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تحت شعار: التطورات التكنولوجية والاتجاهات الحديثة في التعليم

Original article

Immediate Effects of Anesthesia Agents on Liver Function

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ABSTRACT

Anesthetic agents and types may deteriorate liver function; therefore, choosing anesthetics with less hepatotoxicity is important. The elevations of serum aminotransferase (AST), alanine transaminase (ALT), and alkaline phosphatase (ALP) levels are frequently observed after surgical procedures, whether performed under general or spinal (regional) anesthesia. Therefore, the study aimed to investigate and compare the changes in liver enzymes following general anesthesia and regional anesthesia. An observational sheet was used to obtain data from patients and then statistically analyzed using the IMB Statistical Package for Social Sciences (SPSS) Statistic software version (23). A significant difference in the liver enzymes levels change was determined with a p-value of < 0.05. it was observed that in both groups of general and regional anesthesia, the level of AST, ALT, and ALP enzymes was significantly elevated post-operative compared to pre-operative with (P=0.000), especially in the level of ALT enzyme. The current study indicated that both general and regional anesthesia caused increased liver enzymes.

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INTRODUCTION

The liver is an essential organ in the human body responsible for a wide range of functions that help support metabolism, immunity, digestion, detoxification, and vitamin storage, among others [1]. The liver is the major site of exogenous medication metabolism. The primary result of medication metabolism is the production of more water-soluble and therefore more easily excreted medication metabolites. Medication is sometimes bio-transformed into more reactive metabolites, which may lead to toxicity [2]. Anaesthetic agents, like most medications, undergo metabolism in the liver and are sometimes associated with toxic reactions [3].

Surgery and anaesthesia are stressful situations and lead to increased liver enzymes postoperative. The elevations of serum aminotransferase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), or bilirubin levels are frequent after surgical procedures, whether performed under general or spinal anaesthesia [4]. Although the liver contributes significantly to homeostasis and gets 25% of cardiac output, systemic hypotension and declines in cardiac output are the sole factors that alter portal vein flow [5]. Hepatic function is impacted by anaesthesia, surgery, and anaesthesia itself; conversely, liver disease can impact surgery and anaesthesia [6].

Surgery and anaesthesia are stressful situations and lead to increased liver enzymes postoperative. The elevations of serum aminotransferase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), or bilirubin levels are frequent after surgical procedures, whether performed under general or spinal anaesthesia [4]. The impact of inhalation

anaesthetics on hepatic blood flow and function is related to both the degree of liver dysfunction and the type of abdominal surgery. Other factors that affect hepatic blood flow include age, volume, intraoperative posture, surgical technique, blood pressure, local anaesthetics, hemoglobin level, oxygen level, and volatile anaesthetics [7]. Anaesthesia may enhance hepatic arterial blood flow while decreasing cardiac output and portal blood flow. Inhalation anaesthetics alter portal venous and hepatic artery vascular resistance, allowing for the restoration of total hepatic flow. Using isoflurane and Sevoflurane anaesthesia at low and high flow has not been linked to clinical hepatotoxicity [8]. Thiopental, Etomidate, and Propofol improve portal and hepatic arterial blood flow, although intravenous anaesthesia can impair liver function. However, there is minimal evidence that intravenous anaesthetics have any effect on postoperative liver function. It is unclear how central neuroaxonal obstructions influence liver function [6].
Most surgical procedures, whether carried out under spinal, epidural, or general anaesthesia, only cause slight changes in the serum liver biochemical assays. An increase in postoperative blood aminotransferase, alkaline phosphatase, or bilirubin levels in people without underlying cirrhosis is not noted. Anesthesia-related drugs may reduce hepatic blood flow by 30% to 50% after induction [9]. The current study was focused on investigating and comparing the immediate changes in the liver enzymes during anaesthesia using a different type of anaesthesia agents.

METHODS

A cross-sectional study was conducted by collecting samples from surgical patients of various ages and genders who underwent general and spinal anaesthesia procedures in the operating rooms of general surgery departments at Zawia Medical Centre (ZMC), Foreign Center (LFC), and Medical Experience Center (MEL). Thirty blood samples were tested for serum levels of aspartate aminotransferase (AST), Alanine Aminotransferase (ALT), and Alkaline phosphatase (ALP) before and after anaesthesia was administered.
Our data were statistically analyzed with SPPS software. The frequency, percentages, standard deviations, and mean values were determined. The Wilcoxon test was used to evaluate levels of liver enzymes before and after anaesthesia.

RESULTS

The total blood samples collected in this study were 43, divided into two groups. Group one under general anesthesia, represented 17 blood samples from both genders (15(80%) male and 2(11.8%) females). Group two were regional anesthesia, with 26 blood samples, equally distrusted between both genders, as shown in Table 1.

Table 1. Participants in the study's demographics criteria

Types of anesthesia	*Total Number of blood samples (n= 43)*
General anaesthesia	***17***
Regional anaesthesia	***26***

Table 2 displays the overall gender frequency among our analysis's general anaesthesia patients: there are 15 male patients (88.2%) and 2 female patients (11.8%). Additionally, our results indicate the state of health of the patients under general anaesthesia; of these, 12 (or roughly 70.6%) were classified as ASA I level. and (3) those with an ASA II level, or roughly 17.6% of the total. Eleven per cent of patients were categorized as ASAS III. Table 2 illustrates that among the various types of surgeries performed under general anaesthesia, 7 appendectomies accounted for 41.2% of the total, while 4 cholecystectomy procedures constituted 23.5%. Additionally, it reveals that 2 surgeries were performed between 2 and 4 hours, accounting for 11.8%, while 8 procedures were completed between 1 and 2 hours, accounting for 47.1%. Figure 1 displays the effect of general anaesthesia on the level of the AST, ALT, and ALP before and after the anaesthesia. All the enzymes increased after the anesthesia especially the ALT level from 22.69 to 35.57**.** The Wilcoxon test showed that there was a statistically significant difference between post and pre-form AST (P=0.001) and for ALT (P=0.001), However, the p-value was (0.011) for post and pre-ALP of these 26 patients, 13 (50%) Female and 13 (50%) Male to the frequency of the gender in regional anaesthesia patients. Demographic data, including age, type, time and health status of the patients who undergone regional anaesthesia.

Table 2. ASA health status of the patients, Types and times of operation under general anaesthesia

Type of Anesthesia	Gender		Types of operation	Time of operation	Health Status of the Patients
General Anesthesia	Female 2(11.8%)	Male 15(88.2%)	Appendectomy 7 (41.2 %)	Less than 1 Hour 6 (35.3 %)	ASA I 12 (70.6 %)
			Orthoplisurgry 2 (11.8%)	1 to 2 Hours 8 (47.1 %)	ASA II 3 (17.6%)
			Cholecystectomy 4 (23.5%)	2 to 4 Hours 2 (11.8%)	ASA III 2 (11.8%)
	Total= 17		Urology surgery 2 (11.8%)	-	Total 17 (100 %)

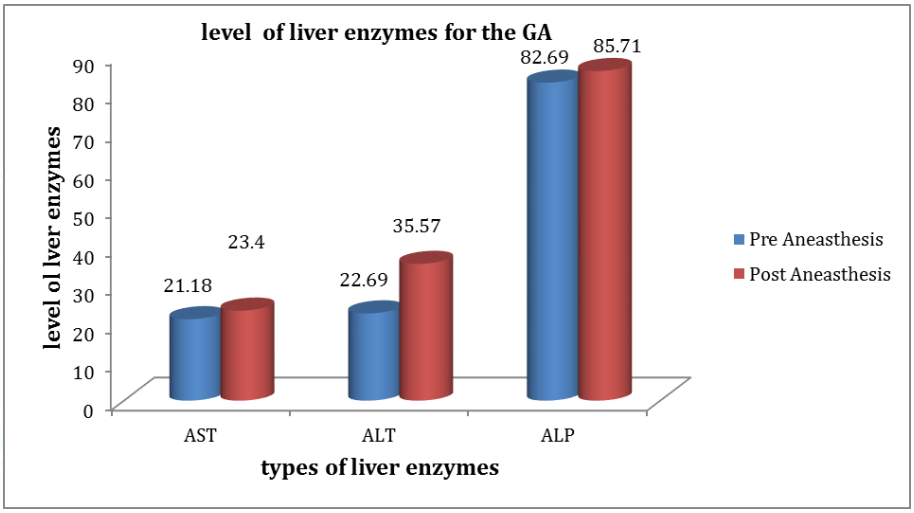

Figure 1. Mean and standard deviation for the level of (AST, ALT & ALP) for the general anaesthesia group.

Our result showed the frequency of the gender in regional anaesthesia patients was male and female equal in number which represents 50%. The health status of the patients who underwent regional anaesthesia was 19 patients considered as ASAI level which represented around 73.1% of the cases. Only (3) patients were considered as ASAIV level by 11.5% of the cases. The different types of operation are done under regional anaesthesia. The orthopaedic surgery (16) represented 61.5% of the cases. The gyno-surgery (9) represented 34.6% of the cases. Bone process one case represented 3.8% shows the time of operation. The operations done in fewer than one hour were 12 representing 46.2%. Of the operations done from 1 to 2 hours 13 operations represent 46.2% and for the operation done between 2 to 4 hours 1 represents 3.8%. All demographic features are present, as shown in Table 3.

Table 3. ASA health status of the patients, Types and times of operation under regional anesthesia

Type of Anesthesia	Gender		Types of operation	Time of operation	Health Status of the Patients
Regional Anesthesia	Female 13(50.00%)	Male 13(50.00%)	Orthopaedic-surgery 16 (61.5%)	Less than 1 Hour 12 (46.2 %)	ASAI 19 (73.1 %)
			Gaynor-Surgery 9 (34.6%)	1 to 2 Hours 13 (50.00%)	ASAIV 3 (11.5%)
			Bone process 1 (3.8%)	2 to 4 Hours 1 (3.8%)	-

The results after the operation and the effect of regional anaesthesia on the level of the AST, ALT, and ALP before and after the anaesthesia are shown in Figure 2. All the enzymes increased after the anesthesia especially the ALP level from 71.26 to 78.05**.** The Wilcoxon test showed that there was a statistically significant difference between post and pre-form AST (P=0.000) and for ALT (P=0.000), and ALP (P=0.000**)**.

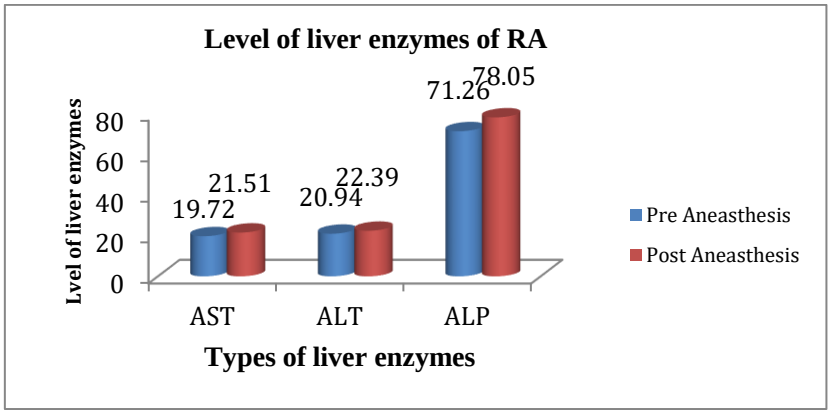

Figure 2. Mean and standard deviation for the level of (AST, ALT, ALP) for the regional anaesthesia group

DISCUSSION

In the present study, the level of aspartate transaminase (AST) alanine transaminase (ALT) and alkaline phosphatase (ALP) enzymes in the isoflurane and Marcaine groups immediately after the operation increased compared to the pre-surgery stage, and this increase was significantly higher in the isoflurane group, especially in the level of ALT enzyme. These changes in the level of liver enzymes may be due to the longer the anaesthesia time, especially in general anaesthesia. A previous study indicated that a variety of perioperative factors such as prolonged anesthesia time may be involved in injury to the liver after surgery [17]. However, our study had shown that the level of ALT significantly increased after general anaesthesia using isoflurane, and this increase may be due to direct liver injury. Liver injury, whether acute or chronic, eventually causes an increase in serum transaminase levels. Both AST and ALT are highly concentrated in the liver. AST is also diffusely present in the heart, skeletal muscles, kidneys, brain, and red blood cells, but ALT has low concentrations in the skeletal muscles and kidneys. Therefore, an increase in ALT levels is more specific to liver injury [10].

In general, mild transient elevations of serum liver enzymes (less than two times normal values), particularly aminotransferase and alkaline phosphatase, are common after surgical procedures, regardless of the type of anaesthesia or surgery [11]. On the other hand, procedures involving a significant quantity of blood loss and intra-abdominal surgeries linked to impaired hepatic blood flow significantly raise the risk of postoperative liver damage [12]. Injury to the liver during surgery may be caused by several perioperative variables in addition to surgical trauma, including hypotension, hypovolemia, extended anaesthesia, ventilation mode, operating posture, infection, or perioperative drugs [11]. Anaesthetics and their metabolites may impact on the liver's function after surgery. By immune- or non-immune-mediated processes, volatile anaesthetic metabolites can cause varying degrees of liver damage [13].

Our findings indicate that upon recovery, there was an elevation in the level of liver enzymes, particularly ALT, in the group that was given isoflurane for general anaesthesia. In previous study, anaesthesia using isoflurane caused rising in the level of liver enzymes such as AST and ALT until 14 days after anaesthesia [14]. According to our findings, the reduced incidence of liver injury following isoflurane may be explained by the drug's lower metabolism and superior preservation of hepatic blood flow [11]. Most surgical procedures are monitored with small changes in liver function tests, regardless of whether they are conducted under regional (epidural or spinal) or general anaesthesia [15]. During all surgical operations, anaesthesia lowers blood flow to the liver. Anaesthesia reduces cardiac output, which reduces portal blood flow, and also alters portal venous and hepatic artery vascular resistance. The decrease in blood flow may result in a symptomatic increase in the outcomes of liver functions in healthy individuals. Biological testing Following surgery after induction, anaesthetic medications may reduce hepatic blood flow by 30% to 50% [16].

Our study has shown that regional anaesthesia using Marcaine affects the liver enzyme, where thesis enzymes are increased after surgery as compared to the pre-surgery. However, a few studies have been done to investigate the effects of regional anaesthesia on liver enzymes.

CONCLUSION

The current study aimed to determine the immediate effect of both general and regional anaesthesia on liver enzymes. The level of was investigated before and after the anaesthesia to observe the changes . The results of the study showed that the level of aspartate transaminase (AST) alanine transaminase (ALT) and alkaline phosphatase (ALP) enzymes in

the general and regional anesthesia immediately after the operation increased compared to the pre-surgery stage, and this increase was significantly higher in general anesthesia especially in the level of ALT enzyme. Many aspects of the current study remain unclear and require more investigation. All prior investigations found that anaesthesia has an effect on the levels of liver enzymes, but they did not explain why. There have only been a few investigations on the influence of regional anaesthesia on lever enzymes, thus more research is needed. There have only been a few investigations on the influence of regional anaesthesia on lever enzymes, thus more research is needed.

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Conflicts of Interest
The authors declare no conflicts of interest.

REFERENCES

1. Kalra A, Yetiskul E, Wehrle CJ, Tuma F. Physiology, liver. 21 Dec; 2018.
2. Rahimzadeh P, Safari S, Faiz SH, Alavian SM. Anesthesia for patients with liver disease. Hepatitis Monthly. 2014 Jul;14(7).
3. Vidaurre J, Gedela S, Yarosz S. Antiepileptic drugs and liver disease. Pediatric Neurology. 2017 Dec 1;77:23-36.
4. Hoetzel A, Ryan H, Schmidt R. Anesthetic considerations for the patient with liver disease. Current Opinion in Anesthesiology. 2012 Jun 1;25(3):340-7.
5. Xanthopoulos A, Starling RC, Kitai T, Triposkiadis F. Heart failure and liver disease: cardiohepatic interactions. JACC: Heart Failure. 2019 Feb;7(2):87-97.
6. Oh SK, Lim BG, Kim YS, Kim SS. Comparison of the postoperative liver function between total intravenous anesthesia and inhalation anesthesia in patients with preoperatively elevated liver transaminase levels: a retrospective cohort study. Therapeutics and clinical risk management. 2020 Apr 5:223-32.
7. Mohseni M, Safari S, Alavian SM. Volatile anesthetics in ischemic liver injury: enemy or friend?. Hepatitis monthly. 2014 Jun;14(6).
8. Safari S, Motavaf M, Siamdoust SA, Alavian SM. Hepatotoxicity of halogenated inhalational anesthetics. Iranian red crescent medical journal. 2014 Sep;16(9).
9. Simegn AE, Melesse DY, Bizuneh YB, Alemu WM. Perioperative management of patients with liver disease for non-hepatic surgery: A systematic review. Annals of medicine and surgery. 2022 Mar 1;75:103397.
10. Song JE, Kang MK, Lee YR, Lee CH, Park JG, Kweon YO, Tak WY, Park SY, Jang SY, Hwang JS, Jang BK. Multicenter analysis of clinical features and prognosis of COVID-19 patients with hepatic impairment. Gut and Liver. 2021 Jul 7;15(4):606.
11. Dabir S, Mohammad-Taheri Z, Parsa T, Abbasi-Nazari M, Radpay B, Radmand G. Effects of propofol versus isoflurane on liver function after open thoracotomy. Asian Cardiovascular and Thoracic Annals. 2015 Mar;23(3):292-8.
12. Snowden C, Prentis J. Anesthesia for hepatobiliary surgery. Anesthesiology Clinics. 2015 Mar 1;33(1):125-41.
13. Reichle FM, Conzen PF. Halogenated inhalational anaesthetics. Best practice & research Clinical anaesthesiology. 2003 Mar 1;17(1):29-46.
14. Kashifard M, Alijanpour E, Hoseinian M, Tayebi P. A comparison between the effect of halothane and propofol on liver enzymes after general anesthesia.2010. 89-93
15. Mohammed OK, Alabbassi MG, Aldujaili AA, Shakoor DA, Almoossawi MM. Effect of General and Spinal Anesthesia on Hepatic and Renal functions and Hemodynamic parameters of Iraqi Women Undergo Cesarean Section: Comparative Study. Al Mustansiriyah Journal of Pharmaceutical Sciences. 2018 Dec 1;18(2):78-90.
16. Mufeed MA, Rashid JE. Biochemical changes of liver enzymes; ALT, AST, ALP in patients after surgical operation under general anesthesia. Medical Journal of Babylon. 2015;12(4):1191-7.
17. Kim BD, Ver Halen JP, Grant DW, Kim JY. Anesthesia duration as an independent risk factor for postoperative complications in free flap surgery: a review of 1,305 surgical cases. Journal of reconstructive microsurgery. 2014 May;30(04):217-26.

التأثيرات الفورية لأدوية التخدير على وظائف الكبد

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المستخلص

عوامل وأنواع التخدير قد تؤدي إلى تدهور وظائف الكبد. لذلك، من المهم اختيار أدوية التخدير ذات السمية الكبدية الأقل. يتم ملاحظة ارتفاع مستويات ناقلة الأمين في الدم(AST) ، وناقلة أمين الألانين(ALT) ، والفوسفاتيز القلوي (ALP) بشكل متكرر بعد العمليات الجراحية، سواء تم إجراؤها تحت التخدير العام أو النخاعي (المنطقي). ولذلك هدفت الدراسة إلى دراسة ومقارنة التغيرات في إنزيمات الكبد بعد التخدير العام والتخدير النخاعي. تم استخدام ورقة المراقبة للحصول على بيانات من المرضى ثم تحليلها إحصائيًا باستخدام إصدار البرنامج الإحصائي (SPSS) (23) . تم تحديد اختلاف كبير في تغير مستويات إنزيمات الكبد بقيمة $p < 0.05$. وقد لوحظ أنه في كلا المجموعتين تحت التخدير العام والنخاعي، كان مستوى إنزيماتAST ، ALT، و ALPمرتفعاً بشكل ملحوظ بعد العملية مقارنة مع ما قبل العملية مع(P=0.000) ، وخاصة في مستوى إنزيم .ALT أشارت الدراسة الحالية إلى أن التخدير العام والإقليمي تسبب في زيادة إنزيمات الكبد.

الكلمات الدالة. ناقلة أمين الأسبارتات، ناقلة أمين الألانين، الفوسفاتيز القلوي، التخدير العام، التخدير النخاعي.