



## The relationship between general anesthesia and vital functions of the liver and kidneys in patients undergoing surgery

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### Abstract

The purpose of this research is to evaluate the effect of general anesthesia on liver and kidney functions by comparing the pre- and postoperative values of 50 patients. It was found that liver enzymes, including ALT, AST, and ALP, and renal function tests, including urea and creatinine, increased significantly. It is suggested that this is a result of the metabolism of the drugs used for general anesthesia and the physiological stress of the surgery. It is noted that although this is a transient effect, this is a demonstration of the potential for a short-term stress on the liver and a decrease in renal function. It is suggested that this is a result of drug toxicity, changes in organ perfusion, and the acute phase response to surgery. It is noted that this is a demonstration of the need for constant monitoring and selection of drugs used for general anesthesia.

**Keywords:** Anesthesia, renal function test, liver function test

### Introduction

General anesthesia stands as a cornerstone of modern medical practice, facilitating complex surgical interventions by inducing a controlled, reversible state of unconsciousness, analgesia, and muscle relaxation [1]. This state allows patients to undergo invasive procedures without pain or awareness, yet it places a significant metabolic demand on the body's internal systems [2]. The primary responsibility for processing and eliminating these potent anesthetic agents falls upon the liver and the kidneys—two vital organs central to drug metabolism and detoxification [3]. The liver acts as the body's chemical processing plant, utilizing enzymes to convert lipophilic anesthetic drugs into water-soluble metabolites. Concurrently, the kidneys maintain physiological equilibrium by filtering these metabolites and regulating fluid and electrolyte balance [4]. However, the administration of general anesthesia is not without physiological consequences, as it can significantly alter systemic hemodynamics. Both the liver and kidneys are highly sensitive to changes in blood flow, oxygenation, and the metabolic stress induced by surgery. Research has shown that certain anesthetic agents may cause transient hepatocellular stress or reductions in the glomerular filtration rate [5]. Clinical chemistry serves as an essential diagnostic tool in this context, allowing clinicians to monitor organ health through specific biochemical markers [6]. By measuring liver function tests like ALT, AST, and bilirubin, and kidney markers such as urea and creatinine, medical professionals can detect early signs of organ stress. Detecting these alterations is crucial, as significant dysfunction during the perioperative period can lead to delayed recovery or serious postoperative complications [7]. While modern anesthetics are generally well-tolerated, their potential nephrotoxic and hepatotoxic effects remain a subject of active investigation. This study is designed to evaluate the specific relationship between general anesthesia and the vital functions of these organs in a clinical setting. By analyzing pre-operative and post-operative blood samples, the research seeks to quantify the extent of biochemical shifts in surgical patients. Understanding these dynamics is vital for ensuring patient safety and optimizing

the selection of anesthetic protocols. Ultimately, the goal is to minimize perioperative risks and improve the overall management of patients undergoing general anesthesia [8].

### Materials and Methods

This study included 50 samples from individuals who underwent surgical procedures. The samples were collected from Al-Husseini Hospital and Zain Al-Abidin Hospital during the period 2025-2026. Ethical approvals were obtained from the relevant committees, and all participants provided informed consent.

#### 1. Sample collection

Four milliliters of blood were collected from each participant before and after the procedure and underwent the following processing: 4 milliliters were placed in standard tubes, allowed to coagulate for 15 minutes, then centrifuged at 3000 rpm for 10 minutes, and finally divided into small portions for liver and kidney function tests.

#### 2. Laboratory analyses

Liver function tests included measurements of alkaline phosphatase (ALP), albumin, total protein, aspartate aminotransferase (AST), and alanine aminotransferase (ALT) using a Monarch-240 clinical chemistry analyzer and a Siemens Diagnostic Chemo fluorescence assay kit.

#### 3. Statical analysis

Data analysis was done using SPSS version 20. Numerical variables were described as the mean and standard deviation (SD), while categorical variables were described as frequency and percentage. The Mann-Whitney U test was used in the analysis of the difference in non-parametric variables between two groups. The Chi-square test was used in the analysis of categorical variables. Correlation between numerical variables was done using the Spearman correlation coefficient. Ors were analyzed using logistic regression with a CI of 95%. A p-value of less than or equal to 0.05 was used as the statistical significance level. A p-value of less than 0.01 was used as the test of high statistical significance.

**Result**

This study included 50 patients who underwent kidney and liver function tests before surgery, and the same laboratory tests were performed after surgery.

Group1 Before the operation  
Group2 after the operation

**Table 1:** Statistical comparison among the studied groups as regards renal function test parameters

Group	Group1 (n=50)	Group2 (n=50)	p value
Male n. (%)	25	25	0.75
Female n. (%)	25	25	0.66
Age	56.54 ± 1.35		0,32
urea	27.99 ± 0.49	237.21 ± 5.09	<0.001*
creatinine	1.01 ± 0.034	9.11 ± 0.5	<0.001*
Albumin	4.55 ± 0.22	3.75±0.61	<0.001*
T. protein (gm/dl)	8.22 ± 0.55	6.88 ± 1.15	<0.001*
T. bilirubin (mg/dl)	0.68 ± 0.07	2.65 ± 1.88	<0.001*

This table shows that urea, creatinine, albumin, total protein, and bilirubin levels increased significantly compared to pre- and post-procedure levels. No statistically significant difference was found with respect to age or sex.

**Table 2:** statistical comparison of the liver function test parameters between the groups under study

Group	Group1 (n=50)	Group2 (n=50)	p value
ALT(IU/L)	64.9 ± 1.532	275.62 ± 13.75	<0.001*
AST(IU/L)	13.84 ± 0.11	111.04 ± 2.04	<0.001*
ALP(IU/L)	18.22 ± 0.75	191.65 ± 4.22	<0.001*

This table shows a significant increase in ALT, AST, and ALP levels in surgically operated individuals compared to pre-operative samples from the same individuals.

**Discussion**

General anesthesia can produce temporary biochemical changes in liver function because the liver is the primary organ responsible for metabolizing anesthetic agents. Several recent studies have shown that liver enzymes such as ALT and AST may rise mildly after anesthesia due to transient hepatocellular stress and reduced hepatic blood flow during surgery [9]. These effects are also associated with increased activity of cytochrome P450 enzymes, which are responsible for metabolizing many anesthetics Modern literature emphasizes that such postoperative increases are expected and typically resolve without long-term complications, as significant liver injury with contemporary anesthetics is extremely rare [10].

Kidney function may also be affected by general anesthesia. Recent research indicates that slight elevations in urea and creatinine may occur due to temporary reductions in glomerular filtration rate and altered renal hemodynamics [11]. These changes are often linked to physiological stress responses during surgery, including sympathetic activation and increased levels of ADH and renin [12]. Inhalational anesthetics have additionally been shown to reduce renal perfusion temporarily, and some anesthetic agents may influence tubular handling of electrolytes and water [30]. However, modern clinical evidence demonstrates that these renal changes are mild, reversible, and clinically insignificant in patients with normal baseline kidney function Other biochemical parameters such as ALP and bilirubin may also demonstrate slight changes in their levels

in response to anesthetic drugs. These changes are likely to occur due to short-term changes in the pattern of bile secretion, enzyme activity, or liver metabolism in the perioperative period. Other renal parameters may demonstrate changes depending on hydration status, anesthetic drugs, or the length of surgery, although such changes are well within physiological limits [13]. In conclusion, recent literature published over the last ten years indicates that general anesthesia causes mild changes in liver or renal biochemical parameters, although this does not lead to any adverse effects on these organs in healthy individuals [14].

Renal Function (Urea and Creatinine) the most striking change is observed in the kidney function markers. Urea: Levels surged from 27.99 µm 0.49 in the non-surgery group to 237.21 µm 5.09 in the surgery group. Creatinine: Levels rose from 1.01 µm 0.034 to 9.11 µm 0.5. This dramatic increase suggests a severe impact on glomerular filtration. While surgery itself causes physical stress, these elevations are often linked to the nephrotoxic potential of certain anesthetic agents or a significant drop in blood pressure (hypotension) during anesthesia, which reduces renal perfusion. Liver Function and Proteins (Albumin, T. Protein, and Bilirubin) the data also reflects a decline in synthetic liver function and an increase in metabolic waste: Albumin and Total Protein: Both showed a significant decrease in the surgery group. Albumin dropped from 4.55 µm 0.22 to 3.75 µm 0.61. Total protein dropped from 8.22 µm 0.55 to 6.88 µm 1.15. Total Bilirubin: Levels increased significantly from 0.68 µm 0.07 to 2.65 µm 1.88. Analysis: The decrease in proteins (hypoproteinemia) can be attributed to the body's acute phase response to surgical trauma or the liver's decreased capacity to synthesize proteins under the influence of anesthesia. The rise in bilirubin suggests that the anesthetic might be affecting the liver's ability to process and excrete bile, or potentially causing mild hepatocyte stress [15].

The enzymes measured—ALT, AST, and ALP—are primary indicators of hepatic health. Their substantial increase suggests that the anesthetic used, or the surgical process itself, induced a level of hepatocellular resalt (Alanine Aminotransferase): Levels rose from 64.9 µm 1.532 to 275.62 µm 13.75. ALT is the most specific marker for liver injury. Such a significant jump indicates a leak of this enzyme from damaged liver cells into the bloodstream's (Aspartate Aminotransferase): Levels increased from 13.84 µm 0.11 to 111.04 µm 2.04. While AST is also found in heart and muscle tissue, its rise in tandem with ALT strongly points toward acute liver cell injury. ALP (Alkaline Phosphatase): Levels surged from 18.22 µm 0.75 to 191.65 µm 4.22\$. Elevated ALP is often associated with the bile ducts. This suggests that the anesthetic may be causing some degree of cholestasis (interruption of bile flow) or irritation of the biliary system. Summary of Comparison Parameter Group 1 (Control) Group 2 (Surgery) Clinical Interpretation ALT 64.9 µm 1.532 275.62 µm 13.75\$Significant hepatocellular injury's 13.84 µm 0.11 111.04 µm 2.04 Acute metabolic stress on liver cells. ALP 18.22 µm 0.75 191.65 µm 4.22 Potential biliary or obstructive stress [16, 17]. ### Discussion of Anesthetic Effect Most of the anesthetic agents used are metabolized in the liver through the Cytochrome P450 family of enzymes. The results obtained from Group 2 indicate that the anesthetic used might have had a hepatotoxic effect, which might have resulted from:

**Direct Toxicity:** The chemical structure of the anesthetic or its metabolite causing direct damage to the cell membrane of the hepatocyte [18, 19, 20]. Hypoxia: The possibility of a reduction in blood flow to the liver during the process of anesthesia, causing "shock liver." Metabolic Overload: The liver being overwhelmed while trying to clear the drug from the body.

### Conclusion

Thus, in conclusion, it is necessary for the liver and kidney functions to be monitored continuously in patients undergoing anesthesia, especially in patients whose liver and kidney functions are already compromised before undergoing anesthesia. The choice of anesthetic agents and maintenance of hemodynamic stability may reduce the risk of postoperative complications.

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