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ORIGINAL ARTICLE

STUDY ON SEPSIS-CLINICAL, BIOCHEMICAL PROFILE AND CORRELATION WITH BLOOD CULTURE

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ABSTRACT: AIM: To study the pattern and outcome of the patients with sepsis. **OBJECTIVE:** To find the occurrence of positive blood culture among the different grades of sepsis and assess the type of organ dysfunction commonly encountered. **MATERIAL AND METHOD:** The present study is a cross sectional study, conducted over the patient of sepsis, who are admitted JAH Group of hospital, Gwalior, M. P. Data was collected from 100 patients. Blood sample for bacterial culture/sensitivity were collected and sent soon after a diagnosis is made. Complete data was obtained during the stay in the hospital from the time of diagnosis which includes the hospital stay. The onset of severe sepsis and septic shock were assessed during hospital stay. **RESULT:** Out of the 100 patients, the incidence of sepsis was found to be high in the elderly age group. 39% are males and 61% are females. 50% had sepsis, 39% had severe sepsis, 11% had septic shock. The common organ dysfunction encountered were renal 50%, followed by hepatic (46%), CNS (2%) and respiratory (2%).The number of organ dysfunction in individual patients are none in 50(50%), 1 in 47(47%) and 2 in 3(3%). Out of 100 patients, 26(26%) had positive blood culture and 74(74%) had no organism grown in blood culture. According to grade of sepsis, patient with only sepsis had 100% recovery, while 92.31% of severe sepsis recovered, 7.69% expired and those with septic shock 72.3% recovered and 27.27% expired. **CONCLUSION:** In this study we conclude that positive blood cultures were found in 26% of patients which are predominantly gram negative organisms. The common organ failure we encountered was renal. The common source of infection is respiratory tract followed by urinary tract. The prognosis was good in initial stages of sepsis, but was grave with septic shock (27.7% mortality). Hence early recognition and prompt management of sepsis is of paramount importance.

KEYWORDS: Sepsis, Sepsis outcome, Sepsis statistics.

INTRODUCTION: Sepsis is the most common cause of death in patients in the intensive care unit, and often leads to the development of multiple organ dysfunction syndrome (MODS). Although there have been many attempts to prevent the development of MODS, mortality estimates for sepsis are still consistently in the range of 40–60%.(1) In the modern intensive care unit, gram-positive bacteria account for up to 50% of severe sepsis, yet the pathogenesis of gram-positive sepsis is more poorly understood than that of gram-negative sepsis.(2) There is an increasing amount of experimental evidence showing that fundamental differences exist in the host response to gram-positive bacteria compared with the response to gram-negative bacteria. It is generally thought that one of the fundamental differences between gram-positive and gram-negative bacteria is the way in which they initiate disease.(3)

Previous studies indicated that the liver is a major organ responsible for the initiation of MODS during sepsis, as it plays a central role in metabolism and in host defense mechanisms.(4,5)

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In general, the liver participates in host defense and tissue repair through hepatic cell cross-talk that controls most of the coagulation and inflammatory processes. When this control is not adequate, a secondary hepatic dysfunction may occur that some-times leads to MODS and death.[6,7]

MATERIAL AND METHODS: The present study was conducted in J A group of hospital, Gwalior, M.P. (G. R. Medical College, Gwalior, M. P.). The present study is a cross sectional study, conducted over a period between September 2011 to November 2012 on patient of sepsis. The patients of sepsis who are admitted within a period of 1 year in JAH Group of hospital, Gwalior, M. P. were enrolled in the present study. Total of 100 patients were included in the study. Data were collected from 100 patients. The criteria for selection is, any patient admitted in J. A. Group of Hospitals, Gwalior (M. P.) who fulfill the criteria for sepsis according to consensus conference criteria i.e. systemic inflammatory response syndrome caused by infection as underlying etiology (or) at least clinical evidence of infection. Blood sample for bacterial culture/sensitivity were collected and sent soon after a diagnosis is made. Complete data was obtained during the stay in the hospital from the time of diagnosis which includes the hospital stay. The onset of severe sepsis and septic shock were assessed during hospital stay.

Inclusion Criteria:

- All patients >15yrs of age who fulfil the criteria for sepsis.
- All patients with or without underlying organ dysfunction on admission will be taken into consideration.

Exclusion Criteria: Patients with no evidence of infection.

Method and Data Collection: All the patients of sepsis admitted in JA group of hospital were screened; informed and written consent was taken from the eligible patients and enrolled in the present study. The patients were interviewed and underwent thorough physical examination. Their Data comprising of name, age, sex, personal, occupational and proper history was recorded on the proforma. All patients were evaluated on the basis of clinical and biochemical parameters.

History and Examination: A detailed history was elicited from all patients included in this study with emphasis on the symptomatology of sepsis. Their complete physical and systemic examination was done and vital signs (Pulse, BP, RR, and Temperature) were recorded.

Investigations: All patients were subjected to the following investigation at the time of inclusion into the study.

- Routine hemogram.
- Random blood sugar.
- Liver function test.
- Renal function test.
- Urine R/M and C/S.
- Blood culture sensitivity.
- Chest X-Ray.
- Sputum C/S.
- USG Abdomen.

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Grading of sepsis was done according to consensus conference 1991 American college of chest physicians (ACCP) and society of critical care medicine (SCCM).

Statistical Analysis: Data was analyzed using Microsoft excel, the software statistics calculator described data was analyzed using students test. Two tailed P value <0.05 was considered significant.

RESULT AND ANALYSIS: A total number of 100 cases of sepsis admitted in J.A. Group of Hospitals, who met the inclusion criteria, were studied. Out of the 100 patients, the incidence was found to be high in the elderly in the (45-54), (55-64), (65-74) and (>75) age group. (Table-1).

In our study 45(45%) are males and 55(55%) are females. (Table-2).

Out of 100 patients included, 50(50%) had sepsis, 39(39%) had severe sepsis, 11(11%) had septic shock. (Table-3).

In our study out of 100 patients the mortality ranged from nil for patient with sepsis, 7.69% with severe sepsis and 27.27% in patients with septic shock. (Table-4).

In our study, the common organ dysfunction to be encountered are renal 50%, followed by hepatic (46%), CNS (2%) and respiratory (2%). (Table-5).

The number of organ dysfunction in individual patients are none in 50(50%), 1 in 47 (47%) and 2 in 3(3%). The mortality associated with these are none, 10.63% and 33.3% respectively? (Table-6).

Out of 100 patients, 26(26%) had positive blood culture and 74(74%) had no organism in blood culture. (Table-7).

Out of those with bacterial growth in blood culture i.e. 26 out of 100 patients, 18(69.23%) had gram negative growth and 8(30.76%) had gram positive growth. (Table-8).

Blood cultures were positive in 26(26%) of patients organism predominantly gram negative (69.23%) and (30.76%) were gram positive. The common gram negative organisms are Klebsiella, citrobacter, acenetobacter and staphylococcus aureus being the common gram positive bacteria. (Table-9).

This table reveals that most common focus of sepsis as respiratory tract 46%, followed by urinary tract 32%, abdomen 20% and skin 2%.(Table-10).

Most common underlying illness was pneumonitis (30%) followed by plasmodium vivax (14%), pulmonary TB (8%), COPD (7%), diabetes mellitus (8%). (Table-11).

The duration of hospital stay varied from a minimum of 1 day to maximum of 13 days and a mean duration of 5.38 days. (Table-12).

Out of 100 patients, 94(94%) recovered from sepsis and 6(6%) of the patients expired. (Table-13).

We observed the 94 (94%) recovered and 6(6%) expired. According to grade of sepsis, patient with only sepsis had a 100% recovery, while in severe sepsis92.31% recovered, 7.69% expired and those with septic shock 72.3% recovered and 27.27% expired. (Table-14).

DISCUSSION: The incidence of the disease in our study group was 20% in(15-24) year of age group, 12% in(25-34), 12% in(35-44), 18% in (45,-54), 18% in(55-64), 13% in (65-74), and 07% in >75 year of age group.

45% of the study population was male, and female comprised 55% of the study.

Bertrand Guidet et al[8] in their study on sepsis and organ dysfunctions who observed that the incidence of sepsis steeply increases above the age of 50 years and frequently involving men.

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Eliezer Silva et al[9] also found that the mean age for patients with sepsis was 65.2 years with 58.7% of them being males.

Flatten et al[10] observed that the mean age for incidence was 57.9 years.

Gestel et al[11] in their observation in Dutch ICU's found that 70% of the patients were older than 60 years and male to female ratio was 1.7.

In our study of 100 patients with sepsis, 50%were diagnosed to have sepsis, 39% had severe sepsis and 11% with septic shock. The mortality rate is nil for sepsis to 7% in severe sepsis and 27.27% in patients with septic shock.

Eliezer Silva et al in their study involving1383 patients with sepsis found that the incidence of sepsis was found in 46.9%, severe sepsis in27.3% and septic shock in 23% with a mortality rate of 33.9% for sepsis, 46.9 % in severe sepsis and 52.2% with patients in septic shock.

Hans Flatten et al[12] in his analysis of data from patients in various ICU's in Norway in 1999 identified 6,665 patients with sepsis of them 2,121 patients had severe sepsis and the mortality rate is 15% for uncomplicated sepsis and 31.8% in severe sepsis.

Our observations revealed that the common organs to get involved are renal (50%) followed by hepatic (46%), respiratory (2%), CNS (2%).

Mortality rate is nil for no organs involved to 10.63 % for single organ dysfunction, 33.33% in two organ dysfunction.

Bertrand Guidet et al in their observation concluded respiratory followed by circulatory and renal dysfunction as the common organs to be involved. They also noted that number of organ dysfunctions in a given patient is proportional to the mortality rate as no organ involvement is associated with 5.5% mortality, for single organ involvement with10.5% and two organ involvement with 42.7% mortality.

In our study we found 26% of our patients with a positive blood culture with predominant Gram negative growth, Klebsiella, Citrobacter, Acenetobacter being the most common organisms and Staphylococcus aureus the common gram positive organism.

Whereas Hugonnet et al[13] in their observation comparing two groups of patients with sepsis during 80's and 90's concluded that spectrum of organisms in blood culture has changed from predominant Gram negative in the 80's to Gram positive in 90's and positive blood cultures from 21% in 80's to 47% in 90's.

But Guidet et al[14] observed positive blood cultures in 32.2% of patients with sepsis with Pseudomonas being the predominant Gram negative organism and Staphylococcus the Gram positive organism which is in agreement with our observation Flatten19 in his observation of 6,665 patients with sepsis found 31.8% of them with positive blood culture.

In our study we observed that the respiratory tract was the most common source of infection (46%), followed by urinary tract (32%), skin and abdomen (20%) and skin related infection in (02%) of the studied group.

The BASES study conducted by Eliezer Silva et al, concluded that the main source of infection was respiratory tract (65.6%) followed by urinary tract (5.6%), abdominal/surgical wound (4%), blood stream (2.5%) and unknown sites (21.4%).

Gestel and associates in their observation in Dutch Intensive Care Units concluded that the most common site of infection were the lungs 47% and the abdomen 34%.

Bertrand Guidet et al in their study of sepsis and organ dysfunction concluded that the common foci of infection are the respiratory tract followed by abdomen and cardiovascular.

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Our results are also in accordance with Albertic et al,[15] Vincent JL et al,[16] Ewigs et al,[17] Curtis JR et al.[18]

Our study revealed Plasmodium vivax malaria (14%), diabetes (08%), hypertension (03%), pulmonary tuberculosis (08%), COPD (07%), chronic kidney disease (04%), CVA (01%) and Plasmodium falciparum malaria (04%) as the common underlying illness in patients with sepsis.

Eliezer Silva et al during their study of sepsis have found that the frequency of chronic diseases coexisting was as follows: Hypertension in (38.1%), Diabetes (21.7%), Malignancy (18.3%), COPD (14.0%), Chronic Renal Failure (7.5%), Liver cirrhosis (4.3%) and CCF (4.1%).

Gestel et al and their associates in their study observed that diabetes, chronic heart failure, history of cerebrovascular accidents and chronic kidney disease were commonly seen in patients with sepsis.

Our patients with sepsis had an average of 5.38 days hospital stay.

Silva et al in their observation noted that the average I.C.U. stay for patients with sepsis was 4 days duration (2-9) days.

Flatten et al in his analysis found that the mean hospital stay for patients with sepsis was 14.9 days.

Gestel et al and his colleagues found that the average stay in hospital was 13.3 +1.1 day in patients with severe sepsis.

In our study, we observed overall 6% mortality.

Silva et al in their study observed a mortality of 21.8%.

Hugonnet et al[19] and associates noted a mortality of 37% in their study of patients with sepsis.

The 28-day mortality was 1/42 (2%) among septic patients, 1/20 (5%) among patients with severe sepsis, and 0/5 (0%) among patients with septic shock. Given the low numbers, the results must be interpreted with caution, but the observed mortality is lower than in most other studies of patients with sepsis and septic shock.[20,21,22,23] Martin GS et al,[20] Brun-Buisson C et al.[21] Rangel-Frausto MS et al [22], Brun-Buisson C et al.[23]

CONCLUSION: In this study we concluded that positive blood cultures were found in 26% of patients which are predominantly gram negative organisms. The common organ failure we encountered was renal. The common source of infection was respiratory tract followed by urinary tract. The prognosis was good in initial stages of sepsis, but was grave with septic shock (27.7% mortality). Hence early recognition and prompt management of sepsis is of paramount importance.

Sl. No.	Age group (In yrs)	Number	Percentage (%)	Mean±SD
1.	15-24	20	20%	18.9±2.86
2.	25-34	12	12%	27.25±2.45
3.	35-44	12	12%	38.33±2.73
4.	45-54	18	18%	48.84±2.99
5.	55-64	18	18%	58.52±2.54
6.	65-74	13	13%	68.30±2.35
7.	> 75	7	7%	79.14±5.92

Table 1: Age distribution

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Sl. No.	Sex	Number	Percentage (%)
1.	Male	45	45%
2.	Female	55	55%

Table 2: Sex distribution

Sl. No.	Grade	Number	Percentage (%)
1.	Sepsis	50	50%
2.	Severe sepsis	39	39%
3.	Septic shock	11	11%

Table 3: Grading of sepsis

Sl. No.	Grade	Number	Percentage (%)
1.	Sepsis	0	0%
2.	Severe sepsis	3	7.69%
3.	Septic shock	3	27.27%

Table 4: Mortality rate in relation to grade of sepsis

Sl. No.	Type of Organ Dysfunction	Number	Percentage (%)
1	Renal	25	50%
2	Hepatic	23	46%
3.	CNS	1	2%
4.	Respiratory	1	2%

Table 5: Organ dysfunction

No. of Organ Dysfunction	Number	Percent	Mortality Number	Mortality (Percent)
0	50	50%	0	0%
1	47	47%	5	10.63%
2	3	3%	1	33.3%
Total	**100**	**100%**	**6**	

Table 6: Number of organ dysfunction and associated mortality

Sl. No.	Blood Culture	Number	Percentage
1.	Positive	26	26%
2.	No growth	74	74%

Table 7: Blood culture - status

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		Gram Stain		Total
		Positive	Negative	
Blood culture	Negative	-	-	-
	Positive	8	18	26
Total		**8**	**18**	

Table 8: Gram's stain

Sl. No.	Blood Culture	Number	Percentage (%)
1.	Acenetobacter	3	3%
2.	Citrobacter	4	4%
3.	Staph. Aureus	4	4%
4.	Klebsiella	6	6%
5.	Pseudomonas	2	2%
6.	E.Coli	1	1%
7.	Staphylococcus spp. (Other)	3	3%
8.	Gram negative Bacilli	2	2%
9.	Streptococcus spp.	1	1%
7.	No Growth	74	74%

Table 9: Blood culture types of organisms

Sl. No.	Type	Frequency	Percentage
1.	Respiratory Tract	46	46%
2.	Urinary Tract	32	32%
3.	Skin	2	2%
4.	Abdomen	20	20%
	Total	**100**	**100%**

Table 10: Source of infection

Sl. No.	Underlying Illness	Number	Percentage
1.	Diabetes mellitus	8	8%
2.	Hypertension	3	3%
3.	Pulmonary TB	8	8%
4.	COPD	7	7%
5.	CKD	4	4%
6.	CVA	1	1%
7.	G.B. Calculus	1	1%
8.	Liver Abscess	1	1%
9.	Plasmodium Vivax Malaria	14	14%
10.	Chronic Liver Disease	3	3%
11.	RHD	7	7%
12.	CAD	3	3%

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13.	Compressive Myelopathy	1	1%
14.	Plasmodium Falciparum Malaria	4	4%
15.	Bronchial Asthma	1	1%
16.	Pneumonitis	30	30%
17.	Hepatitis	2	2%
18.	Herpes Labialis	1	1%
19.	Heat Stroke	1	1%

Table 11: Number of underlying illness

	No. of patients	Minimum	Maximum	Mean	Std. Deviation
No. of days of hospital stay	100	1	13	5.38	2.13

Table 12: Duration of stay in hospital

Sl. No.	Outcome	Number	Percentage
1.	Expired	6	6%
2.	Recovered	94	94%

Table 13: Final outcome

		Grade			Total
		Sepsis	Severe sepsis	Septic shock	
Final outcome	Expired	0(0%)	3(7.69%)	3(27.27%)	6(16%)
	Recovered	50(100)	36(92.31%)	8(72.3%)	94 (94%)
Total		**50(100%)**	**39(100%)**	**11(100%)**	**100(100%)**

Table 14: Final outcome in relation to Grade of Sepsis

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