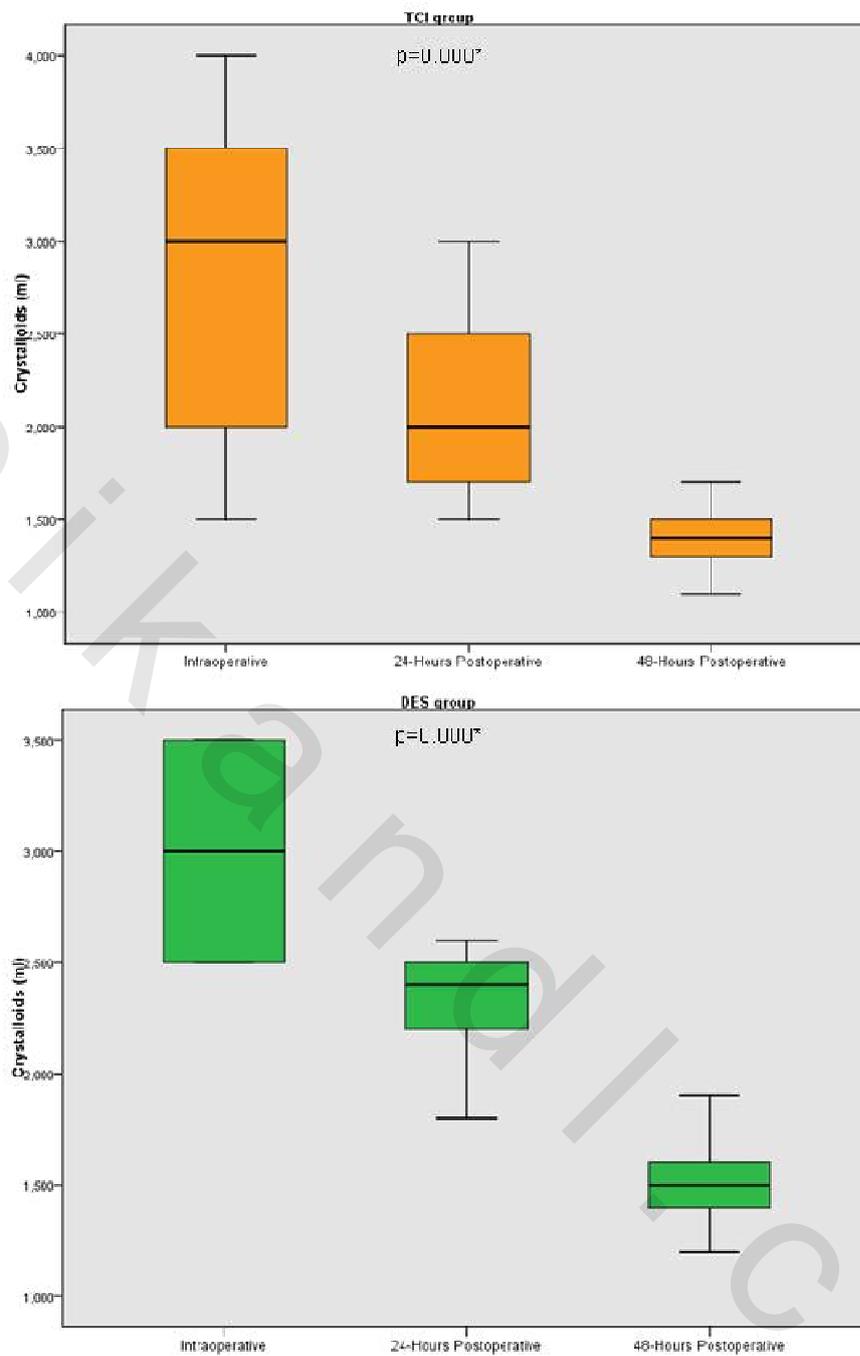
NS: Non-significant

\* Significant at  $p < 0.01$



**Figure 27-a:** Box and Whisker plot of Crystalloids (ml) in TCI group and Des group in patients undergoing hepatic resection.

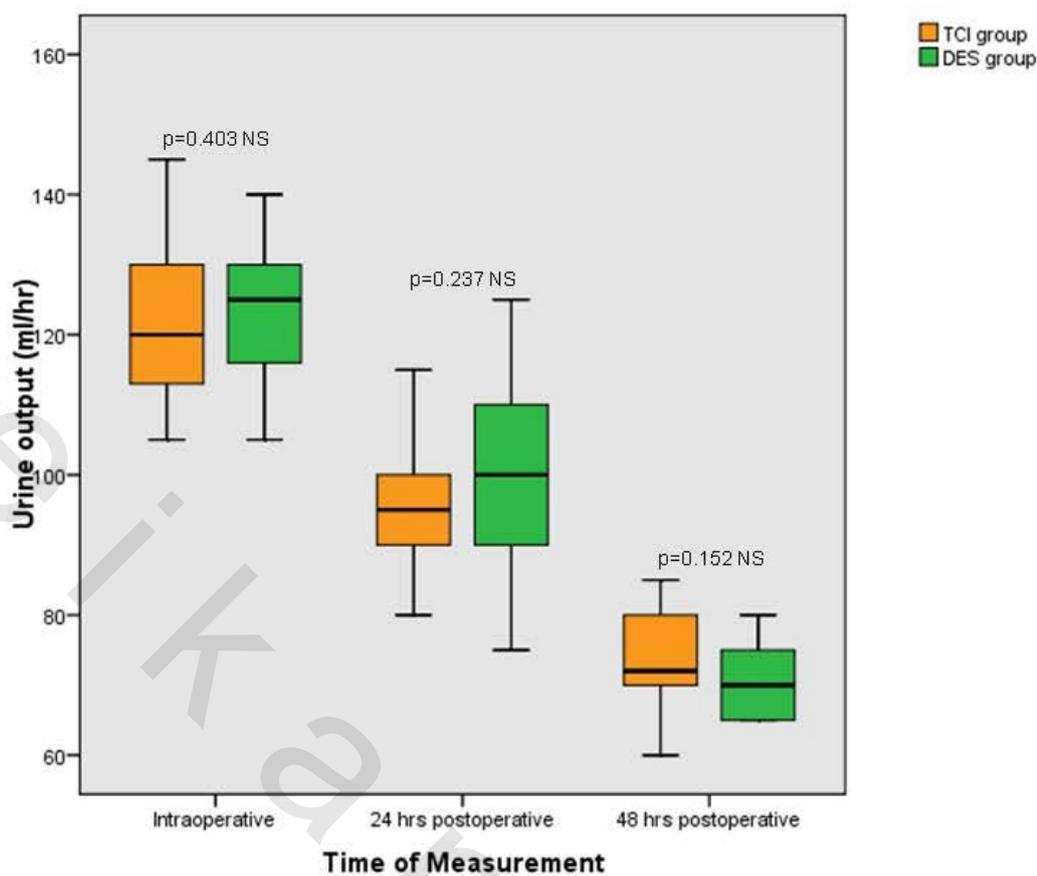
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 27-b:** Box and Whisker plot of Crystalloids (ml) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

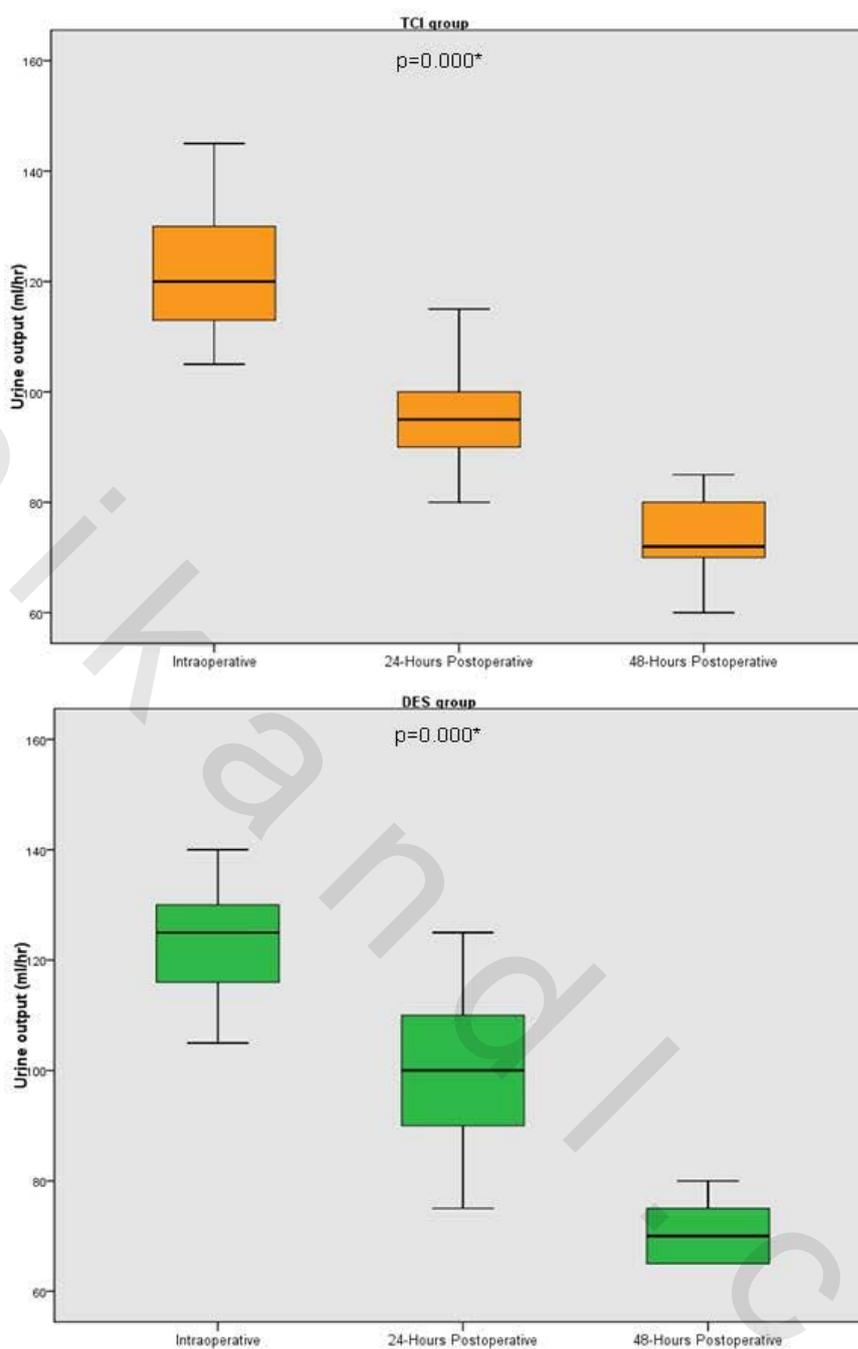
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

Repeated measure ANOVA is significant  $p < 0.01$ .



**Figure 28-a:** Box and Whisker plot of Urine output (ml/hr) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 28-b:** Box and Whisker plot of Urine output (ml/hr) in TCI group (top) and Des group (bottom) in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.

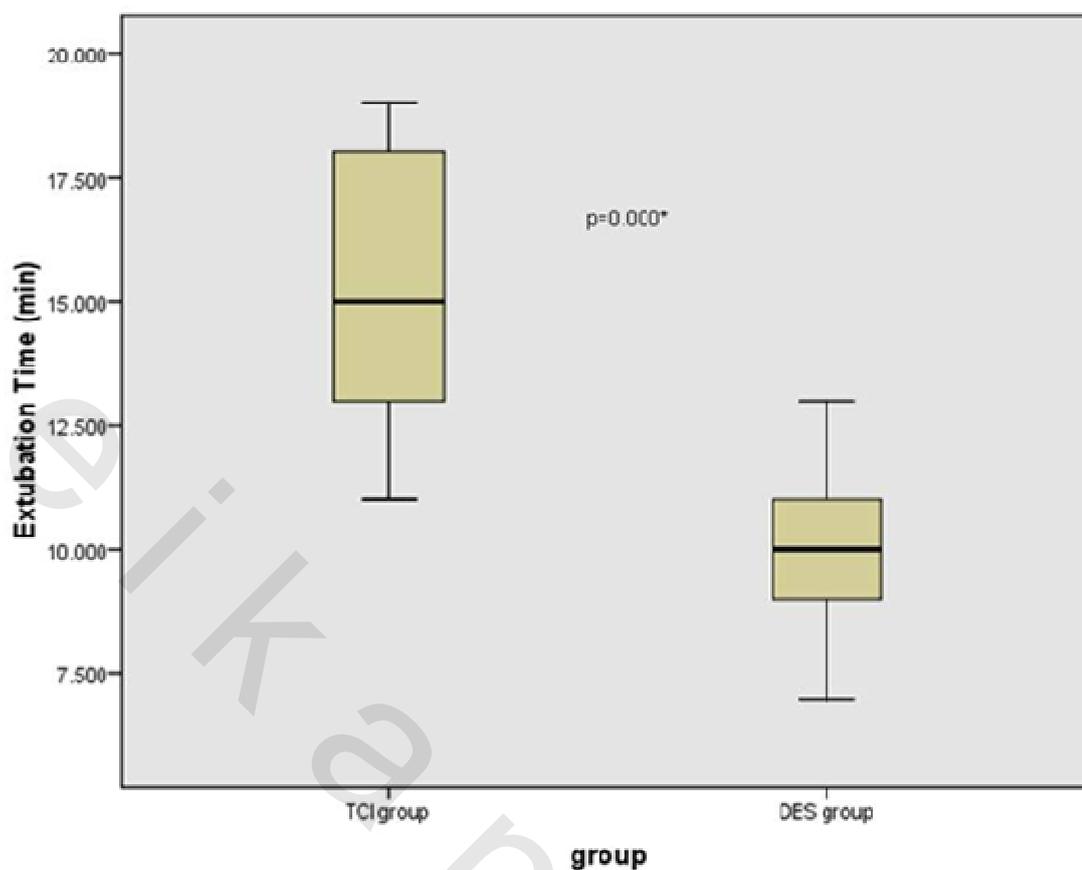
Repeated measure ANOVA is significant  $p < 0.01$ .

**Table 17: Differences between groups regarding extubation time, ICU & hospital stay, TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane.**

Studied variables	Groups	Mean $\pm$ SD	t- test	p-- value
<b>Extubation time</b>	<b>TCI</b>	15.20 $\pm$ 2.629	8.972	0.000*
	<b>DES</b>	9.76 $\pm$ 1.507		
<b>ICU stay</b>	<b>TCI</b>	1.60 $\pm$ 0.500	1.124	0.267 NS
	<b>DES</b>	1.44 $\pm$ 0.506		
<b>Hospital stay</b>	<b>TCI</b>	6.12 $\pm$ 1.129	0.128	0.899 NS
	<b>DES</b>	6.08 $\pm$ 1.077		

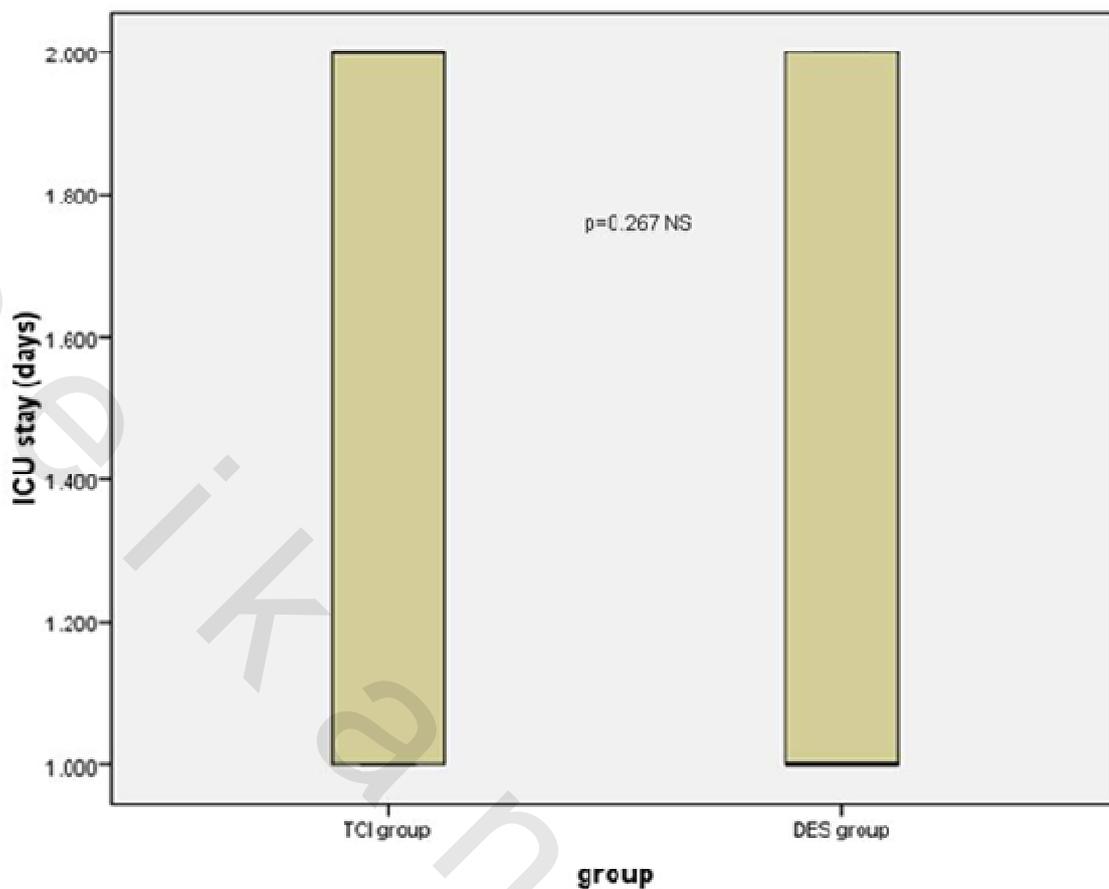
NS: Non-significant

\* Significant at  $p < 0.01$



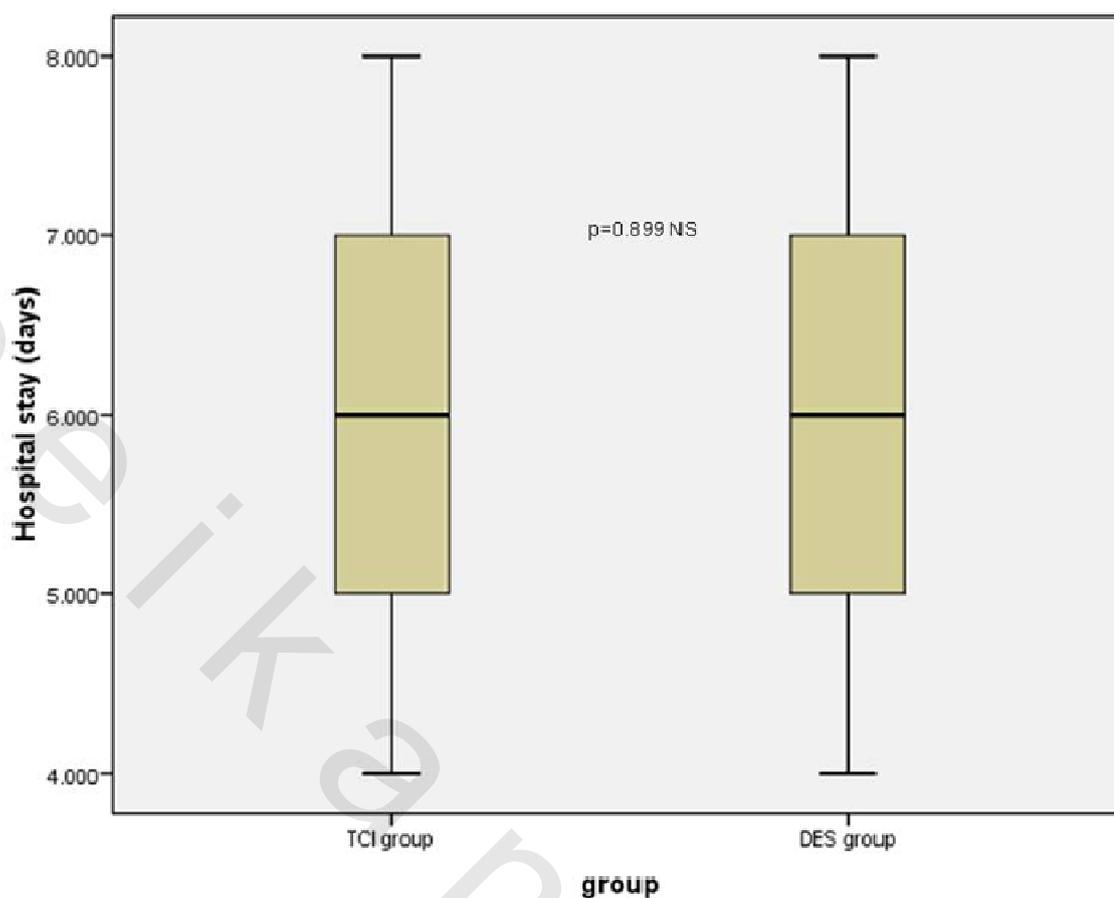
**Figure 29:** Box and Whisker plot of Extubation time (min) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 30:** Box and Whisker plot of ICU stay (days) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (in TCI group is equal to the 75<sup>th</sup> percentile and in DES group is equal to the 25<sup>th</sup> percentile) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 31:** Box and Whisker plot of Hospital stay (days) in TCI group and Des group in patients undergoing hepatic resection.

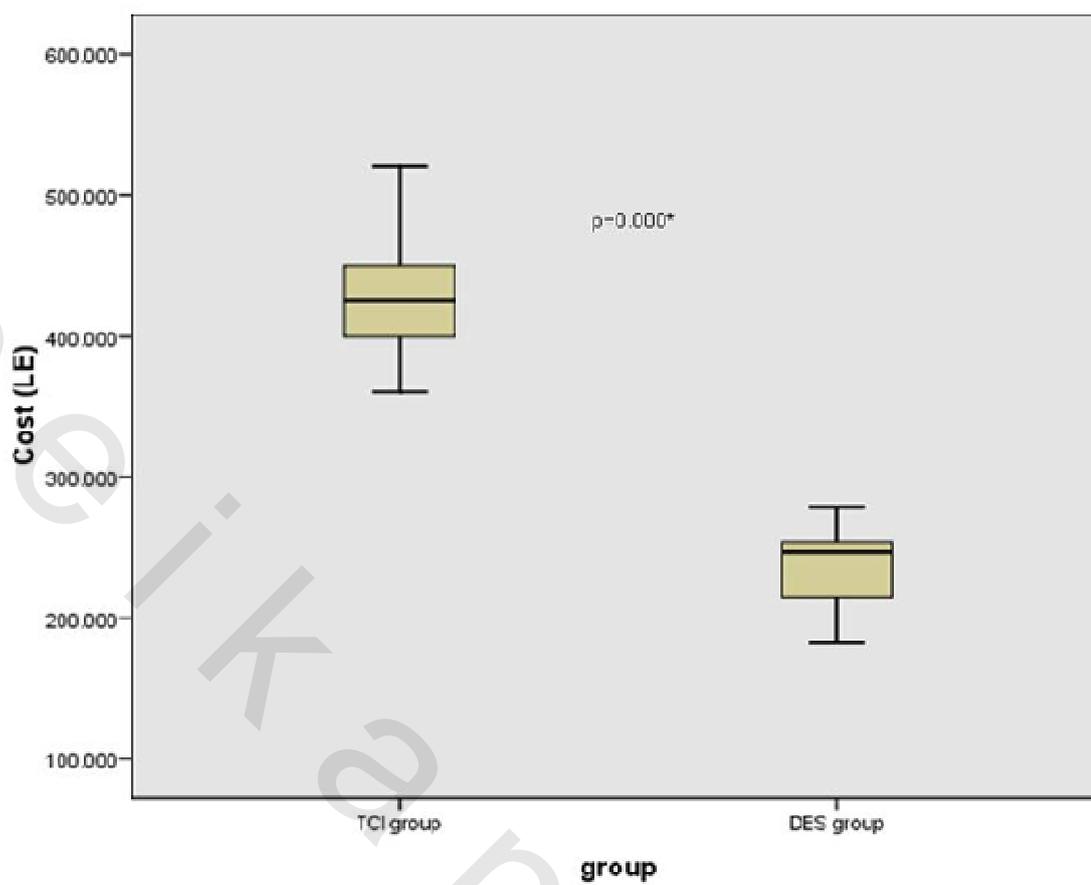
Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.

**Table 18: Differences between groups regarding anaesthesia time & cost. , TCI, Target control Prpopofol/Fentanyl Infusion; DES, Desflurane.**

Studied variables	Groups	mean±SD	t-test	p- value
<b>Anaesthesia time (min)</b>	<b>TCI</b>	222.60±10.420	0.457	0.651
	<b>DES</b>	220.00±26.496		NS
<b>Anaesthesia cost (US Dollars)</b>	<b>TCI</b>	62.65±8.233	2.27	0.000*
	<b>DES</b>	33.70±3.836		
<b>Anaesthesia cost (LE)</b>	<b>TCI</b>	438.60±57.563	15.954	0.000*
	<b>DES</b>	235.92±26.496		

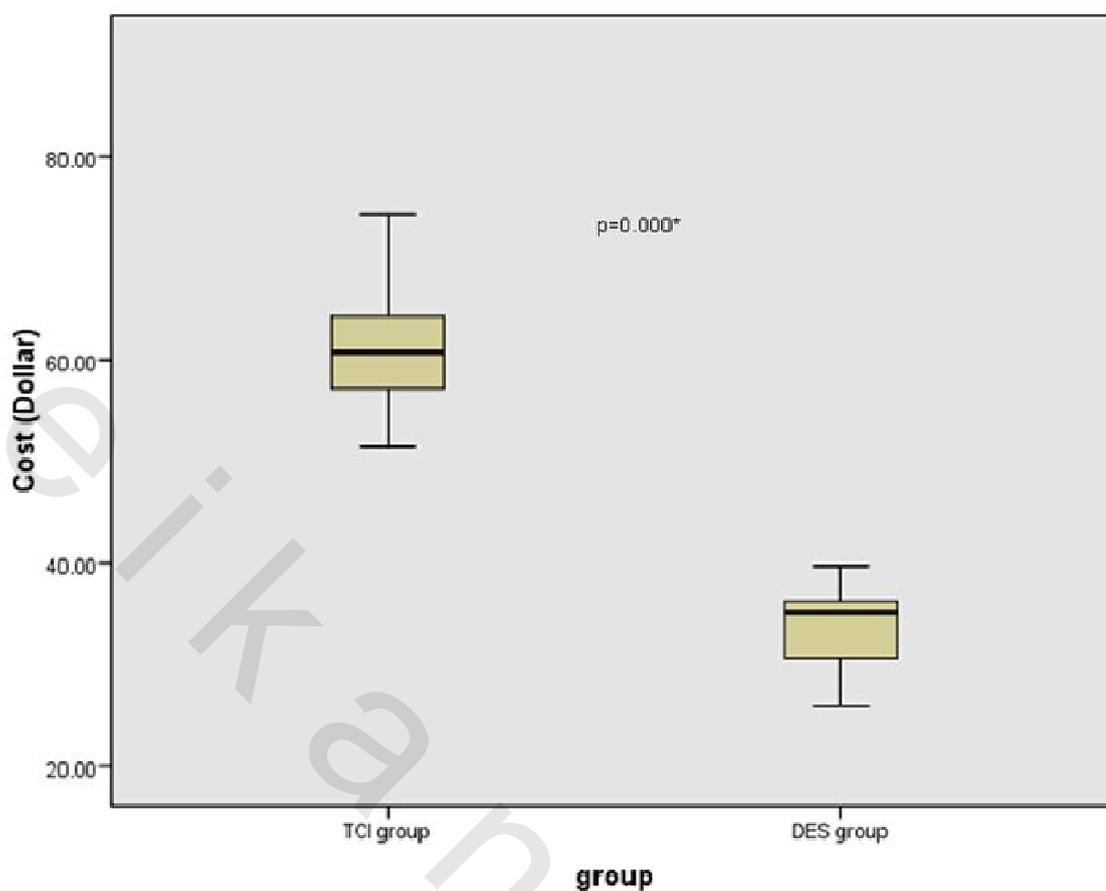
NS: Non-significant

\* Significant at  $p < 0.01$



**Figure 32:** Box and Whisker plot of Cost (LE) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



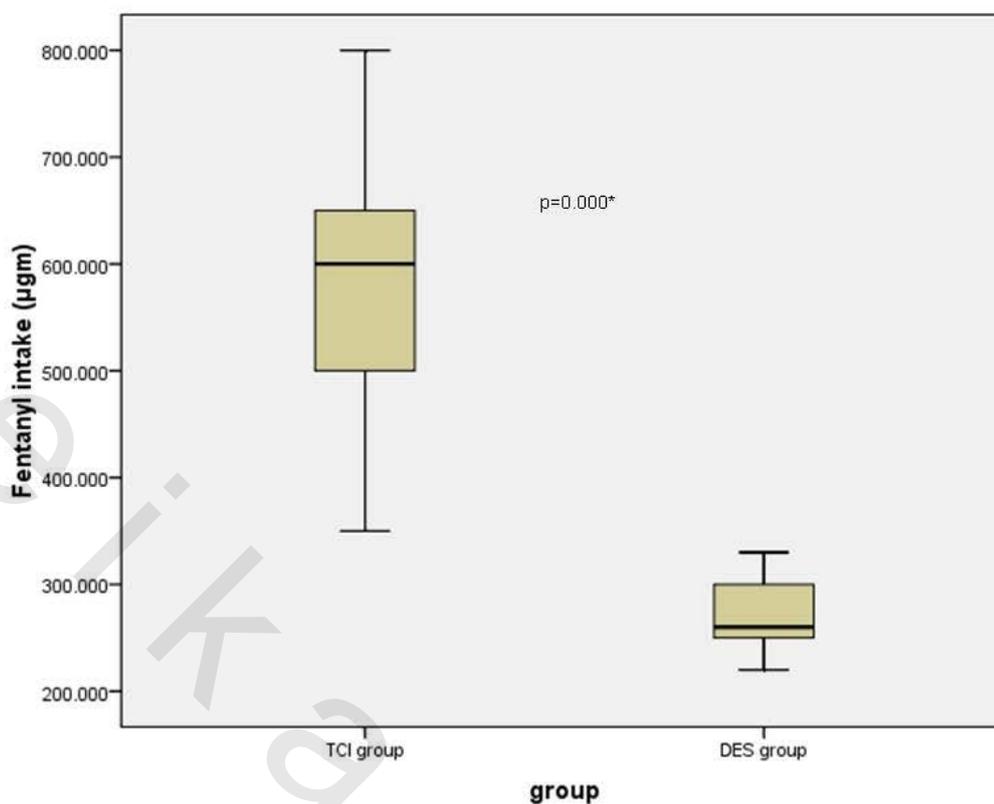
**Figure 33:** Box and Whisker plot of Cost (Dollar) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.

**Table 19: Differences between groups regarding Fentanyl intake, , TCI, Target control Propofol/Fentanyl Infusion; DES, Desflurane**

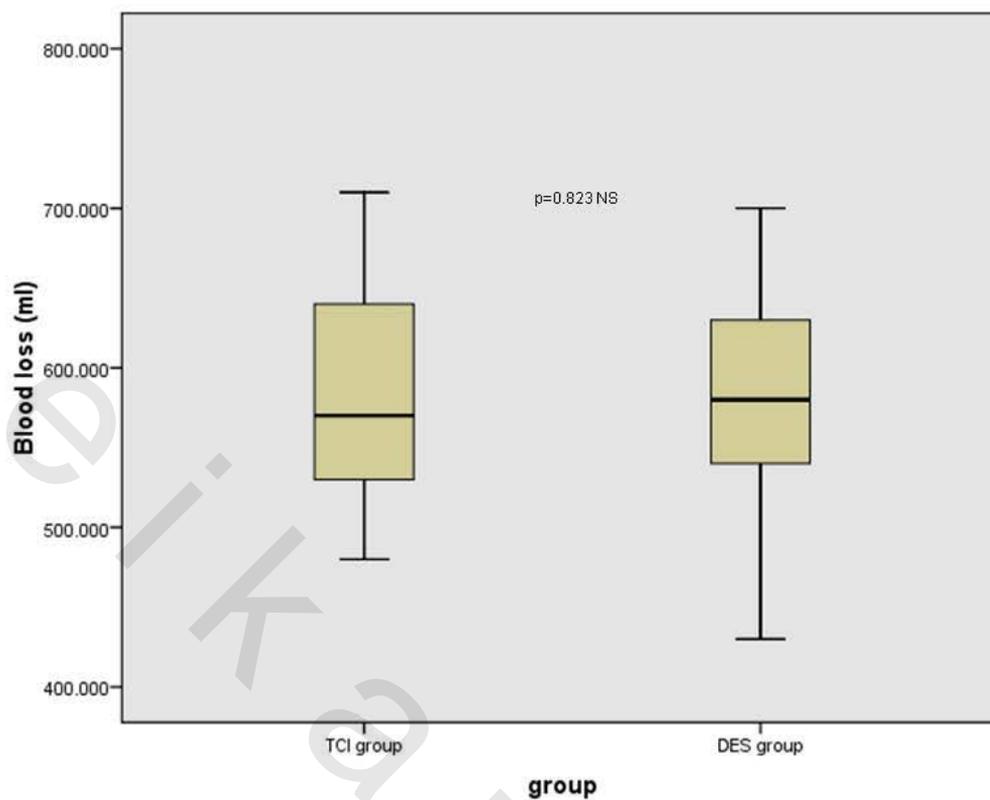
Variable	Group	Mean $\pm$ SD	T test	<i>p</i> - value
Fentanyl intake	TCI	584.82 $\pm$ 126.322	12.126	0.000*
	DES	270.00 $\pm$ 29.860		

\* Significant at  $p < 0.01$



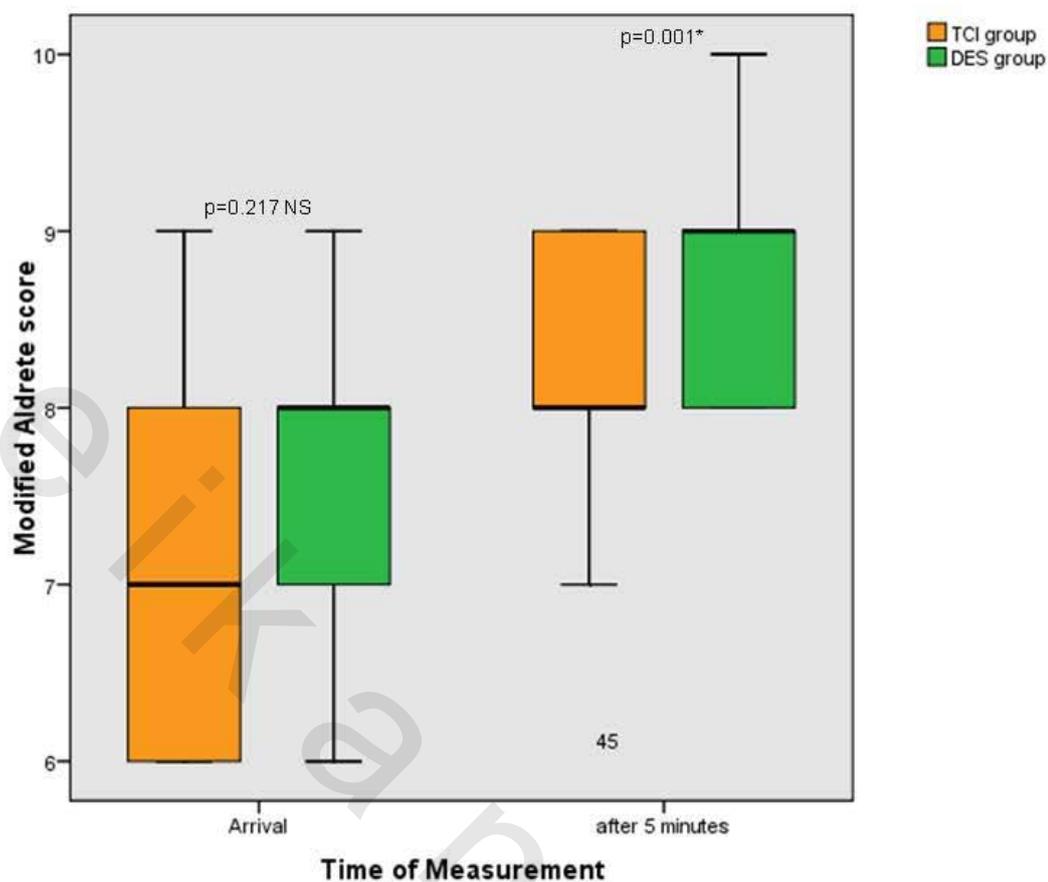
**Figure 34:** Box and Whisker plot of Fentanyl intake ( $\mu\text{gm}$ ) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 35:** Box and Whisker plot of Blood loss (ml) in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.



**Figure 36:** Box and Whisker plot of Modified Aldrete score in TCI group and Des group in patients undergoing hepatic resection.

Minimum to maximum (error bar), median (thick line in the middle of the box) and 25<sup>th</sup> and 75<sup>th</sup> percentiles (the box) are shown at selected time points.  $p < 0.01$  is significant.