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THE ASSESSMENT OF THE DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA IN PREDICTING MORTALITY IN PATIENTS WITH SECONDARY PERITONITIS

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ABSTRACT

INTRODUCTION: *Serial lactate measurement is found to predict mortality in septic shock. Majority of patients with peritonitis for emergency laparotomy are in sepsis and mortality rate is substantial. However, lactate dynamics has not been studied in this patient population.*

OBJECTIVE: *To determine the diagnostic accuracy of hyperlactatemia in predicting the 28-days mortality of patientswith secondary peritonitis.*

STUDY DESIGN: *Descriptive cross sectional study.*

STUDY SETTING: *Study was conducted at Department ofGeneral Surgery, Dr. Ruth K.M Pfau Civil Hospital Karachi*

DURATION OF STUDY: *Six months after approval of synopsisfrom **07-06-22** till **07-12-22**.*

SUBJECTS AND METHODS: *Quantitative and qualitative data was collected, presented and analyzed. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality was calculated.*

RESULTS: *A total of 108 patients who met the inclusion and exclusion criteria were included in this study. Mean age, height, weight, BMI and duration of hospital stay in our study was 44.23±13.57 years, 26.72±1.56 kg/m2 158±7.28 cm, 78.7±9.87 kg and 9.08±5.51 days. 49 (45.4%) were male and 59 (54.6%) were female. Out of 108 patients, sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality was found to be 94.2%, 69.8%, 60%, 96.2% and 77.7% respectively.*

CONCLUSION: *Preoperative, immediate postoperative and 24-h postoperative lactate value independently predict 28-daymortality in peritonitis patients undergoing emergency laparotomy.*

Keywords: *Lactate, peritonitis, emergency laparotomy and 28-day in-hospital mortality*

INTRODUCTION

Peritonitis due to perforation of the gastrointestinal tract is one ofthe most common surgical emergencies all over the world [1] and has relatively high morbidity and mortality rates. [2] Peritonitis is the commonest cause of sepsis in developing countries. Despite the treatment measures, mortality rates are still high (up to 40%) in most of the patients, present late with septicemia[3]. Patients undergoing emergency laparotomy for intra-

abdominal infection experience high perioperative mortality despite of advancement of surgical technique, antibiotic therapy and intensive care support. In the UK, overall 30-days mortality is one in seven and reaches almost one in four for the elderly (age ≥80 years) [4] Peritonitis may be primary, secondary or tertiary[5] . Primary peritonitis results from bacterial, chlamydial, fungal, or mycobacterial infection in the absence of perforation of gastro- intestinal tract. Primary peritonitis is usually caused by streptococci and is most commonly seen in children with nephrotic syndrome and adults with ascites secondary to liver disease[6].

Acute secondary peritonitis represents the common presentation of gastro-intestinal perforation and can be either chemical or Bacterial4 . Secondary peritonitis frequently caused by peptic ulcer disease, acute appendicitis, colonic diverticulitis and pelvic inflammatory disease, dehiscence of bowel anastomosis or leakage, development of intra-abdominal abscess. Severe secondary peritonitis may follow penetrating intestinal injury that is not recognized or treated promptly (>12-hour delay)[7] . In surgical wards secondary peritonitis is the commonest indication for admissions resulting into increased workload, increased duration of hospital stays, and complications such as enterocutaneous fistula, surgical site infections and sepsis[8]

.Secondary peritonitis is the second leading cause of sepsis in patients in intensive care units globally. Overall mortality is 6%, but mortality rises to 35% in patients who develop severe sepsis. [9] Approximately 15% of patient with secondary peritonitis are ill enough to require ICU care. Secondary peritonitis is polymicrobial with anaerobic gram negative bacilli (e.g. Bacteroides fragilis) predominating[7]. Tertiary peritonitis is a severe recurrent or persistent intra-abdominal infection >48 hour after apparently successful and adequate surgical source control of secondary peritonitis. Although it is less common, it may comprise of a severe systemic inflammation response. Tertiary peritonitis is associated with microbial shift towards nosocomial flora including Staphylococci coagulase-negative, Candida, Enterococci, Pseudomonas, Enterobacter and other opportunistic bacteria and fungi [5] . Causes of peritonitis includes Bacterial (gastrointestinal and non-gastrointestinal), chemical (bile, barium, pancreatic, contrast media), Allergic (starch peritonitis), Traumatic (operative handling), Ischemia (strangulated bowel, vascular occlusion), Miscellaneous (familial Mediterranean fever). Most cases of peritonitis are caused by invasion of peritoneal cavity by bacteria. It is usually secondary to inflammatory insult, most often gram negative infection with enteric organisms and anaerobes [10]

The diagnosis of peritonitis is supported by clinical signs, e.g., abdominal pain and tenderness, nausea, vomiting, diminished intestine sounds, fever, shock, and diagnostic tests, e.g., abdominal x-ray, chest x-ray, ultrasound and CT scan. Ultrasound may be positive in up to 72%, CT in up to 82%. Leukocytes and C reactive protein may be altered but are not direct signs of peritonitis ll. Perforation peritonitis is linked with multiple organ dysfunction syndrome (MODS) in up to 73%patients and mortality increases up to 30% in such cases. [4] Acute generalized peritonitis from gastrointestinal hollow viscus perforation is a potentially life threatening condition. Early identification of patients with severe peritonitis may help inselecting patients for aggressive surgical approach [12] ' A majorityof the patients present late, with septicemia thus increasing the incidence of morbidity and mortality and complicating the task of the anesthesiologists to provide optimal perioperative care in these patients. Early prognostic evaluation of abdominal sepsis is desirable to select high-risk patients for more aggressive therapeutic procedures and to provide objective classification of the severity of the disease[13] Numerous studies have tried to identify prognostic biomarkers in critically ill patients. Of those identified, lactates or lactate clearance, base excess, and serum pro-calcitonin (PCT) are used most often in clinical practice. In addition, many scoring systems, such as the Acute Physiology and Chronic Health Evaluation (APACHE Il) score, the Simplified Acute Physiology Score Il (SAPS Il), the Sequential Organ Failure Assessment (SOFA) and the Mannheim Peritonitis Index (MPl) systems, have been introduced to estimate disease severity and prognosis in critically ill patients. [2] Serum lactate has been studied for its diagnostic and prognostic utility even at early phases of sepsis in critically ill patients. A lactate value> 4mmol/L in sepsis or septic shock indicates the need for aggressive resuscitation. [4] At physiological pH, lactic acid exists in an ionized form as lactate; approximately

1500 mmol of lactate is produced daily by muscle fibers, brain, skin, red blood cells and intestine as an end productof glycolysis. Lactate levels are normally maintained at less than
mmol/L by a delicate balance between production and clearance (by liver and kidneys). Anything that affects lactate production, clearance or both leads to hyperlactatemia; this is seen in a variety of conditions such as sepsis, shock, cardiac arrest, tissue hypoxia, burns and some pharmacological agents (linezolid, metformin, theophylline etc.) [14] In critically ill patients, lactate serves as a global marker of tissue hypo perfusion and insufficient oxygen delivery[7] . The admission lactate level, highest lactate level and time interval to normalize the serum lactate are
important prognostic indicators for survival. Serum lactate is alsoused to monitor the patient physiological response to resuscitation. The marker of resuscitation is the Lactate level of less than 2.2mmol/lit achieved after resuscitation[15]. In previouslypublished study cut off value of lactate on admission (AL1) is taken as 2.35mmol/lit and cut off value of lactate after 24 hours (AL24) is taken as 2.05mmol/lit. [14] Despite strenuous literature search, local studies evaluating the effectiveness of hyperlactatemia as a predictor of mortality in secondary peritonitis were not found. Moreover, there is extensive data available on septic associated hyperlactatemia but scarce data available on secondary peritonitis associated hyperlactatemia in surgical patients. So, this study will help in assessing the effectiveness ofpreoperative baseline lactate level (AL1) and postoperative lactatelevels at 24 hours (AL-24) in prediction of early mortality, which if found significantly accurate, may be used in future to evaluate the risk of mortality in patients with secondary peritonitis and delineate effective management plan accordingly.

ORIGINAL STUDY
OBJECTIVE:
To determine the diagnostic accuracy of hyperlactatemia inpredicting the 28-days mortality of patients with secondary peritonitis.

OPERATIONAL DEFINITION
SECONDARY PERITONITIS: It was defined in this study as: Patients presents with generalized or abdominal pain (VAS>5), fever (>98.6F), tenderness or board like rigidity on examination with at least one of the following. (1) Free gas under diaphragm on chest x-ray and CT scan Abdomen. (2)Free fluid in abdomen on US or CT scan Abdomen.

HYPERLACTATEMIA:
Hyperlactatemia defined as lactate levelsbetween 2mmol/L and 4 mmol/L A cutoff value of arterial lactate >2.05mmol/L will predict the mortality in this study.

DIAGNOSTIC ACCURACY:
It was measured in terms of sensitivity, specify, positive predictive value and negative predictive value by taking true positive, true negative, false positive and false negative on arterial lactate levels comparing with outcomes (survivors or non-survivors).

$$\text{Diagnostic accuracy} = \frac{TP+TN}{TP+TN+FP+FN} \times 100$$

MORTALITY: Mortality or death is the number of deaths in a population during a given time (hospital admission till 28 days).

ARTERIAL LACTATELEVEL	OUTCOME	
	NON SURVIVORS	SURVIVORS
≥2.05mmol/l	TRUE POSITIVE(TP)	FALSE POSITIVE(FP)
<2.05mmol/l	FALSE NEGATIVE (FN)	TRUE NEGATIVE (TN)

TRUE POSITIVE: Proportion of patients in whom Arterial lactate level >2.05/L was associated with mortality

TRUE NEGATIVE: Proportion of patients in whom Arterial lactatelevel ≤ 2.05/L was not associated with mortality
FALSE POSITIVE: Proportion of patients in whom Arterial lactatelevel >2.05 was not be associated with mortality

FALSE NEGATIVE: Proportion of patients in whom Arterial lactate level ≤ 2.05mmol/L was associated with mortality.

SENSITIVITY: SN=(TP/TP+FN)×100

SPECIFICITY SP=(TN/TN+FP)×100

POSITIVE PREDICTIVE VALUE
PPV=(TP/TP+FP)×100

NEGATIVE PREDICTIVE VALUE
NPV=(TN/TN+FN)×100

DIAGNOSTIC ACCURACY
=(TP+TN/TP+FN+TN+FP)×100.

METHODS AND MATERIALS

STUDY DESIGN: Descriptive cross sectional study.

STUDY SETTING: Study was conducted at Department of General Surgery, Dr. Ruth K.M Pfau Civil Hospital Karachi

DURATION OF STUDY: Six months after approval of synopsis from **07-06-22** till **07-12-22**.

SAMPLE SIZE: In the literature, mortality in the setting ofperitonitis has been estimated at 40%.3 The sample size is calculated by using the sensitivity of 84.5 %14, specificity of 61.1%14, confidence interval of 95% and desired precision of 11.Final sample size is 108.

SAMPLING TECHNIQUE: Non-probability consecutive sampling.

SAMPLE SELECTION:
INCLUSION CRITERIA:
Patients of both gender admitted through Emergency room (ER) with diagnosis of secondaryperitonitis (as per aforementioned definition), undergoing exploratory laparotomy.
Age 15-65 years

EXCLUSION CRITERIA:
Patient with primary peritonitis, peritonitis secondary to trauma, malignancy, post-operative peritonitis secondary to anastomotic leak, or managed non operatively
Patients not consenting to participate in the study.

Patient of secondary peritonitis operated elsewherereferred to our hospital.
Patient on medications like metformin, linezolid, theophylline and nucleoside reverse transcriptase inhibitors that affect lactate levels.
Patient who have undergone prior exploratorylaparotomy in the current hospitalization period
Patient having history of ICU stay in last 6months

DATA COLLECTION PROCEDURE:

The study was conducted after the approval from college ofphysicians and surgeons Pakistan (CPSP) and after obtaining institutional review board(IRB) approval. All patients presenting to Dr. Ruth K.M Pfau Civil Hospital Karachi emergency, fulfilling the inclusion criteria and operational definition, were selected and enrolled by year 2 or 3 surgical residents. Informed consent was taken from all the patients to participate in this study. A detailed history of the patient's current illness, previous history of surgery, other comorbid illnesses (if present, severity of comorbidity and treatment they are taking.), drug allergy was recorded along withbaseline vitals. Arterial blood gases were done and added in a recorded Performa. For the purpose of study, only two lactate values will be analyzed once, initially on admission (arterial lactate initial—AL1) and the other, 24 hours after surgery (arterial lactate at 24hour—AL24). Mortality was recorded in first 28 days followingsurgery. Patients received a standard regime of broad spectrum antibiotics and their electrolyte and fluid status was optimized before surgery. All patients received general anesthesia with tracheal intubation and positive pressure ventilation. Intraoperatively, electrocardiogram (ECG), oxygen saturation (Sp02), non-invasive blood pressure (NIBP), temperature and urine output was monitored. Patients were followed up postoperatively till the outcome for 28days during hospital stay and if patient were discharged, we followed him on call and OPD based. The data of all patients was collected on constructed proforma designed for the study which contained demographic information (name, age, gender), BMI, hospital registration number, contact number, etiology and site of secondary peritonitis, associated disease, serum lactate level on admission (preoperative) and after 24 hour (postoperative), mortality and final outcome (diagnostic accuracy). All data was filled by independent perceiver (postgraduate trainee 1-2 years).

DATA ANALYSIS PROCEDURE:

The software program SPSS for windows (version21) was utilized for all statistical analysis. Mean+/- standard deviation wascalculated for quantitative variables, for example age, height, weight, BMI and lactate levels (at time of admission and 24 hours' post-surgery). Median was calculated for abnormally distributed data. Frequencies and percentages was calculated for qualitative variables for example marital status, gender, ethnicity, etiology and mortality of secondary peritonitis. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy was calculated for survivors or non-survivors (i-e. Mortality) at the time of admission and 24 hours postoperatively by taking lactate value cut off >2.05. Stratification was done with regard to age, gender of patients, BMI in order to demonstrate the effect of these on outcomes through diagnostic accuracy.

RESULTS

A total of 108 patients who met the inclusion and exclusion criteria were included in this study from the Department of General Surgery, Dr. Ruth K.M Pfau Civil Hospital Karachi.
Out of 108 patients minimum age of the patient was 20 while maximum age of the patients was 65 years. Mean age in ourstudy was 44.23 years with the standard deviation of ±13.57. Mean height, weight, BMI and duration of hospital stay in our study was 26.72±1.56 kg/m2, 158±7.28 cm, 78.7±9.87 kg and 9.08±5.51 days. As presented in Table 1. As shown in Table 1.
Out of 108 patients, 35 (32.4%) and 73 (67.6%) had and did not have mortality. As shown in Figure 1.
Out of 108 patients, 55 (50.9%) and 53 (49.1%) had and did not have hyperlactatemia respectively. As shown in Figure 2.
Out of 108 patients, 49 (45.4%) were male and 59 (54.6%)were female. As shown in Figure 3.

Frequency distribution of age showed that out of 108 patients, 45 (41.7%) and 63 (58.3%) patients were in age group 15-45 years and 46-65 years respectively. As presented in Figure4.

Frequency distribution of duration of hospital stay showed that out of 108 patients, 34 (31.5%) and 74 (68.5%) patients hadduration of hospital stay ≤ 7 and > 7 days respectively. As presented in Figure 5.

Frequency distribution of diabetes mellitus type II showed that out of 108 patients, 25 (23.1%) and 83 (76.9%) had and didnot have diabetes mellitus type II respectively. As presented in Figure 6.

Frequency distribution of hypertension showed that out of 108 patients, 35 (32.4%) and 73 (67.6%) had and did not have hypertension respectively. As presented in Figure 7.

Frequency distribution of ischemic heart disease showed that out of 108 patients, 20 (18.5%) and 88 (81.5%) had and didnot have ischemic heart disease respectively. As presented in Figure 8.

Frequency distribution of BMI status showed that out of 108patients, 25 (23.1%) and 83 (76.9%) had BMI ≤ 30 and > 30 kg/m2 respectively. As presented in Figure 9.

Out of 108 patients, sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality was found to be 94.2%, 69.8%, 60%, 96.2% and 77.7% respectively.As shown in Table 2-3.

Stratification for age with respect to sensitivity, specificity, positive predictive value, negative predictive value and diagnosticaccuracy of hyperlactatemia for the prediction of mortality in agegroup 15-45 years was found to be 71.4%, 78.9%, 38.4%, 93.7%and 77.7% respectively. Moreover, in age group 46-65 years was found to be 100%, 60%, 66.6%, 100% and 77.7% respectively. As presented in Table 4.

Stratification for gender with respect to sensitivity, specificity, positive predictive value, negative predictive value anddiagnostic accuracy of hyperlactatemia for the prediction of mortality in male group was found to be 84.6%, 75%, 58%, 93.1% and 77.5% respectively. Moreover, in female group was found to be 100%, 88.8%, 62.8%, 100% and 77.9% respectively.As presented in Table 5.

Stratification for duration of hospital stay with respect to sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality in duration ≤ 7 days group was found to be 83.3%, 75%, 41.6%, 95.4% and 73.5% respectively.Moreover, in duration > 7 days group was found to be 96.5%, 66.6%, 65.1%, 96.7% and 78.3% respectively. As presented in
Table 6.

Stratification for diabetes mellitus type II with respect to sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality in patients who had diabetes mellitus group was found to be 100%, 00%, 80%, 00% and 80% respectively. Moreover, in patients who did not have diabetes mellitus group was found to be 86.6%, 75%, 43.3%, 96.2% and77.1% respectively. As presented in Table 7.

Stratification for hypertension with respect to sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality in patients who had hypertension group was found to be 100%, 38.4%, 73.3%, 100% and 77.1% respectively. Moreover, in patients who did not have hypertension group was found to be 84.6%, 76.6%, 36.3%, 95.8% and 78% respectively. As presented in Table 8.

Stratification for ischemic heart disease with respect to sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality in patients who ischemic heart disease group was found to be 100%, 42.8%, 42.8%, 100% and 60% respectively. Moreover, in patients who did not have ischemic heart disease group was found to be 93.1%, 76.2%, 65.8%, 95.7% and 81.8% respectively. As presented in Table 9.

Stratification for BMI status with respect to sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality in BMI ≤ 30 kg/m2 group was found to be 50%, 50%,84%, 84% and 50% respectively. Moreover, in BMI > 30 kg/m2 group was found to be 85.7%, 73.9%, 40%, 96.2% and 75.9%respectively. As presented in Table 10.

TABLE-1
DESCRIPTIVE STATISTICSn=108

VARIABLE	MEAN	STANDARD DEVIATION	MIN-MAX
AGE (YEARS)	44.23	±13.57	20-65
DURATION OFHOSP STAY (DAYS)	9.08	±5.51	4-13
BMI (KG/M^2)	26.72	±1.56	23-29
HEIGHT (CM)	158	±7.28	148-162
WEIGHT (KG)	78.7	±9.87	68-115

FIGURE-1
MORTALITY DISTRIBUTIONn=108

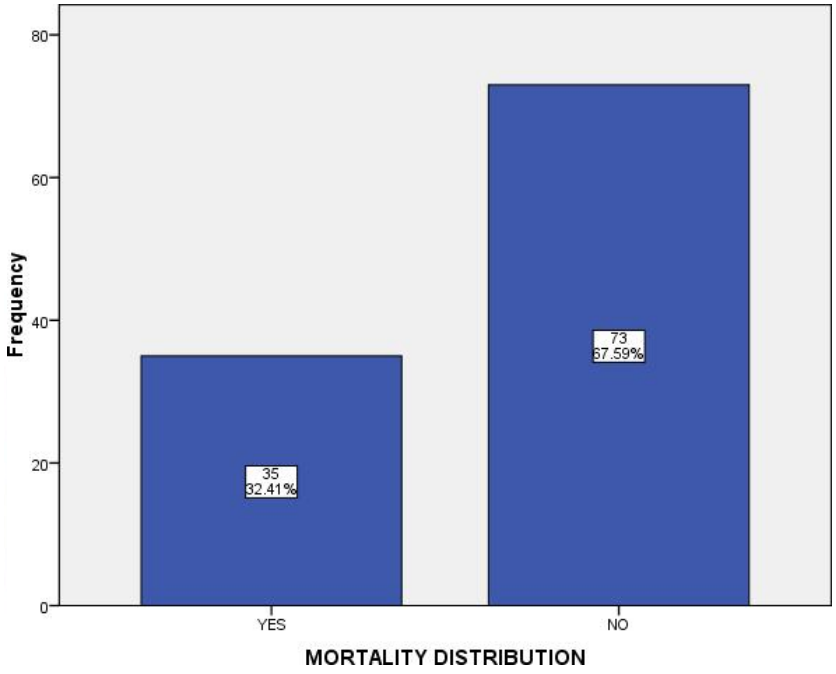

FIGURE-2
HYPERLACTATEMIA DISTRIBUTIONn=108

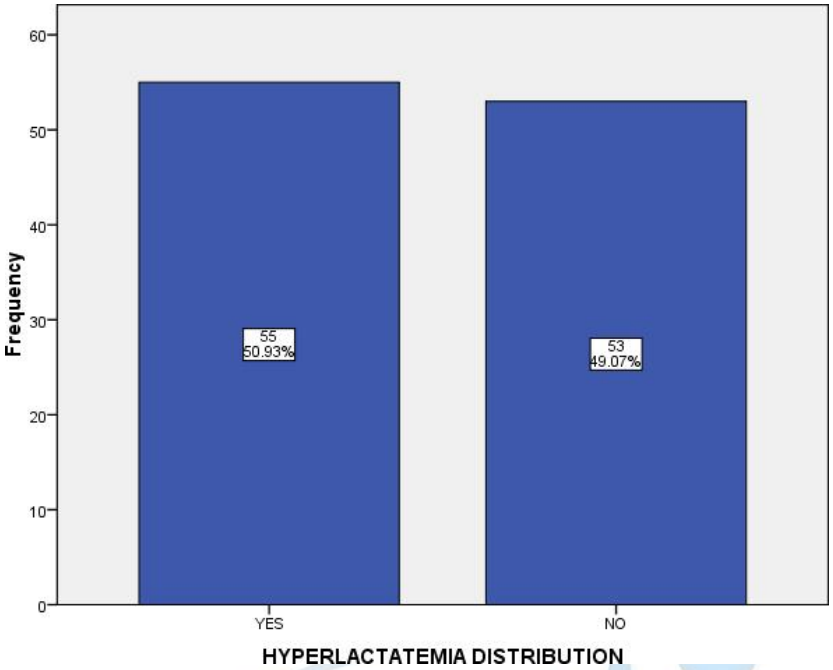

FIGURE-3
GENDER DISTRIBUTIONn=108

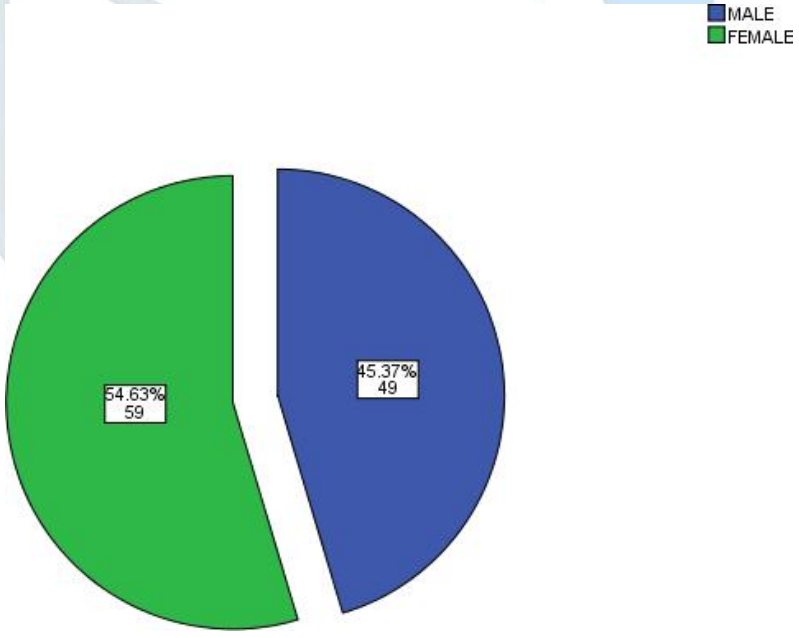

FIGURE-4
AGE DISTRIBUTIONn=108

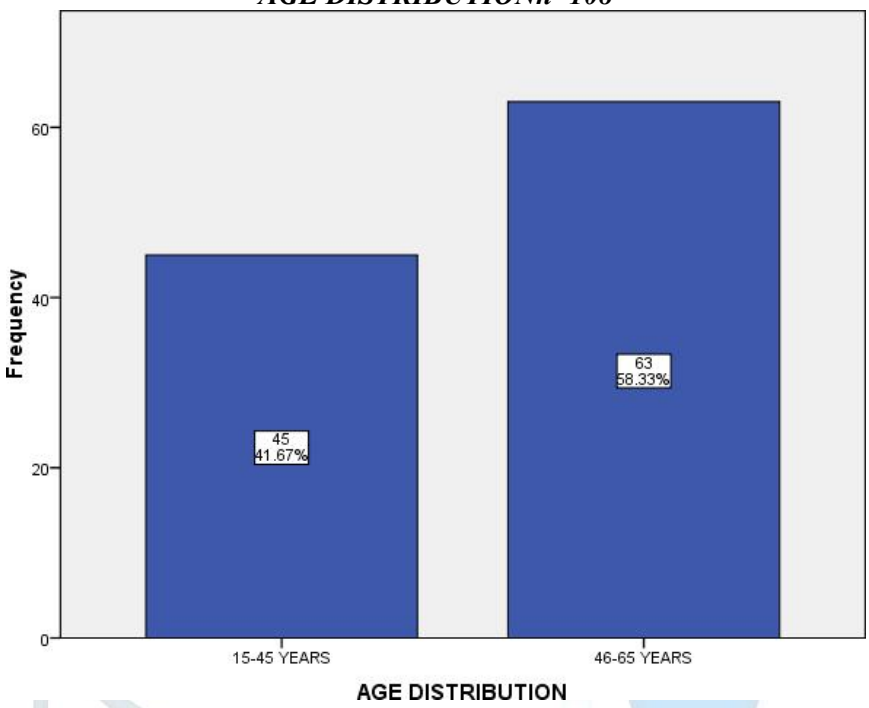

FIGURE-5
DURATON OF HOSPITAL STAY DISTRIBUTIONn=108

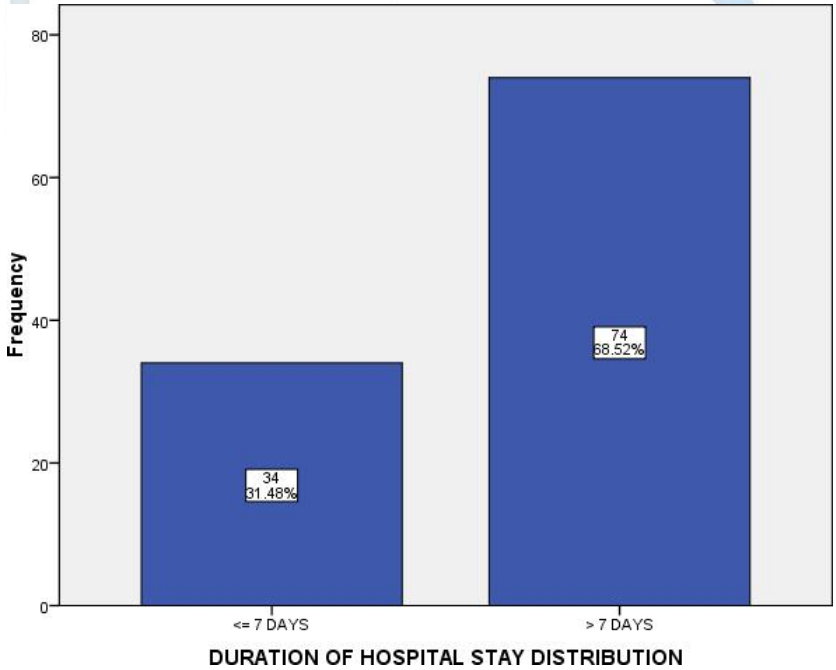

FIGURE-6
TYPE 2 DIABETES MELLITUS DISTRIBUTIONn=108

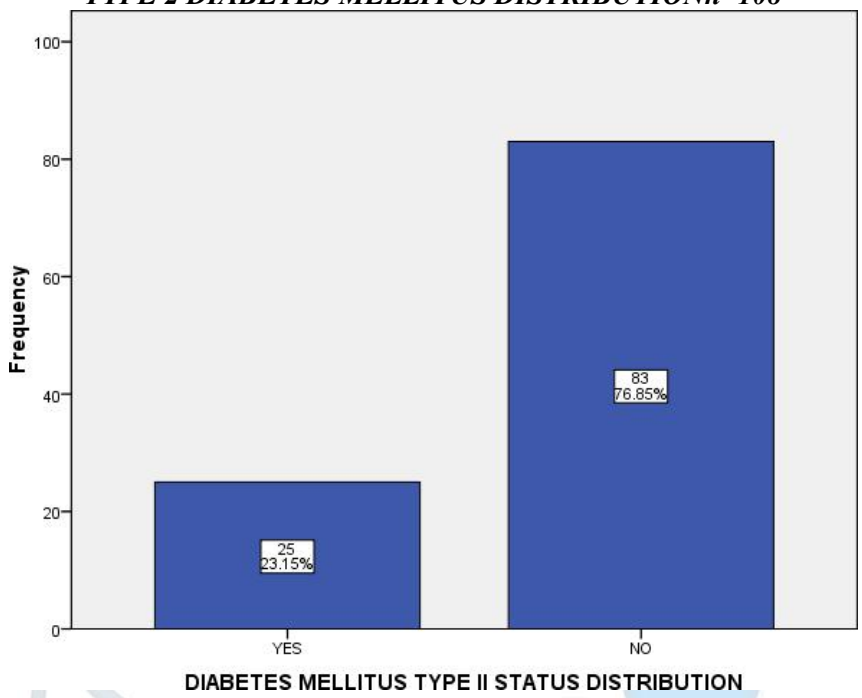

FIGURE-7
HYPERTENSION DISTRIBUTIONn=108

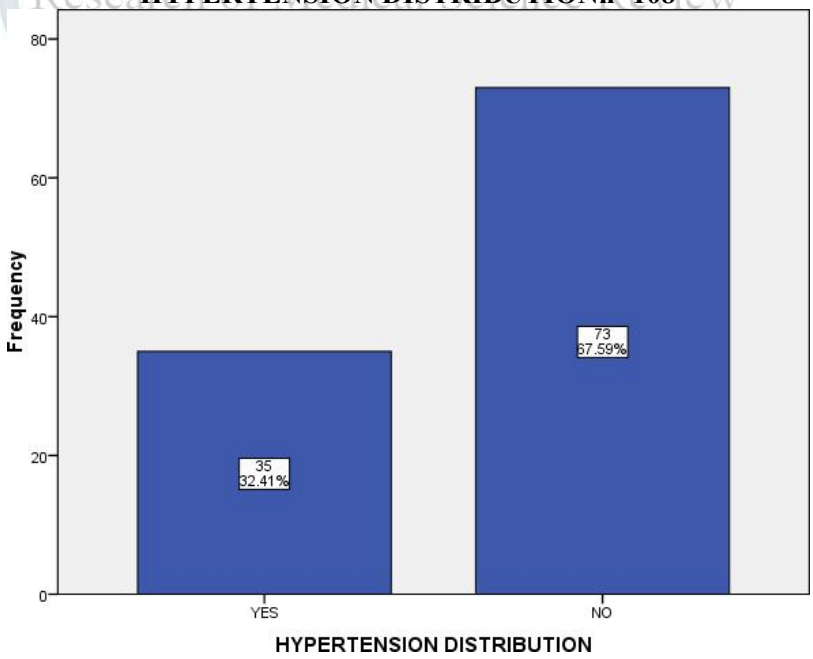

FIGURE-8
ISCHEMIC HEART DISEASE DISTRIBUTION
n=108

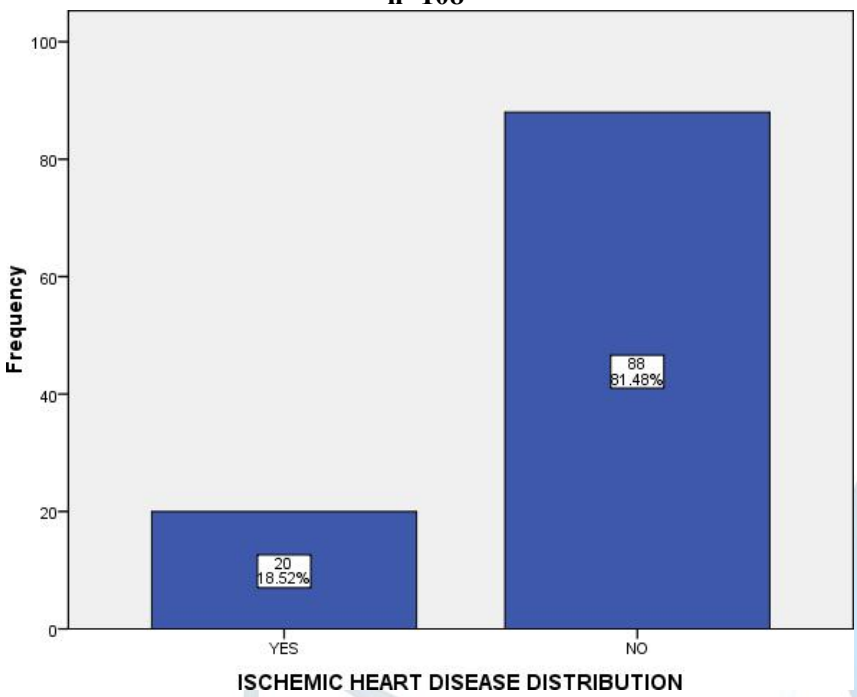

FIGURE-9
BMI STATUS DISTRIBUTIONn=108

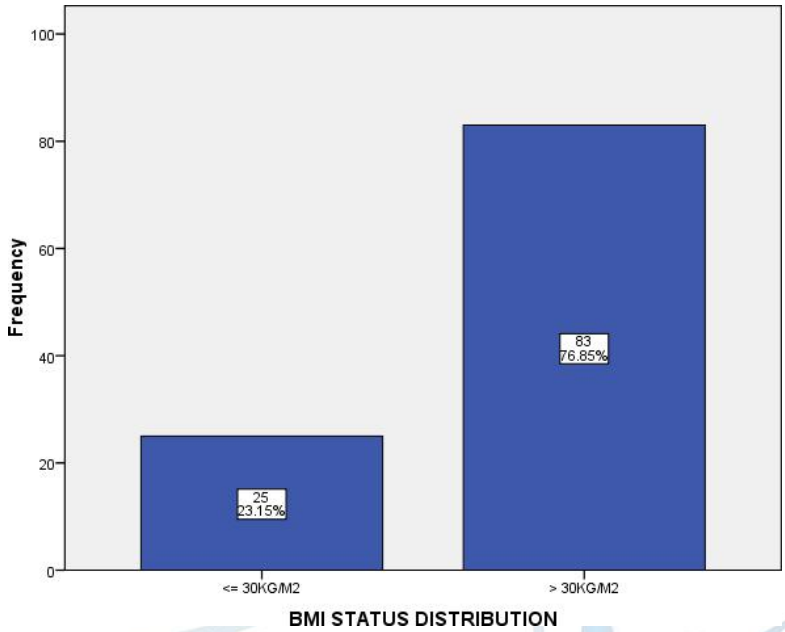

TABLE-2
DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITHPERITONITIS n=108

HYPERLACTATEMIA	MORTALITY		TOTAL
	YES	NO	
YES	33(TP)	22(FP)	55
NO	02(FN)	51(TN)	53
TOTAL	35	73	108

TABLE-3
DIAGNOSTIC ACCURACY, SENSITIVITY, SPECIFICITY, POSITIVE PREDICTIVE VALVE, NEGATIVE PREDICTIVEVALUE OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITH WITH PERITONITIS **n=108**

SENSITIVITY	TP/TP+FN x 100	**94.2%**
SPECIFICITY	TN/TN+FP x 100	**69.8%**
POSITIVE PREDICTIVE VALUE	TP/TP+FP x 100	**60%**
NEGATIVE PREDICTIVE VALUE	TN/FN+TN x 100	**96.2%**
DIAGNOSTIC ACCURACY	TP + TN/TOTAL PATIENTS x 100	**77.7%**

TABLE-4

DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITHPERITONITIS ACCORDING TO AGE n=108

AGE (YEARS)	HYPERLACTATEMIA	MORTALITY		TOTAL	
		YES	NO		
15-45	YES	05(TP)	08(FP)	13	**SEN 71.4%** **SPE 78.9%**
	NO	02(FN)	30(TN)	32	**PPV 38.4%** **NPV 93.7%**
	Total	07	38	45	**DA 77.7%**
46-65	YES	28(TP)	14(FP)	42	**SEN 100%** **SPE 60%**
	NO	00(FN)	21(TN)	21	**PPV 66.6%** **NPV 100%**
	Total	28	35	63	**DA 77.7%**

TABLE-5

DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITHPERITONITIS ACCORDING TO GENDER **n=108**

GENDER	HYPERLACTATEMIA	MORTALITY		TOTAL	
		YES	NO		
MALE	YES	11(TP)	09(FP)	20	**SEN 84.6%** **SPE 75%**
	NO	02(FN)	27(TN)	29	**PPV 58%** **NPV 93.1%**
	Total	13	36	49	**DA 77.5%**
FEMALE	YES	22(TP)	13(FP)	35	**SEN 100%** **SPE 88.8%**
	NO	00(FN)	24(TN)	24	**PPV 62.8%** **NPV 100%**
	Total	22	37	59	**DA 77.9%**

TABLE-6
DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITHPERITONITIS ACCORDING TO DURATION OF HOSPITAL STAY n=108

DURATION OF HOSPITALSTAY	HYPERLACTATEMIA	MORTALITY YES	MORTALITY NO	TOTAL	
≤7 DAYS	YES	05(TP)	07(FP)	12	**SEN 83.3%** **SPE 75%**
	NO	01(FN)	21(TN)	22	**PPV 41.6%** **NPV 95.4%**
	Total	06	28	34	**DA 73.5%**
>7 DAYS	YES	28(TP)	15(FP)	43	**SEN 96.5%** **SPE 66.6%**
	NO	01(FN)	30(TN)	31	**PPV 65.1%** **NPV 96.7%**
	Total	29	45	74	**DA 78.3%**

TABLE-7
DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITHPERITONITIS ACCORDING TO DIABETES MELLITUS TYPEII ***n=108***

DIABETES MELLITUS TYPEII	HYPERLACTATEMIA	MORTALITY YES	MORTALITY NO	TOTAL	
YES	YES	20(TP)	05(FP)	25	**SEN 100%** **SPE 00%**
	NO	00(FN)	00(TN)	00	**PPV 80%** **NPV 00%**
	Total	20	05	25	**DA 80%**
NO	YES	13(TP)	17(FP)	30	**SEN 86.6%** **SPE 75%**
	NO	02(FN)	51(TN)	53	**PPV 43.3%** **NPV 96.2%**
	Total	15	68	83	**DA 77.1%**

TABLE-8
DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITHPERITONITIS ACCORDING TO HYPERTENSION n=108

HYPERTENSION	HYPERLACTATEMIA	MORTALITY YES	MORTALITY NO	TOTAL		
YES	YES	22(TP)	08(FP)	30	**SEN**	**100%**
	NO	00(FN)	05(TN)	05	**SPE**	**38.4%**
	Total	22	13	35	**PPV**	**73.3%**
					NPV	**100%**
					DA	**77.1%**
NO	YES	11(TP)	14(FP)	25	**SEN**	**84.6%**
	NO	02(FN)	46(TN)	48	**SPE**	**76.6%**
	Total	13	60	73	**PPV**	**44%**
					NPV	**95.8%**
					DA	**78%**

TABLE-9
DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITH PERITONITIS ACCORDING TO ISCHEMIC HEART DISEASE ***n=108***

ISCHEMIC HEART DISEASE	HYPERLACTATEMIA	MORTALITY YES	MORTALITY NO	TOTAL		
YES	YES	06(TP)	08(FP)	14	**SEN**	**100%**
	NO	00(FN)	06(TN)	06	**SPE**	**42.8%**
	Total	06	14	20	**PPV**	**42.8%**
					NPV	**100%**
					DA	**60%**
NO	YES	27(TP)	14(FP)	41	**SEN**	**93.1%**
	NO	02(FN)	45(TN)	47	**SPE**	**76.2%**
	Total	29	59	88	**PPV**	**65.8%**
					NPV	**95.7%**
					DA	**81.8%**

TABLE-10

DIAGNOSTIC ACCURACY OF HYPERLACTATEMIA FOR PREDICTING MORTALITY IN PATIENTS ADMITTED WITHPERITONITIS ACCORDING TO BMI STATUS n=108

BMI STATUS	HYPERLACTATEMIA	MORTALITY		TOTAL	
		YES	NO		
≤30 KG/M2	YES	21(TP)	04(FP)	25	**SEN 50%** **SPE 50%**
	NO	21(FN)	04(TN)	25	**PPV 84%** **NPV 84%**
	Total	42	08	50	**DA 50%**
>30 KG/M2	YES	12TP)	18(FP)	30	**SEN 85.7%** **SPE 73.9%**
	NO	02(FN)	51(TN)	53	**PPV 40%** **NPV 96.2%**
	Total	14	69	83	**DA 75.9%**

DISCUSSION

Peritonitis due to perforation of the gastrointestinal tract is one ofthe most common surgical emergencies all over the world. Thereis paucity of data from Pakistan regarding its etiology, prognosticindicators, morbidity, and mortality patterns. Despite advances in surgical techniques, antimicrobial therapy, and intensive care support, management of peritonitis continues to be highly demanding, difficult, and complex. A majority of the patients present late, with septicemia, thus increasing the incidence of morbidity and mortality and complicating the task of the anesthesiologists to provide optimal perioperative care in these patients. Early prognostic evaluation of abdominal sepsis is desirable to select high-risk patients for more aggressive therapeutic procedures and to provide objective classification of the severity of the disease, as also to choose the optimal perioperative anesthetic management strategies.

A total of 108 patients who met the inclusion and exclusion criteria were included in this study. Mean age, height, weight, BMI and duration of hospital stay in our study was 44.23±13.57 years, 26.72±1.56 kg/m2, 158±7.28 cm, 78.7±9.87 kg and 9.08±5.51 days. 49 (45.4%) were male and 59 (54.6%) were female. Out of 108 patients, sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of hyperlactatemia for the prediction of mortality was found to be 94.2%, 69.8%, 60%, 96.2% and 77.7% respectively.

Mortality was 15.04% at 28 days. Age, SOFA, qSOFA, APACHE, preoperative lactate, MPI and site of perforation were significantly different between survivors and non-survivors. Arterial lactate values at preoperative (cut off 2.75 mmol/L), immediate postoperative (cut off 2.8 mmol/L) and 24h-postoperative period (cut off 2.45 mmol/L) independently predicted mortality at day 28. Combination of MPI and 24-h lactate value was best predictor of mortality with AUC 0.9.[15]

Lactic acid is an intermediate of carbohydrates and non- essential amino-acid metabolism, and its blood level is the net difference between its production and clearance. Lactic acid through Pasteur effect provides major energy to survive hypoxia. Lactate is produced in excess as a response to inflammatory mediators, as in peritonitis. Moreover, reduced lactate clearance may occur due to microcirculatory disarray, which could

affect oxygen utilisation by mitochondria at the tissue level and due to deranged renal function from sepsis or hypovolemia. Reversal of organ dysfunction in septic patients has been suggested to be partof a protective regulatory process, which induces a temporary hypometabolic state resembling hibernation that may protect thecells from dying and allow the possibility of functional recovery.

Overall mortality was 16.07% (36 patients) and morbidity was 63.39% (pulmonary complications commonest); preoperative lactate (more than 2.35 mmol/L), 24-h postoperative lactate (more than 2.05 mmol/L), need for vasopressors and mechanical ventilation independently correlated with morbidity and mortality. A simple prognostic scale constructed using cut-off values of AL_I , AL_{24} , need for vasopressor support and mechanical ventilation showed a sensitivity of 97.22% and specificity of 52.13% for predicting mortality. [16]

CONCLUSIONS

In conclusion, there are various indices mentioned in literature topredict morbidity and mortality due to sepsis. However, only a feware specific for peritonitis, but none of them take into account thepreoperative factors and laboratory investigations. Preoperative, immediate postoperative and 24-h postoperative lactate value independently predict 28-day mortality in peritonitis patients undergoing emergency laparotomy. Furthermore, age of the patient, the duration of symptoms, delay in surgical intervention,preoperative blood sugar, blood urea, and serum creatinine levels are independent predictors of mortality in patients with perforation peritonitis. Recognizing such patients early may help anesthesiologists in risk stratification and in providing an early goal-directed therapy and optimal perioperative care; thus reducing the morbidity and mortality rates.

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