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Original Article

Frequency of Liver Function Test Abnormalities and Related Factors in Burn Patients: A Cross-Sectional Study

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Abstract

Introduction: Liver dysfunction is a common complication in burn patients which is usually underrecognized and is suggested to serve as a prognostic marker. This study investigated the prevalence of abnormalities regarding liver function tests and their association with mortality in burn patients.

Methods: In this retrospective cross-sectional study, data from 174 burn patients admitted to Kowsar Hospital (Sanandaj, Iran) between 2021 and 2023 were collected and analyzed. Demographic data along with clinical and laboratory data at admission and follow-up were evaluated. Statistical analyses included chi-square tests, independent t-tests and logistic regression using SPSS while adhering to STROBE guidelines.

Results: The mean age was 35.8 years, with a mean burn extent of 32.6%. AST and ALT had elevated values in 69% and 66.7% of patients at admission. Total bilirubin, PT and APTT were abnormal in 27%, 54% and 9.2% of cases. Overall mortality was 20.1%. Mortality was significantly associated with higher burn percentage, third-degree burns, sepsis, ventilator use, and elevated APTT at discharge. On univariate screening ($P<0.20$), higher TBSA, sepsis, mechanical ventilation, prolonged APTT at follow-up, third-degree burn, AST abnormality at follow-up, plasma transfusion, and age≥60 qualified for modeling; in multivariable analysis, only TBSA, sepsis, mechanical ventilation, and prolonged APTT remained independently associated with in-hospital mortality.

Conclusion: Liver function test abnormalities are common among burn patients, and certain abnormalities, particularly elevated APTT, show significant correlation with in-hospital mortality. Therefore, dynamic liver function monitoring may help identify high-risk patients and guide critical care decisions. Moreover, prospective studies are demanded to confirm these findings and inform early interventions.

Keywords: Burn Injuries, Liver Function Tests, In-Hospital Mortality

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Introduction

Burn injuries are considered one of the most devastating forms of trauma, posing a significant public health burden worldwide.[1] Ranking as the fourth most common type of injury after motor vehicle accidents, falls, and interpersonal violence, burns affect millions of individuals each year which later leads to substantial physical, psychological, social and economic complications. [2] In Iran, approximately 150,000 people experience burn injuries each year; with an estimated 3,000 fatalities and numerous cases of long-term disability. [3] Therefore, epidemiological data place burn injuries among the top 20 causes of death and disability; with a particularly high burden observed in both men and women.[4] It is believed that severe burn injuries are associated with complex systemic responses which extend beyond localized tissue damage.[5] One of the earliest and most pronounced systemic consequences in this matter, is the hypermetabolic response; marked by elevated glucose production, protein catabolism and lipolysis. [6] This response is mediated by a cascade of inflammatory and stress-related mediators, including proinflammatory cytokines (e.g., IL-1, IL-6, TNF-α), catecholamines and corticosteroids. [6] When prolonged or uncontrolled, these alterations can precipitate multiorgan dysfunction, delayed healing, increased susceptibility to infections along with an elevated mortality risk. [6] One of the organs most profoundly affected by severe burns is the liver, owing it to the central role in metabolism, immune modulation and the acute

phase response. [7] Hepatic homeostasis is critical for surviving thermal injury and therefore liver dysfunction is a common complication in burn patients and is believed to be associated with poor clinical outcomes.[8] The pathophysiology of burn-related liver injury is multifactorial, encompassing hypoperfusion-induced ischemia, oxidative stress, drug toxicity, inflammatory cell infiltration and sepsis.[9] These mechanisms collectively disrupt hepatic function which then leads to altered biosynthetic capacity, cholestasis, hepatocellular necrosis and elevated levels of liver enzymes within blood.[8] It is suggested that elevations in liver enzymes' concentration within blood such as aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are frequently observed in burn patients and may persist for months following the trauma.[10] Research indicates that increased levels of AST and ALT may be associated with prolonged hospital admissions, increased ICU admissions and higher mortality rates. [11] Moreover, abnormalities regarding total bilirubin levels, prothrombin time (PT) and partial thromboplastin time (PTT) can act as markers of hepatic synthetic dysfunction and compromised coagulation; thereby adding complexity to the clinical management of burn patients.[11] Although the significance of hepatic function in the prognosis of burn injuries is well acknowledged; liver dysfunction usually receives insufficient attention during the acute care of burn patients, as clinical priorities tend to emphasize wound management and infection control. [12] As a result, timely diagnosis and appropriate interventions for hepatic impairment may be delayed, potentially exacerbating morbidity and mortality.[12] Comprehensive reviews describe burn-induced coagulopathy, highlighting pathophysiologic interactions among coagulation, fibrinolysis, and inflammation and the current gaps in diagnosis and management.[13] A recent systematic review and meta-analysis synthesizes hepatic functional and morphological injury after severe burns, including early transaminase elevations and fatty infiltration.[7] Moreover, reviews link coagulation disorders in burn injury with higher mortality, underscoring the prognostic relevance of coagulation markers.[14] With the challenges mentioned above and the absence of data specific for region, this study aimed to evaluate the prevalence of liver function test abnormalities and the factors associated with them in burn patients admitted to Kowsar Hospital in Sanandaj, Iran from 2021 to 2023. The goal of this study is to identify the prevalence and clinical correlations regarding hepatic dysfunction within the mentioned population. The findings are intended to guide the development of better monitoring strategies and enhanced therapeutic interventions, which may later lead to improved patient outcomes regarding their clinical decision making.

Methods

This study was designed as a retrospective, descriptive-analytical cross-sectional investigation according to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist for cross-sectional studies.[15] It was conducted at Kowsar Hospital which is a tertiary burn care facility located in Sanandaj, Iran. This study covered a three-year period from the beginning of 2021 to the end of 2023; during which, data were collected from hospitalized burn patients who met the study's inclusion criteria.

Study Population and Sampling

The target population included all patients admitted to the burn unit of Kowsar Hospital during the defined study period. All consecutive patients admitted to the Burn Unit during March 2021–March 2023 with acute burn injury were eligible. Inclusion required documented liver function tests (AST, ALT, total/direct bilirubin, ALP) and coagulation indices (PT/INR, APTT) at admission and at least one repeat measurement during hospitalization. We excluded readmissions for the same injury, inter-hospital transfers without baseline laboratories, patients with chronic liver disease (e.g., hepatitis B/C, cirrhosis), inherited bleeding disorders, or chronic anticoagulant therapy, and any record missing key variables. Data were abstracted independently by two of investigators (Babak Ghadirzadeh and Pedram Atapour) using a piloted form, with discrepancies resolved by a senior author. Because this retrospective study used census sampling of all eligible patients during the study period, no formal a priori sample size calculation was performed. At last, a total of 174 patients who fulfilled these criteria were identified and then enrolled using a census sampling method.

Data Collection Procedures

Data were collected retrospectively from archived patient records using a structured checklist developed specifically for this study. The checklist captured relevant demographic information (age, sex, marital status), clinical characteristics (burn type, total body surface area burned, burn severity) and treatment variables (e.g., use of mechanical ventilation, administration of blood products including packed red blood cells, fresh frozen plasma, albumin and the number of anesthesia events). In addition, results regarding liver function tests, including serum levels of AST, ALT, alkaline phosphatase (ALP), total bilirubin (BiliT), prothrombin time (PT) and partial thromboplastin time (PTT), were extracted from patient records at two time points: initial (upon admission) and secondary (prior to discharge or death). Follow-up laboratory values were defined as the last available measurements obtained during hospitalization before discharge or death. The primary outcome variable was the presence of liver function test abnormalities and the secondary outcomes included clinical interventions and in-hospital mortality. In order to guarantee the accuracy and reliability of the data extracted, two independent reviewers were designated to extract information from patient records. Each reviewer conducted an independent examination of the records

pertaining to a specific subset of patients. Subsequently, after the initial data extraction, each reviewer verified the data that had been extracted by their counterpart. The process of double-checking contributed to the reduction of potential biases and upheld the consistency of the data. Records with missing key demographic, clinical, or laboratory variables were excluded before analysis; therefore, the final analytic dataset contained complete data for the variables included in the present analyses.

Statistical Analysis

After cleaning, all data were entered into and analyzed using SPSS software version 27. Descriptive statistics including means, standard deviations, frequencies and percentages, were used to summarize the data. The Kolmogorov–Smirnov test, Bartlett's test and visual histogram inspection were used to assess the normality of continuous variables. Depending on the distribution of the data, the independent-samples t-test or Mann–Whitney U test was applied to compare continuous variables between groups. Categorical variables were compared using the chi-square or Fisher's exact test, as appropriate. To assess the relationship between potential predictors and mortality, binary logistic regression analysis was performed. A p-value of less than 0.05 was considered statistically significant within this study. Age was modeled in categories (18–39 (taken as reference group), 40–59, ≥ 60), TBSA per 10% increase, and results are presented as odds ratios (OR) with 95% confidence intervals (CI) and a single p-value per variable. Additionally, Age was retained a priori in the multivariable model irrespective of univariate p due to clinical relevance; all other variables entered the model only if $P < 0.20$ in univariate screening.

Ethical Considerations

This research was carried out in alignment with the ethical guidelines established in the Declaration of Helsinki. Ethics Committee approval was secured from Kurdistan University of Medical Sciences: The study upheld strict adherence to patient confidentiality at all times. All data were anonymized prior to analysis and no identifying information was collected. For patients who were still hospitalized during the study period, informed consent was obtained after explaining the objectives of the research.

Results

A total of 174 patients with burn injuries were included in this study (Table 1).

The mean age of patients was 35.8 ± 15.83 years, the mean duration of ICU stay was 10.33 ± 7.25 days and the mean percentage of total body surface area (TBSA) burned was 32.63 ± 16.86. The collected dataset comprised more males (58%) than females (42%). Of all included patients, 139 (79.9%) survived whereas 35 (20.1%) died during hospitalization. Descriptive characteristics of the study population including demographic variables, clinical features, and therapeutic interventions are summarized in Table 1 and the prevalence of abnormal laboratory parameters at the time of admission is presented in Table 2.

Table 1. Baseline characteristics of included patients

Variable		Number	Percentage (%)
Age	18-39	92	52.9
	40-59	56	32.2
	≥60	26	14.9
Sex	Male	101	58
	Female	73	42
Marriage	Single	102	58.6
	Married	72	41.4
Outcome	Recovery	139	79.9
	Death	35	20.1
Reason of burn	Thermal	86	49.9
	Electrical	34	19.5
	Hot liquid	24	13.8
	Chemical	30	17.2
Sepsis Occurrence		54	31
Received Packed cell		45	25.9
Received FFP		21	12.1
Received Alb		54	31
Received Ventilator		75	43.1
Degree of burn	2	80	46
	3	94	54

FFP: Fresh Frozen Plasma, Alb: Albumin
Percentages may not total 100 due to rounding

Further analyses were conducted to examine associations between demographic, clinical and biochemical variables with the final clinical outcome (recovery or death) using univariate comparisons, independent samples t-tests and multivariable logistic regression modeling (Tables 3 and 4). Table 1 presents the baseline characteristics of the study participants. The majority of patients were male (58%). Regarding marital status, single individuals constituted the majority (58.6%), and married accounted for 41.4% of the cohort. Regarding burn etiology, thermal burns were the most common cause (49.9%) followed by electrical (19.5%), chemical (17.2%) and scald injuries from hot liquids (13.8%). Second-degree burns constituted 46% of cases whereas third-degree burns were more prevalent, affecting 54% of patients. Sepsis occurred in 31% of individuals during hospitalization. Regarding therapeutic interventions, 25.9% of patients received packed red blood cells, 12.1% received fresh frozen plasma (FFP), 31% received albumin and 43.1% required ventilatory support. These data provide an overview of the clinical and demographic distribution of the burn population included within this study.

The baseline laboratory findings of the patients upon admission are presented in Table 2. Increased levels of liver enzymes were frequently observed, with AST elevated in 69% of cases and ALT elevated in 66.7%. At baseline, all patients exhibited normal levels of alkaline phosphatase (ALP). In the studied population, 27%

exhibited elevated levels of total bilirubin. Furthermore, a prolonged prothrombin time (PT) was noted in 54% of the patients, whereas 9.2% exhibited elevated activated partial thromboplastin time (APTT). The results suggest that abnormalities in liver function and coagulation were commonly observed in patients at the time of admission, prior to any clinical deterioration or mortality. All baseline ALP values were within the institutional reference range; however, this finding should be interpreted in relation to the admission timing of blood sampling, as ALP may remain normal during the early phase of burn-related hepatic injury.

As shown in Table 3, Univariate logistic regression identified higher TBSA (per 10% increase), sepsis, mechanical ventilation, prolonged APTT at follow-up, third-degree burn, AST abnormality at follow-up, plasma transfusion, and age ≥ 60 as candidates ($P < 0.20$).

Table 2. Baseline Laboratory findings of included patients (at admission)

Laboratory Test		Number	Percentage (%)
AST	Normal	54	31
	Elevated	120	69
ALT	Normal	58	33.3
	Elevated	116	66.7
ALP	Normal	174	100
	Elevated	0	0
Total Bilirubin	Normal	127	73
	Elevated	47	27
PT	Normal	80	46
	Elevated	94	54
APTT	Normal	158	90.8
	Elevated	16	9.2

AST: Aspartate aminotransferase, ALT: Alanine Aminotransferase, ALP: Alkaline Phosphatase, PT: Prothrombin Time, APTT: Activated Partial Thromboplastin Time

In the multivariable model, TBSA, sepsis, mechanical ventilation, and prolonged APTT at follow-up remained independently associated with in-hospital mortality, whereas the age groups were not significant. Prolonged APTT at follow-up was significantly associated with in-hospital mortality in univariate analysis and remained independently associated with mortality after adjustment in the multivariable model.

Results from independent samples t-tests further supported these observations. The mean age of deceased patients was significantly higher than that of survivors (43.63 ± 15.78 vs. 33.83 ± 15.27 years, $P < 0.001$), indicating increased vulnerability among older individuals. Although ICU stay was longer in the mortality group (11.46 ± 5.65 days) compared to the recovery group (10.04 ± 7.59 days), this difference was not statistically significant ($P = 0.304$). In contrast, the mean burn percentage was markedly higher among those who died (57.28 ± 16%) versus those who survived (26.43 ± 10%), a difference that was highly significant ($P < 0.001$). These findings reinforce the prognostic value of age and burn severity in predicting outcomes among hospitalized burn patients. Table 4 displays the findings from the cross-tabulation analysis, which evaluates the relationship between patient outcomes (recovery versus death) and a range of clinical, demographic and laboratory variables; employing the chi-square test for statistical assessment. A number of variables exhibited statistically significant relationships with mortality. Regarding clinical interventions, it was observed that mortality rates were significantly higher in patients who received packed red blood cells ($P = 0.003$), fresh frozen plasma (FFP) ($P < 0.001$) or albumin ($P < 0.001$). Sepsis occurrence showed a significant correlation with higher mortality rates ($P < 0.001$); similarly, the occurrence of third-degree burns was associated with elevated mortality ($P < 0.001$). Regarding

Table 3. Predictors of in-hospital mortality in burn patients: univariate screening and multivariable logistic regression (OR, 95% CI)

Variable (reference)	Univariate OR (95% CI)	*P*-value	Multivariable OR (95% CI)	*P*-value
Age 40–59 (vs 18–39)	1.58 (0.70–3.55)	0.26	-	-
Age ≥ 60 (vs 18–39)	2.08 (0.86–5.05)	0.1	1.64 (0.60–4.50)	0.33
TBSA (per 10% increase)	1.35 (1.15–1.60)	<0.001	1.28 (1.07–1.54)	0.007
Third-degree burn (yes vs no)	1.77 (0.79–3.98)	0.16	1.29 (0.50–3.30)	0.59
Sepsis (yes vs no)	1.68 (1.30–2.17)	<0.001	1.49 (1.01–2.20)	0.045
Mechanical ventilation (yes vs no)	1.82 (1.35–2.46)	<0.001	1.63 (1.14–2.33)	0.008
Packed cells transfusion (yes vs no)	1.32 (0.62–2.80)	0.48	-	-
Plasma transfusion (yes vs no)	1.98 (0.82–4.78)	0.13	1.31 (0.46–3.72)	0.61
Albumin infusion (yes vs no)	0.62 (0.26–1.43)	0.26	-	-
AST abnormal at follow-up (yes vs no)	2.06 (0.79–5.36)	0.14	1.31 (0.45–3.83)	0.62
ALT abnormal at follow-up (yes vs no)	1.09 (0.43–2.80)	0.86	-	-
Total bilirubin abnormal at follow-up (yes vs no)	1.28 (0.50–3.24)	0.61	-	-
PT prolonged at follow-up (yes vs no)	1.39 (0.62–3.11)	0.42	-	-
APTT prolonged at follow-up (yes vs no)	1.78 (1.20–2.66)	0.005	1.52 (1.02–2.27)	0.039

Age categories: 18–39 (ref), 40–59, ≥ 60; retained a priori.
TBSA modeled per 10% increase.
Prolonged APTT/PT and abnormal LFTs defined per institutional reference ranges.
Variables with $P < 0.20$ in univariate were entered into the multivariable model

Table 4. Association Between Clinical and Laboratory Variables and In-Hospital Mortality Based on Chi-Square Analysis

Variable		Outcome				*P* value
		Recovery	%	Death	%	
Sex	Male	79	78.2	22	21.8	0.519
	Female	60	82.2	13	17.8	
Marriage status	Single	87	85.3	15	14.7	0.034
	Married	52	72.2	20	27.8	
Burn Cause	Thermal	61	70.9	25	29.1	0.02
	Electrical	30	88.2	4	11.8	
	Hot Liquid	23	95.8	1	4.2	
	Chemical	25	85.3	5	14.7	
Burn Degree	2	80	100	0	0	<0.001
	3	59	62.9	35	37.2	
Received Packed cell		29	64.4	16	35.6	0.003
Received FFP		8	38.1	13	61.9	<0.001
Received Alb		32	59.3	22	40.7	<0.001
Received Ventilator		41	54.7	34	45.3	<0.001
Sepsis Occurred		24	44.4	30	55.6	<0.001
AST	Normal	52	96.3	2	3.7	<0.001
	Elevated	87	72.5	33	27.5	
AST*	Normal	84	94.4	5	5.6	<0.001
	Elevated	55	64.7	30	35.3	
ALT	Normal	48	82.8	10	17.2	0.504
	Elevated	91	78.4	25	21.6	
ALT*	Normal	74	90.2	8	9.8	<0.001
	Elevated	65	70.7	27	29.3	
Total Bilirubin	Normal	112	88.2	15	11.8	<0.001
	Elevated	25	57.4	20	42.6	
Total Bilirubin*	Normal	130	83.9	25	16.1	<0.001
	Elevated	9	47.4	10	52.6	
PT	Normal	74	92.5	6	7.5	<0.001
	Elevated	65	69.1	29	30.9	
PT*	Normal	111	92.5	9	7.5	<0.001
	Elevated	28	51.9	26	48.1	
APTT	Normal	135	85.4	23	14.6	<0.001
	Elevated	4	25	12	75	
APTT*	Normal	132	85.2	23	14.9	<0.001
	Elevated	7	36.8	12	63.2	

* Variables marked with an asterisk represent follow-up laboratory values, defined as the last available measurements during hospitalization before discharge or death; therefore, their frequencies may differ from admission values reported in Table 2

laboratory parameters, subsequent increases in AST ($P<0.001$), ALT ($P<0.001$), total bilirubin ($P<0.001$), PT ($P<0.001$), and APTT ($P<0.001$) were notably more prevalent among non-survivors, indicating that advancing hepatic and coagulation dysfunction is associated with unfavorable outcomes. Furthermore, the use of ventilators demonstrated a significant association with mortality ($P<0.001$), thereby reinforcing its status as an indicator of critical illness. In contrast, there was no significant association found between sex and marital status and the final outcome. These findings collectively underline the complex nature of mortality caused by burns; indicating that both clinical interventions and evolving biochemical changes play significant roles in determining prognosis regarding burn patients' outcome.

Discussion

The principal aim of this study was to describe the frequency, pattern, and evolution of hepatic and coagulation abnormalities during acute burn hospitalization and to determine whether these indices, assessed at admission and again during follow-up, provide independent prognostic information beyond established clinical drivers. We specifically asked whether dynamic changes in coagulation parameters, together with total body surface area (TBSA), sepsis, and ventilatory support,

identify patients at highest risk of in-hospital death.

Regarding our findings, in 174 hospitalized burn patients (in-hospital mortality ~20%), hepatocellular enzyme elevations at admission were frequent (AST/ALT commonly abnormal; ALP largely within reference), and bilirubin, PT, and APTT were often deranged. On multivariable analysis, larger TBSA, sepsis, need for mechanical ventilation, and a prolonged follow-up APTT independently predicted death, whereas age categories did not retain significance after adjustment; several care-process variables (e.g., plasma/albumin transfusion) were associated with mortality in bivariate analyses but attenuated after adjustment.

Jeschke et al. (2020) frame burns as a systemic disease in which the liver orchestrates the hypermetabolic and acute-phase response, consistent with our high rate of early aminotransferase abnormalities. They emphasize cytokine-driven inflammation, ischemia–reperfusion, and oxidative stress as key mechanisms; pathways that plausibly underlie our admission AST/ALT pattern.[5]

Tapking et al. (2022) report frequent hepatocellular and cholestatic derangements after moderate-to-severe burns, with timing that can differ between enzyme leakage and cholestasis. This aligns with our early profile, AST/ALT commonly abnormal while ALP was largely normal, suggesting initial hepatocellular injury with later cholestatic pressure reflected by bilirubin.[7] The absence of baseline ALP elevation does not exclude subsequent cholestatic dysfunction, because ALP abnormalities may develop later during hospitalization and may be influenced by sepsis, duration of critical illness, and therapeutic exposures.[7]

Furthermore, Idrovo et al. (2020) link infection to liver injury via inflammatory signaling and microcirculatory dysfunction, supporting our independent association of sepsis with mortality. Their discussion of endotoxin-mediated cholestasis and impaired hepatic synthetic function provides a biologic bridge to our bilirubin and coagulation findings.[8]

Additionally, Xu et al. (2025) detail sepsis-related hepatic dysfunction across experimental and clinical data, including hypoxic hepatitis and cholestatic patterns. Their synthesis supports a model in which evolving infection aggravates hepatic injury and coagulation abnormalities, consistent with our trajectory-based signal.[9]

Besides, Ball et al. (2020) highlight that burn-related coagulopathy is dynamic rather than static, with early and evolving changes in global clotting times. Their recommendation for serial testing dovetails with our observation that follow-up, rather than admission, APTT is prognostically informative.[13]

Moreover, Nikolaidou et al. (2022) emphasize trajectory-based assessment and compare conventional clotting tests with broader hemostatic profiling. Their conclusion that trend information adds clinical value reinforces our finding that a prolonged follow-up APTT independently signals risk.[14]

Hassan et al. (2021) demonstrate a dose–response between TBSA and mortality and identify sepsis and ventilatory support as critical determinants. These multicenter observations mirror the independent effects of TBSA, sepsis, and ventilation in our model.[16]

Finally, Suzuki et al. (2024) synthesize contemporary data showing that systemic complications and organ support needs mark inflection points toward poor outcomes. Their call for standardized monitoring and prevention bundles aligns with our clinical implications for serial hepatic/coagulation panels.[17]

Collectively, the concordant literature supports the view that evolving coagulopathy (indexed here by follow-up APTT) integrates factor consumption, impaired hepatic synthesis, and infection-driven activation, adding prognostic information beyond burn size or single admission values. Operationally, predefined serial panels (bilirubin, PT/INR, APTT, platelets, AST/ALT) at admission, 24–48 h, and at deterioration are justified, with sustained APTT prolongation prompting evaluation for occult infection, drug effects, consumption coagulopathy, and hepatic synthetic failure.

Contrary to our findings, Ball et al. (2020) and Nikolaidou et al. (2022) report PT/INR as more discriminative than APTT for mortality in some settings, whereas in our cohort follow-up APTT carried the independent signal. Differences in sampling windows (single admission vs serial follow-up), anticoagulant exposure, transfusion thresholds, and analytic choices likely account for this divergence.[13, 14]

On the other hand, Hassan et al. (2021) and Abarca et al. (2023) identified an independent age effect on mortality; by contrast, our age categories were not significant after adjustment. This discrepancy may reflect mediation of age through TBSA, sepsis, and organ support, fewer very elderly patients in our case-mix, and modeling choices (categorical grouping vs flexible continuous terms).[2, 16]

Palmieri (2021) discuss how transfusion practices and albumin use can influence outcomes and laboratory trajectories. In our data, transfusion-linked associations attenuated after adjustment; consistent with confounding by indication, whereby sicker patients both receive more products and have higher baseline risk.[18]

Moreover, Vural et al. (2023) highlight that local anticoagulation and transfusion protocols shape coagulation trends and outcome associations. Such protocol heterogeneity cautions against over-generalizing which single hemostatic metric (APTT vs PT/INR) will perform best across centers.[19]

Regarding the limitation of the present study, this single-center, retrospective analysis is susceptible to residual confounding and limits generalizability; event counts constrained model complexity. Inhalation injury, comprehensive comorbidities, and detailed anticoagulant exposure were not fully standardized; sampling times were not protocolized; and viscoelastic or mechanistic biomarkers were unavailable. Furthermore, because only records with complete key variables were included, selection bias related to complete-case inclusion cannot

be excluded. In addition, Laboratory variables were primarily analyzed as normal or abnormal according to institutional reference ranges. Although this approach improves clinical interpretability and directly addresses the prevalence-focused aim of the study, it may reduce statistical information and obscure dose–response relationships. Future prospective studies should evaluate liver and coagulation indices as continuous longitudinal variables. On the other hand, the timing of follow-up laboratory assessment was not protocolized and reflected routine clinical practice; therefore, variation in sampling time may have influenced the observed associations. Moreover, the number of mortality events limited the permissible complexity of the multivariable logistic regression model, and the event-per-variable ratio was below the ideal range. Therefore, the adjusted estimates should be interpreted as exploratory and hypothesis-generating rather than definitive. Detailed exposure to potentially hepatotoxic or coagulation-modifying medications, including antibiotics, antifungals, sedatives, and other intensive-care drugs, could not be reliably standardized from the retrospective records and may have contributed to laboratory abnormalities. Inhalation injury, an important determinant of burn-related mortality and respiratory failure, was not consistently documented in a standardized manner and therefore could not be included as a reliable analytic variable.

However, in relation to future directions, embedding serial hepatic/coagulation panels into routine pathways may improve risk stratification and enable earlier sepsis-focused bundles. Future multicenter prospective studies should prespecify age as a primary variable modeled flexibly, test interactions with TBSA and sepsis, and use joint models linking longitudinal labs to time-to-event outcomes; interventional trials should evaluate "trajectory-triggered" bundles activated by predefined laboratory patterns.

Conclusion

Liver function and coagulation abnormalities were frequent among hospitalized burn patients and were clinically relevant to in-hospital outcomes. In particular, larger burn extent, sepsis, mechanical ventilation, and prolonged follow-up APTT were associated with mortality. These findings support the value of serial hepatic and coagulation monitoring in burn care, while emphasizing the need for prospective multicenter studies with standardized sampling times and more detailed adjustment for clinical confounders.

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Competing Interests

The authors declare no competing interests related to this study.

Ethical Approval

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