Original Research

ELEVATED SERUM TRANSAMINASE (SGOT/SGPT) AND SEPSIS IN BURN PATIENTS IN A TERTIARY HOSPITAL, SURABAYA, INDONESIA

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ABSTRACT

Burns trigger hypermetabolic stress reactions that cause inflammatory responses. When there is a sustained or increased hypermetabolic reaction, the inflammatory response can be life-threatening, such as sepsis, and significantly impact hepatic metabolic function. After burns, varying degrees of liver injury are usually associated with burn severity. This study determined the correlation between elevated serum transaminases (SGOT/ SGPT) and sepsis in burn patients at a tertiary hospital of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from January 1, 2018, to December 31, 2020. This was a descriptive-analytic study with a retrospective cohort design. The data in this study included the demography of burn patients, causes of burns, inhalation trauma, burn severity, increased serum transaminase (SGOT/SGPT), mortality, and sepsis. This study found that the correlation between elevated serum transaminases (SGOT/SGPT) and sepsis was determined using the Spearman-Rho Rank statistical test. Burn patients with sepsis in the hospital were dominated by males (65.2%) and mostly aged 26-55 years (69.6%). The flame was found to be the highest cause of burns (80.4%), burn area above 20% (91.3%), the highest level of severity was major burn (91.3%), and no inhalation trauma (54.3%). In this study, there was an increase in SGOT of 69.6% and SGPT of 78.3%, with a mortality rate of 39.1%, with average inpatient days of 24 days. The correlation test between elevated serum transaminase (SGOT) and sepsis showed an insignificant relationship ($p = 0.065$, $p > 0.05$) with a correlation coefficient of 0.200. In contrast, the correlation between elevated serum transaminase (SGPT) and sepsis was significant ($p=0.006$, $p<0.05$) with a correlation coefficient of 0.296.

Keywords: *Burns; elevated of SGOT/ SGPT; sepsis; medicine*

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Highlights:

1. There is no correlation between the increase of SGOT and sepsis.
2. Correlation between the increase of SGPT and sepsis was significant founded.

INTRODUCTION

Burns are body skin damage caused by heat or cold trauma (*frostbite*). The causes are fire, hot water, electricity, chemicals, radiation, and cold trauma (*frostbite*). This damage may include subcutaneous tissue (Ministry of Health 2019).

The leading cause of death in burn patients is multiple organ dysfunction syndromes (MODS) (Li et al. 2021). It is also a direct response to sepsis. It is also found in all patients admitted to the intensive care unit, where there has been a slight improvement in the survival of patients with sepsis over the last few decades, so various efforts have been made to increase the speed of diagnosis and shorten the treatment period for sepsis (Greenhalgh 2017).

Previous studies had shown that burns produced a hypermetabolic stress reaction that caused an inflammatory response. When there was a sustained or increased hypermetabolic reaction, the inflammatory response could be life-threatening, and this had a significant impact on the metabolic function of the liver. After burns, the degree of liver injury varies with the severity of the burn. A study by Borah et al. (2017) found a strong positive correlation between liver enzymes and the degree of burn injury. The immediate increase in liver enzymes after burns may be due to the formation of hepatic edema, which leads to cell damage and the release of liver enzymes.

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Aminotransferases or transaminases are a group of enzymes that catalyze amino acids and oxoacids by transferring amino groups (Esani 2014). Aspartate aminotransferase (AST), formerly called glutamate oxaloacetate transaminase (GOT), and alanine aminotransferase (ALT), formerly called glutamate pyruvate transaminase (GPT), are the most clinically significant aminotransferases. The main clinical application of measurement of serum AST and ALT is the detection and diagnosis of the differential etiology of liver disease. Liver cell injury manifests by increased serum transaminase activity before clinical signs and symptoms (i.e., jaundice) appear. Relative elevations of AST and ALT are hallmarks of viral, toxic, or non-ethanol-induced acute hepatitis. Similar serum transaminase levels under these conditions are thought to be caused by the cellular release of only cytoplasmic enzymes associated with reversible liver cell damage (Walker et al. 1990).

Aspartate transaminase or aspartate aminotransferase (AST) catalyzes the reversible transfers of amino groups between aspartate and glutamate (Jansen et al. 2020, Sookoian & Pirola 2012). It is also an essential enzyme in amino acid metabolism. AST is found in the liver, heart, skeletal muscle, kidneys, brain, and red blood cells. Serum AST levels, serum ALT (alanine transaminase) levels, and their ratio (AST/ALT ratio) are commonly measured clinically as biomarkers for liver health (Giannini et al. 2005).

This study determined the correlation between elevated serum transaminase (SGOT/SGPT) and sepsis in burn patients.

MATERIALS AND METHODS

This study was an observational analytic study with a retrospective cohort design. The data were obtained from patients' medical records in a tertiary hospital of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, for the period January 1, 2018, to December 31, 2020, which met the inclusion criteria of all burn patients who were treated with sepsis and had complete medical records with exclusion criteria of patients with electrical burns, history of comorbidities in the liver and patients who did not have a complete medical record. The sampling used in this study was the total sampling method. Data collection from the patients' medical records had been approved by the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, No. 0536/LOE/301.4.2/VIII/2021.

The data included patients' characteristics (gender and age), degree of burn severity, burn area, causes of burns, inhalation trauma, increase in serum transaminase (SGOT/SGPT), an average of inpatient days, and mortality in injured burn patients. Data on the increase in serum transaminase SGOT and SGPT were tested for correlation with sepsis using the above variables. The correlation with sepsis was determined using the Rank Spearman-Rho statistical test. All data obtained were presented in tabular form.

RESULTS

As many as 276 patients and 86 (31.2%) patients met the inclusion criteria; 46 patients were found with sepsis (American Burn Association Sepsis Criteria), while 40 patients did not have sepsis. Data were processed statistically with SPSS 25 version and displayed in tabular form.

Table 1. The sex distribution of burn patients with infection

Sex	n=46	Percentage (%)
Male	30	65.2
Female	16	34.8

It was found that the number of male burn patients who experienced sepsis was 30 patients (65.2%), while female patients were only 16 (34.8%).

Table 2. Age distribution of burn patients with infection

Age (year)	n=46	Percentage (%)
0-5	1	2.2
6-11	2	4.3
12-16	3	6.5
17-25	9	19.5
26-35	11	23.9
36-45	12	26.1
46-55	4	8.7
56-65	1	2.2
>65	1	2.2

The data in Table 2 indicate that the most of the burn patients were in early adulthood, ranging from 36-45 years, as many as 12 patients (26.1%), while the most minor group with one patient each (2.2%) is the group of 0-5 years old, 55-65 years old, and >65 years old.

Table 3. Distribution of etiology/causes of burns in patients

Etiology	n=46	Percentage (%)
Scald	8	17.4
Fire	37	80.4
Thermal contact	1	2.2

The causes of burns in burn patients with sepsis were a fire in 37 patients (80.4%), scald in 8 patients (17.4%), and thermal contact in 1 patient (2.2%).

Table 4. Classification of the severity of burns in the patients

Burn area	n=46	Percentage (%)
< 20%	4	8.7
> 20%	42	91.3

In this study, there were 4 patients (8.7%) with burn area <20% and 42 patients (91.3%) with burns above 20%, as shown in Table 4. This classification is according to ANZBA 2016.

Table 5. Classification of burn area in patients

Severity of burn	n=42	Percentage (%)
Minor	0	0
Moderate	4	8.7
Major	42	91.3

The severity of burn patients, according to the American Burn Association in 2007, was divided into 3. In this study, we found four patients (8.7%) with moderate burns and 42 patients (91.3%) with significant burns (Table 5).

Table 6. Burn patients with inhalation trauma

Inhalation trauma	n=46	Persentase (%)
Yes	21	45.7
No	25	54.3

In this study, 21 patients (45.7%) had inhalation trauma, and 25 (54.3%) did not experience inhalation trauma.

Table 7. Burn patients with increased SGOT

Increase SGOT	n=46	Percentage (%)
Yes	32	69.6
No	14	30.4

In this study, there were 32 patients (69.6%) with elevated SGOT and 14 patients (30.4%) without non-increased SGOT (Table 7).

Table 8. Burn patients with increased SGPT

Increased SGPT	n=46	Percentage (%)
Yes	36	78.3
No	10	21.7

It was found that 36 patients (78.3%) had increased SGPT and ten patients (21.7%) did not have increased SGPT (Table 8).

Table 9. The mortality rate in burn patients with sepsis

Mortality	n=46	Percentage (%)
Yes	18	39.1
No	14	60.9

The mortality rate of patients with sepsis showed that 18 patients (39.1%) died, and 28 patients (60.9%) survived (Table 9).

Relationship between increased serum transaminase (SGOT and SGPT) and the incidence of sepsis

The analysis was carried out using the Spearman-Rho Rank test. The test was stated to have a significant relationship if the p-value <0.05 (Table 10). Statistical tests of the relationship between increased serum transaminase (SGOT) and sepsis using Rank Spearman-Rho obtained a sig/p-value of 0.065, and the relationship between increased serum transaminase (SGPT) and sepsis using Rank Spearman-Rho obtained a sig/p-value of 0.006.

Table 10. Spearman-Rho SGOT rank correlation test results

Correlations				
			Sepsis	SGOT
Spearman's Rho	Sepsis	Correlation Coefficient	1.000	.200
		Sig. (2-tailed)	.	.065
		n	86	86
	SGOT	Correlation Coefficient	.200	1.000
		Sig. (2-tailed)	.065	.
		n	86	86

DISCUSSION

There were 276 patients, with 86 patients (31.2%) included in the inclusion criteria and 190 patients (68.8%) in the exclusion criteria (electrical injury, patients with liver disorders/diseases, incomplete data), where 46 patients (53.4%) were septic, and 40 patients (46.6%) were not. Gomez et al. (2009) conducted an autopsy study on the causes of the death in burn patients in 2009 and found that 60% of deaths were caused by infectious complications and MODS.

Table 11. Spearman-Rho SGPT rank correlation test results

Correlations				
			Sepsis	SGOT
Spearman's rho	Sepsis	Correlation Coefficient	1.000	.296
		Sig. (2-tailed)	.	.006
		n	86	86
	SGOT	Correlation Coefficient	.296	1.000
		Sig. (2-tailed)	.006	.
		n	86	86

The percentage of burn patients who experienced sepsis was dominated by male patients (65.2%). As some studies found that estrogen in women increased immune function (Angele et al. 2014, Taneja 2018), it was plausible that males dominated the infection in burn patients. In this study, the highest incidence was at the age of 26-55 years as many as 32 patients who were in early adulthood to late elderly (productive age).

The causes of burns in sepsis patients in most studies included a fire in as many as 37 patients (80.4%), eight patients with scald (17.4%), and one patient with thermal contact (2.2%). Data of the Ministry of Health, Indonesia, showed that burn cases treated at RSCM from 2012 to 2016 were mostly caused by fire as much as 53.1%, followed by water/scald (19.1%), electricity (14%), thermal contact (5%), and chemical contact (3%). The majority of the burn patients were males (62.8%), comprising 58 patients, while the female ones were 37.2% (32 patients). This was following data released by the American Burn Association in 2017, where 67% of burn patients were males and 33% females, while the highest incidence was at the age of 26-55 years, with as many as 32 patients.

The results of this study indicated that the highest percentage of the severity of burns accompanied by sepsis was in the degree of significant burn amounted to 41 patients (91.3%) with the highest burn area > 20%. The study by Dvorak et al. (2021) stated that patients with a burn area greater than 20% had an increased risk of sepsis and death since the extensive burns caused substantial damage to the skin and could inhibit the ability of the skin as a major barrier to infection.

In this study, from 23 patients with inhalation trauma, 21 patients (91.3%) had sepsis, with a mortality rate of 30.4% for patients with inhalation injury. Inhalation trauma increased 10% to 20% of morbidity and mortality in burn patients, and inhalation trauma has also been an independent predictor of mortality in burn patients. Inhalation trauma also causes increased bronchial blood flow delivering activated polymorphonuclear leukocytes and cytokines to the lungs, which potentiates the inflammatory response. The loss of bronchial epithelium and ROS (Reactive Oxygen Species) results in the loss of plasma proteins and fluids from the intravascular space into the alveoli and bronchioles. Transvascular protein shift causes exudate and blockage formation within the airways, leading to alveolar collapse or complete occlusion of the airways, increased blood flow to the injured lung segment, and decreased ventilation of the collapsed segment to ventilation-perfusion mismatch as the primary mechanism of hypoxemia after trauma. Inhalation. Atelectasis, immune system dysfunction, and mechanical ventilation predisposed to pneumonia, a common complication of inhalation injury (Walker et al. 2015).

The average lengths of stay of burn patients with sepsis who met the inclusion criteria in 2018, 2019, and 2020 were 25, 23, and 30 days, respectively, with the average length of stay for sepsis patients in 2020 was 21 days, hence the average length of stay of burn patients with sepsis at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, for period January 1 2018 to December 31, 2020 was 24 days.

Relationship between increased serum transaminase (SGOT and SGPT) and the incidence of sepsis

The increase in SGOT with sepsis did not have a significant relationship, where the p-value was 0.065 (p-value > 0.05). There was a significant relationship between the increase in SGPT with a p-value of 0.006 (p-value < 0.05) and a correlation coefficient of 0.296, which was positive for both aminotransferases in the liver. However, SGOT is also obtained differently in the heart, skeletal muscle, kidney, brain, and red blood cells, and SGPT has low concentrations in skeletal muscle and kidney, so elevated serum levels of SGPT are more specific for liver damage. In the liver, SGPT is only localized in the cell, whereas SGOT is found in the cytosol (20%) and mitochondria (80%). (Costa et al. 2021).

In this study, data on SGOT and SGPT were obtained in the second-week observation because serum SGOT, SGPT, and ALKP peaked during the first-week post-burn and approached the normal range of 3-5 weeks post-burn. If the damage persisted or sepsis occurred, the enzymes increased (Jeschke et al. 2007). This indicated continued damage, and most of the burn patients at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, were diagnosed with sepsis in the second week. The level of SGOT and SGPT increased slightly < 5 times the normal value, where an increase in SGOT in 46 septic patients was found to be a mild increase (<5 times the normal value) in 31 patients, and a mild increase in SGPT value (<5 times the normal value) in septic patients was found in 32 patients. To distinguish whether the increase in serum transaminases was caused by sepsis or other diseases, it was necessary to carry out various investigations. Costa et al. (2021) stated that a minimal or mild increase in serum aminotransferase was the most common biochemical change encountered in daily clinical practice, and additional investigations needed to be carried out to determine the cause of the increase in serum transaminase whether the cause was extrahepatic or intrahepatic.

Alcohol abuse and, to a lesser extent, drug-induced liver injury are frequently associated with mild aminotransferase abnormalities, and causality should be ruled out clinically. In the western world, chronic viral hepatitis, autoimmune hepatitis, and hereditary hemochromatosis are the most common causes of mild aminotransferase changes (Angganis et al. 2018). Investigations to rule out the above patient causes need to be performed (HBsAg, anti-HCV, ANA test), and if none of the above diseases is found, attention should be paid, to whether the patient suffers from Nonalcoholic Fatty Liver Disease (NAFLD) or steatohepatitis which is also frequently encountered in clinical practice.

In acute liver damage, the patient's pharmacological history is essential. All drugs that have been given are considered again, and the risks and benefits of administration are considered. Suspicion of NAFLD is raised in the presence of conditions associated with metabolic syndrome and insulin resistance (elevated body mass index, diabetes, hyperlipidemia, hypertension), although this disease can occur in patients without associated factors (Costa et al. 2021).

Strength and limitation

The study was conducted at a tertiary hospital, which is a specialized center for burn management, increasing the reliability of the data collected.It included a large sample size, increasing the statistical power of the results.

CONCLUSION

Even though this study used secondary data (medical records), which could have indirectly affected the results, we found that the increase in SGPT and sepsis had a significant correlation with a p-value of 0.006 (p-value <0.05) with a correlation coefficient of 0.296. At the same time, there was no correlation between the increase of SGOT and sepsis (p = 0.065, p> 0.05). Future studies should be conducted to involve different comorbidities, so the effects of the existing comorbidities can be minimized.

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Conflict of interest

None.

Funding disclosure

None.

Author contribution

FPSI, RA, IR and DR were conseptual idea and analysis data. RK write, revised and prepared the draft of the manuscript. A was manuscript arrangement to the final content.

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