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Association of Serum Albumin-Bilirubin Score with Early Post-operative Complications Following Liver Resection

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Abstract **Original Research Article**

Introduction: The Serum Albumin-Bilirubin (ALBI) score has emerged as a valuable tool for assessing liver function and predicting postoperative outcomes in patients undergoing liver resection. This study aims to explore the association between the Al-Bi score and early postoperative complications in patients following liver resection. ***Methods:*** This Prospective observational study was conducted among the indoor patients of the Hepatobiliary unit of the surgery department in Dhaka Medical College Hospital, from 1st January 2023 to 29th December 2023. All patients admitted to the hepatobiliary unit of the department of surgery, Dhaka Medical College Hospital were considered as the study population. A total of 40 patients were selected as study subjects through a purposive sampling technique. Data were analyzed by Statistical Package for Social Sciences (SPSS) version 20.0. ***Result:*** In the early postoperative period, higher Al-Bi scores were significantly associated with increased risks of bile leak and sepsis. Grade 3 patients had a 100% incidence of both bile leaks (P=0.004) and sepsis (P=0.025). In contrast, postoperative bleeding showed no significant association across all Al-Bi score groups. Only Grade 1 sepsis incidence was lower (P=0.030), while other grades showed no significant findings. Overall, higher Al-Bi scores correlated with more frequent bile leaks and sepsis, but not with bleeding. ***Conclusion:*** The study findings hold the significant clinical significance of measuring initial & post-operative Al-Bi scores with post-liver resection outcomes. Therefore, using initial & early post-operative Al-Bi score as a clinical parameter can help optimize post-operative patient care. Moreover, the association between post-operative Al-Bi score & subsequent organ dysfunction and morbidity may offer a good predictor to assess the impact of innovations in surgical techniques or peri-operative care.

Keywords: Serum Albumin-Bilirubin Score, Liver Resection, Postoperative bleeding.

INTRODUCTION

Liver resection is a very complex surgical procedure particularly Major liver resection and liver resection in chronic liver disease. Despite being a highly invasive procedure, it has become safer in recent years. Appropriate patient selection, advances in surgical and anesthetic techniques, use of minimal access surgery, and improvement in perioperative care have expanded the indications of liver resection. Advances in surgical techniques and perioperative care have led to postoperative mortality rates for liver resection ranging from 0% to 22%, with a median of 3.7% [1]. However, post-operative morbidity remains high at around 12.5% to 66% [2], including liver dysfunction, renal dysfunction, and bile leak [3,4]. Patient age is one of the factors linked to perioperative complications and mortality [5,6], and gender, hospital annual number of liver resections [5], pathologic origin of liver tumor, pre-operative liver and renal dysfunction, chronic liver disease [5, 6], and the peripheral neutrophil-to-lymphocyte ratio (NLR) [7]. Blood loss is among the operative factors associated with patient outcomes [7], and transfusion [8], extent of liver resection [8], duration of surgery, simultaneous extrahepatic procedures [8, 9],

and the use of the Pringle maneuver [10]. Numerous factors influence outcomes after liver surgery, but these have not been integrated into a single scoring system. The American Society of Anesthesiologists (ASA) grade and the Portsmouth Physiologic and Operative Severity Score for the Enumeration of Mortality and Morbidity (P-POSSUM) scores are commonly utilized for risk prediction across various types of surgeries [11], including liver surgery [12]. Previous Studies explored the Child-Pugh score (CP score), the Model for End-Stage Liver Disease (MELD) score, and the albumin–bilirubin score (ALBI), combining the ALBI score with platelet count (a surrogate marker of portal hypertension) into the platelet–albumin–bilirubin (PALBI) grade, a new score, such as the ALBI-APRI score. They concluded blood test scores may be combined to achieve a better predictive value of PHLF [13]. However, these scores may not adequately address the unique challenges posed by liver resection. A major reported cause of mortality following this procedure is post-hepatectomy liver failure (PHLF) [14]. While the "50-50 criteria," which include a serum bilirubin level exceeding 50 µmol/L and a prothrombin index (calculated as the laboratory's mean normal prothrombin time divided by the patient's observed PT) below 50% on the fifth postoperative day, may be linked to mortality from post-hepatectomy liver failure (PHLF), an earlier prediction system could prove more valuable in guiding treatment. Moreover, the failure of multiple organ systems can contribute to death after liver resection, emphasizing the necessity for a comprehensive perioperative measure to predict the risk of significant postoperative morbidity and mortality. Therefore, an early post-operative Al-Bi scoring system may be of useful marker to detect earlier morbidity after Liver Resection. This study may help to take necessary measures for patients with a complication of Liver Resection in the earlier period.

METHODS

This Prospective observational study was conducted among the indoor patients of the Hepatobiliary unit of the surgery department in Dhaka Medical College Hospital, from 1st January 2023 to 29th December 2023. All patients admitted to the hepatobiliary unit of the department of surgery, Dhaka Medical College Hospital were considered as the study population. A total of 40 patients were selected as study subjects through a purposive sampling technique. A questionnaire and a consent form were prepared, the sample was selected based on inclusion and exclusion criteria, a questionnaire was filled with informed written consent, and relevant investigations were done. Data were collected by active participation, and interviewing through questionnaires. Univariate and multivariate analysis of the data is carried out using a statistical analysis software program. Descriptive analysis of continuous variables is carried out and presented as the means ± SD. Data were analyzed by Statistical Package for Social Sciences (SPSS) version 20.0. Informed as well as verbal consent of the patient was taken. Ethical clearance was taken from the ethical committee of Dhaka Medical College.

Inclusion criteria:

- The patient underwent liver resection for various indication
- Age between 18 to 70 years

Exclusion criteria:

- Patient with concomitant other malignancy
- Patient with a history of pre-existing chronic liver disease including cirrhosis due to other medical causes like autoimmune hepatitis, hemochromatosis, Wilson's disease
- Patient with concomitant other severe co-morbid illness (severe cardio-respiratory & renal compromise)

RESULTS

Table 1: Distribution of patients according to age (N=40)

Age Group (in years)	n	%
18 – 30	4	10.0
31 – 40	4	10.0
41 – 50	16	40.0
51 – 60	10	25.0
61 – 70	6	15.0
Sex		
Male	18	45.0
Female	22	55.0
Age (Mean ± SD): 48.4 ± 10.27		
Male to female ratio = 1 :1.22		

The study shows that the majority (16,40.0%) of the patients were from the 41-50 years age group. Out of forty patients, the mean age was 48.4 years with a standard deviation of 10.27. [Table 1]

Table 2: Post-operative hematological parameters (POD 3) (N=40)

Biochemical Variables	n	%
Serum Bilirubin		
<17 mmol/L	22	55.0
17-50 mmol/L	10	25.0
>50 mmol/L	6	15.0
Serum Albumin		
<2 gm/dl	4	10.0
2-3.5 gm/dl	22	55.0
>3.5 gm/dl	14	35.0

Out of 40 patients, 55% had serum bilirubin levels below 17 mmol/L, while 25% fell within the 17-50 mmol/L range, and 15% exhibited elevated bilirubin levels (>50 mmol/L). In terms of serum albumin levels, 10% had levels below 2 gm/dl, while 55% had levels between 2 and 3.5 gm/dl, and 35% had levels above 3.5 gm/dl. [Table 2]

Table 3: Post-operative hematological parameters (POD 5) of patients (N=40)

Biochemical Variables on POD 5	n	%
Serum Bilirubin		
<17 mmol/L	24	60.0
17-50 mmol/L	10	25.0
>50 mmol/L	6	15.0
Serum Albumin		
<2 gm/dl	4	10.0
2-3.5 gm/dl	24	60.0
>3.5 gm/dl	12	30.0

This study shows postoperative blood parameters for detecting liver dysfunction. Blood samples were collected in POD 5. Samples were collected from all patients on the subsequent day. However, peak reading in bilirubin usually occurred early in the 5th postoperative course. 15% of patients had raised bilirubin, and 10% decreased albumin levels. [Table 3]

Table 4: Al-Bi Scoring in the early postoperative period (5th POD) (N=40)

Al-Bi Score	n	%
Grade 1 (<-2.6)	24	60.0
Grade 2 (-2.6 to -1.39)	12	30.0
Grade 3 (> -1.39)	4	10.0

Sixty percent (24 patients) were classified as Grade 1, indicating a more favorable score, while 30% (12 patients) fell into Grade 2, and 10% (4 patients) were classified as Grade 3, indicating poorer outcomes. [Table 4]

Table 5: Association between Al-Bi scoring and bile leak in the early postoperative period (5th POD) (N=40)

Al-Bi Score	Bile Leak		P-Value
	Yes	No	
Al-Bi Score Grade 1	4 (16.66%)	20 (83.3%)	0.0004
Al-Bi Score Grade 2	6 (50%)	6 (50%)	0.083
Al-Bi Score Grade 3	4 (100%)	0 (0%)	0.004

Grade 1 Al-Bi score patients experienced bile leaks in 4 cases (16.66%), while the majority (20 patients or 83.3%) did not, resulting in a highly significant P-value of 0.0004. For patients classified with Grade 2 Al-Bi scores, bile leaks occurred in 6 patients (50%), indicating an equal distribution between those with and without leaks, and yielding a P-value of 0.083, suggesting no significant association. In contrast, Grade 3 Al-Bi score patients had a 100% incidence of bile leaks (4 cases), with none exhibiting leakage, leading to a P-value of 0.004, indicating a strong association between higher Al-Bi scores and bile leaks. [Table 5]

Table 6: Analysis of the association of Al-Bi scoring and postoperative bleeding in the early postoperative period (N=40)

Al-Bi Score	Postoperative Bleeding		P-Value
	Yes	No	
Al-Bi Score Grade 1	2 (8.33%)	22 (91.66%)	0.364
Al-Bi Score Grade 2	6 (50%)	6 (50%)	0.697
Al-Bi Score Grade 3	4 (50%)	4 (50%)	0.736

The results indicate that for the Grade 1 Al-Bi score, only 2 patients (8.33%) experienced postoperative bleeding, while 11 patients (91.66%) did not, resulting in a P-value of 0.364, which suggests no significant association between this grade and bleeding incidence. In the Grade 2 Al-Bi score group, bleeding was observed in 6 patients (50%), with an equal number of patients (6) not experiencing bleeding, leading to a P-value of 0.697, indicating no significant relationship. For Grade 3 Al-Bi score patients, bleeding occurred in 4 cases (50%), and 4 patients (50%) did not bleed, which also resulted in a P-value of 0.736, further supporting the lack of significant association. [Table 6]

Table 7: Analysis of the association of Al-Bi scoring and sepsis in the early postoperative period (N=40)

Al-Bi Score	Sepsis		P-Value
	Yes	No	
Al-Bi Score Grade 1	2 (8.33%)	22 (91.66%)	0.030
Al-Bi Score Grade 2	4 (33.33%)	8 (66.66%)	0.393
Al-Bi Score Grade 3	4 (100%)	0 (0.0%)	0.025

The findings show that in patients with Grade 1 Al-Bi score, only 2 individuals (8.33%) developed sepsis, while 22 (91.66%) did not, yielding a P-value of 0.030. This suggests a statistically significant relationship between a lower Al-Bi score and a decreased incidence of sepsis. For the Grade 2 Al-Bi score, 4 patients (33.33%) experienced sepsis, while 8 patients (66.66%) did not, resulting in a P-value of 0.393,

indicating no significant association at this level. In the Grade 3 Al-Bi score group, all 4 patients (100%) experienced sepsis, with none (0.0%) remaining free from infection. This resulted in a P-value of 0.025, demonstrating a strong association between higher Al-Bi scores and increased risk of sepsis. [Table 7]

DISCUSSION

The predominance of patients in the 41–50 years age group aligns with findings from previous studies, which often report that liver resection is more common among middle-aged individuals. For instance, studies have shown that liver resection is frequently performed in patients aged 40 to 60 years, reflecting the typical age of onset for liver tumors, particularly hepatocellular carcinoma and metastatic liver disease [7,8]. The observed male-to-female ratio of 1:1.22 indicates a higher proportion of female patients in this cohort, which is somewhat atypical, as many studies have reported a male predominance in liver disease, particularly in hepatocellular carcinoma [13]. This discrepancy may reflect specific demographic or geographical factors affecting patient selection and disease prevalence in the study population. It showed that the Al-Bi score > -1.39 after liver resection is associated with an increased risk of bile leak, hemorrhage, sepsis, and other complications resulting in a longer hospital stay. Several authors have shown that high Al-Bi scores before and after hepatic resection in the early postoperative phase can be variably associated with renal and hepatic dysfunctions, postoperative peaks in serum bilirubin concentration, length of hospital stay, and mortality [14,15]. Previous studies reported similar findings in a series of patients with a very low postoperative mortality rate. However, recently the relationship between Al-Bi score & outcome after hepatectomy especially in the case of HCC has shown a promising relationship. Al-Bi score > -1.39 is associated with an adverse outcome. Liver blood supply was occluded earlier during anatomical liver resection for minimal blood loss, but the affected segment remain hypoxic for a long duration. Major liver resection usually takes more time. We have performed elective liver resections chiefly for Carcinoma GB, and benign diseases; notably hepatolithiasis. It is because of the high prevalence of these diseases in this region. We had no 30-day mortality, though the morbidity rate was slightly on the higher side (35%) compared to the literature [16]. This relatively high rate of morbidity may be due to the careful identification and documentation provided by both clinical and biochemical examinations performed in the post-operative period at our hospital so that no minor complications were overlooked. This study shows higher Al-Bi scores are strongly associated with increased rates of bile leaks and sepsis, with significant P-values confirming these trends. However, no significant association was found between Al-Bi scores and postoperative bleeding, suggesting that other factors, such as surgical technique, may play a larger role in this complication. Overall, early liver function assessment through Al-Bi scoring can be an important tool for predicting postoperative risks, particularly bile leaks and sepsis, in liver resection patients.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The study findings hold significant clinical significance in measuring initial & post-operative Al-Bi scores with post-liver resection outcomes. Therefore, using initial & early post-operative Al-Bi score as a clinical parameter can help optimize post-operative patient care. Moreover, the association between post-operative Al-Bi score & subsequent organ dysfunction and morbidity may offer a good predictor to assess the impact of innovations in surgical techniques or peri-operative care.

RECOMMENDATION

Initial Al-Bi score can be measured after liver resection for early prediction of compromised outcome. Conduction of further research and validation studies is necessary to establish the reliability and generalizability of the initial Al-Bi score with post-hepatectomy complications. The study should be conducted among larger sample sizes with a long-duration follow-up. A multidisciplinary approach to research work can make a study precise & more authentic in this regard.

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