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A STUDY ON THE SIGNIFICANCE OF BLOOD GLUCOSE VARIATIONS AND THE OUTCOME INCHILDREN AGED 1 MONTH TO 1 YEAR WITH SEPTICEMIA ADMITTED IN PEDIATRIC INTENSIVE CARE UNIT OF A TERTIARY CARE CENTER

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Abstract

Introduction: Sepsis is defined as host response to infection and is an important cause of morbidity and mortality all over the world. In developing countries like India sepsis was found to be an important cause of infant mortality and morbidity. Hyperglycemia, hypoglycemia and glucose variability is a common complication in critically ill and is associated with increase in morbidity and mortality.

Materials and Methods: For all infants admitted with clinical picture of sepsis, detailed history, general examination, systemic examination and glucose levels were recorded. Purposive sampling technique was used. Diagnosis of sepsis is made based on the international consensus of paediatric sepsis. All infants admitted with clinical picture of sepsis were evaluated with complete blood picture, C - reactive protein, Blood culture, ABG. Chest X ray, CSF culture, Urine and stool culture were done as indicated. Subjects were evaluated for organ dysfunction like RFT, LFT profile, coagulation profile. All cases received treatment according to the standard sepsis guideline.

Results: A study was conducted among 100 patients with sepsis age ranged from 1 month to 12 months to assess the significance of blood glucose levels as a prognostic indicator in infants with sepsis. it is seen that in our study majority had pneumonia (40%) as primary foci followed by sepsis without foci (27%) and meningitis (16%). the distribution of blood glucose levels in the study participants among them 48 % had hyperglycaemia, 30% had euglycemia, 13 % had glucose variability and 9 % had hypoglycaemia. 16.7 % of patients with hyperglycemia , 11.1 % of patients with hypoglycemia , 30.8% of patients with glucose variability and 6.7 % of patients witheuglycemia died , p value >0.05 not significant.

Conclusion: Majority of the infants with sepsis had dysglycemia. Dysglycemic subjects had increased risk of mortality, however the difference was not statistically significant. Subjects with dysglycemia had longer duration of hospital stay and the observation was statistically highly significant'. Among the dysglycemic subjects, infants with hyperglycemia and glucose variability had longer stay followed by hypoglycemic subjects.

Key Words: Sepsis, pneumonia, blood glucose, euglycemia, hypoglycaemia.

INTRODUCTION

Sepsis is defined as host response to infection and is an important cause of morbidity and mortality all over the world. In developing countries like India sepsis was found to be an important cause of infant mortality and morbidity.[1]

Hyperglycemia, hypoglycemia and glucose variability is a common complication in critically ill and is associated with increase in morbidity and mortality.

Hyperglycaemia is a stress response seen in critically ill patients. Peripheral insulin resistance, relative insulin deficiency, and impaired glucose metabolism contributes to hyperglycemia. Drugs like glucocorticoids and catecholamines further aggravatesthese biological changes.[2]

Hypoglycaemia is relatively less common than hyperglycaemia in critically ill patients but persistent hypoglycaemia is related to increased mortality and neurological sequelae in critically ill neonates and infants.[3]

The Glucose Variability (GV), otherwise glucose fluctuation, represents the fluctuation of glucose levels over time. It refers to a non-stationary state where glucose levels fluctuates between high and low values and is linked with poor prognosis.[4]

Blood glucose regulation is a complex mechanism which gets disrupted in sepsis. Dysglycemia in adult patients with septicaemia had poor prognosis. There are few research available on the prevalence and prognostic importance of dysglycemia ininfants with sepsis.[5]

AIMS

To study the significance of blood glucose level variations as a prognostic indicatorin infants with sepsis.

OBJECTIVES

1. To determine the incidence of Hyperglycaemia, Hypoglycaemia and Glucose variability in infants with sepsis.
2. To assess the incidence of mortality in infants with sepsis based on their blood glucose levels.
3. To observe the duration of hospital stay in infants with sepsis based on their blood glucose levels.

MATERIALS AND METHODS

For all infants admitted with clinical picture of sepsis, detailed history, general examination, systemic examination and glucose levels were recorded. Purposive sampling technique was used. Diagnosis of sepsis is made based on the internationalconsensus of paediatric sepsis.

All infants admitted with clinical picture of sepsis were evaluated with complete blood picture, C - reactive protein, Blood culture, ABG

Chest X ray, CSF culture, Urine and stool culture were done as indicated. Subjects were evaluated for organ dysfunction like RFT, LFT profile, coagulation profile. All cases received treatment according to the standard sepsis guideline.

Admission glucose levels are measured in biochemistry laboratory in our institution and was measured by a qualified biochemist. 6 hours, 12 hours and 24 hours glucose concentrations were measured with bedside glucometer, according to manufacturer's instructions, the pulp of the thumb was first sterilized using a cotton wool and methylated spirit and allowed to air dry. A sterile 30 G lancet was then used to prick the pulp of the thumb The glucometer was switched on and a test strip was inserted into the sensor of the glucometer, the test strip was used to make contact with the whole blood, which flows into the test strip by capillary action and results were read accordingly .One touch select simple glucometer was used. Glucometer was calibrated at the biochemistry laboratory for every twentieth reading. A difference of less than 10% between that measure by glucometer and that by biochemistry laboratory was regarded as acceptable.

Patients with dysglycemia had more frequent readings as advised by the treating team. Patients with hypoglycaemia received standard treatment protocol, the only intervention in hyperglycaemia cases were restriction of intravenous dextrose fluids. Patients were classified into four groups based on their blood glucose levels as hyperglycaemic, hypoglycaemic, glucose variability and euglycemic and was assessed for mortality and duration of hospital stay in survivors.

Outcome: Mortality, Length of hospital stay.

STATISTICAL ANNALYSIS: Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min - Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. The following assumptions on data was made, Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more Variables of patients, unpaired t-test has beenused to find the significance culture positivity Statistical software: The Statistical software namely, SPSS 26.0, EPI Info were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

ETHICAL CONSIDERATION: Ethical and research clearance was procured from the ethical committee, Government Medical College, Ananthapur. Permission to conduct the study was acquired from the Department of Pediatrics, Government General Hospital, Ananthapur.

RESULTS

A study was conducted among 100 patients with sepsis age ranged from 1 month to 12 months to assess the significance of blood glucose levels as a prognostic indicator in infants with sepsis.

Table 1: AGE DISTRIBUTION OF STUDY PARTICIPANTS

Age Group	No Of Patients	Percentage
2 - 4 Months	41	41.0
5 - 7 Months	28	28.0
8 - 10 Months	23	23.0

> 10 Months & Above	8	8.0
TOTAL	100	100.0

Graph 1: AGE DISTRIBUTION OF STUDY PARTICIPANTS

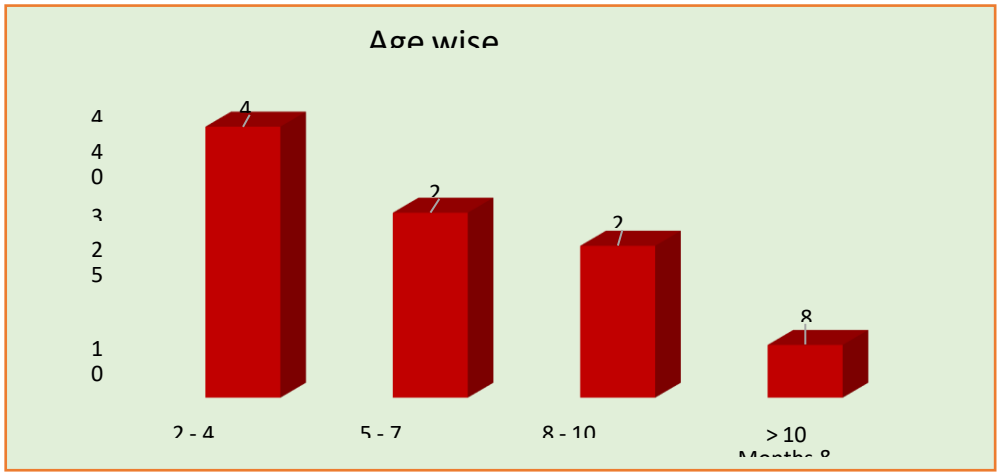

Table 1 shows the age distribution of the study population, it demonstrates that majority of the patients belong to age group between 2-4 months (41%) and it isexpressed in graph 1.

Table No. 2: GENDER DISTRIBUTION OF STUDY PARTICIPANTS

Gender	No. of Patients	Percentage %
Male	51	51.0
Female	49	49.0
Total	100	100.0

Graph 2: GENDER DISTRIBUTION OF STUDY PARTICIPANTS

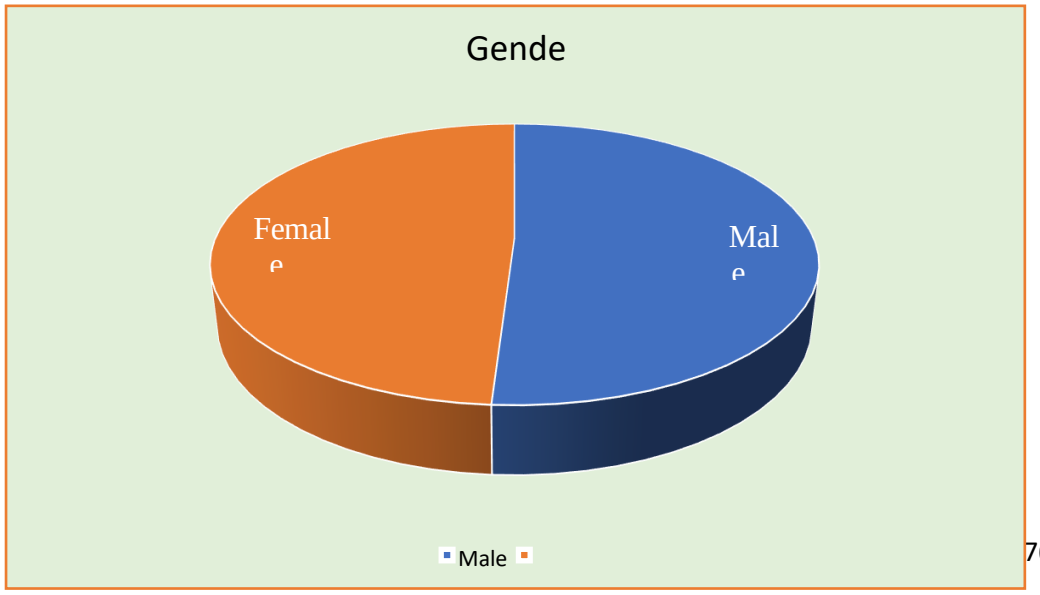

Table shows the gender distribution of the study participants. Among them 51 %were male and 49 % were females. It is expressed in graph 2.

Table No 3: DISTRIBUTION OF SIGNS AND SYMTPOMS IN STUDYPARTICIPANTS

Admission in Hospital	No. of Patients (n=100)	%
Fever	93	93.0
Decreased activity	100	100.0
Poor feeding	95	95.0
Abdominal distension	19	19.0
Fast breathing	54	54.0
Diarrhoea	22	22.0
Vomiting	49	49.0
Seizures	24	24.0
Shock	18	18.0
Bleeding manifestations	10	10.0
Organomegaly	50	50.0

Graph 3: DISTRIBUTION OF SIGNS AND SYMTPOMS IN STUDYPARTICIPANTS

Table 3 shows the signs and symptoms of the study participants, all of them had decreased activity and majority of the patients had symptoms like poor feeding (95%), fever (93 %), fast breathing (54%). It is demonstrated in graph 3.

Table 4 DISTRIBUTION OF PRIMARY FOCI IN STUDY PARTICIPANTS

Primary FOCI	No. of Patients	%
AGE	14	14.0
MENIGITIS	16	16.0
OSTEOMYELITIS	2	2.0
Pneumonia	40	40.0
Septicaemia without foci	27	27.0
UTI	1	1.0
Total	100	100.0

Graph 4: DISTRIBUTION OF PRIMARY FOCI IN STUDY PARTICIPANTS

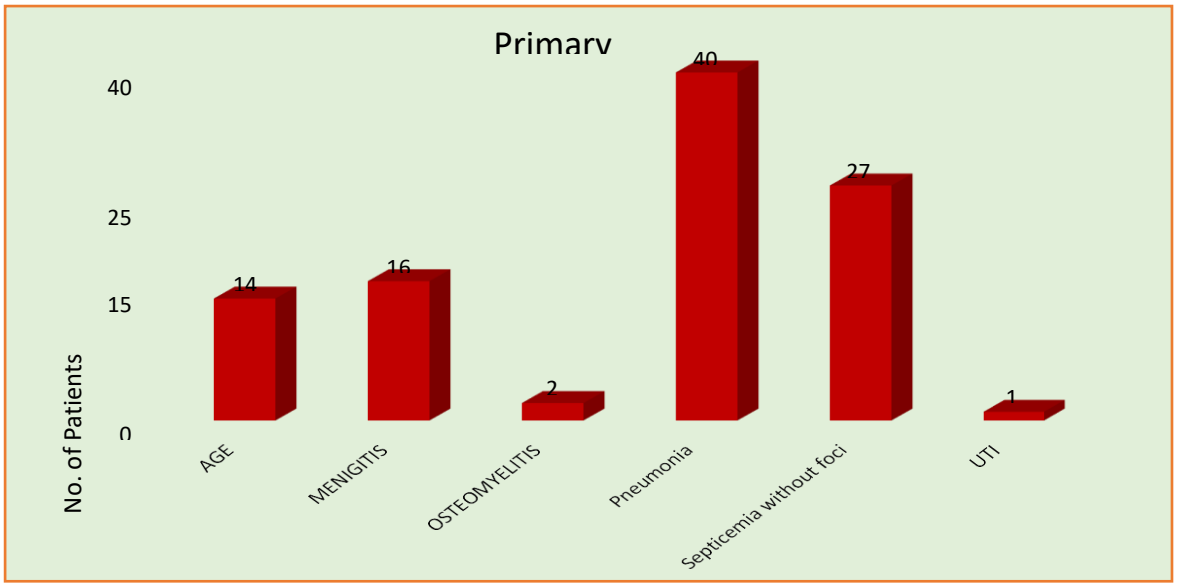

Table 4 shows the distribution of sepsis foci in the study population, it is seen that inour study majority had pneumonia (40%) as primary foci followed by sepsis without foci (27%) and meningitis (16%).

Table 5: CULTURE POSITIVITY IN STUDY PARTICPANTS

Culture	No. of patients	%
Positive	37	37.0%
Negative	63	63.0%

Table 5 shows that 37% of patients had culture positive sepsis and 63% had culture negative sepsis.

Table 6: BLOOD GLUCOSE LEVELS IN STUDY PARTICIPANTS

	No. of Patients (n=100)	**%**
Hyper Glycaemia	48	48.0
Hypoglycaemia	9	9.0
Glucose Variability	13	13.0
Euglycemia	30	30.0

Table 6 shows the distribution of blood glucose levels in the study participants among them 48 % had hyperglycaemia, 30% had euglycemia, 13 % had glucosevariability and 9 % had hypoglycaemia.

Table 7: DISTRIBUTION OF OUTCOME AMONG STUDY PARTICIPANTS

Total Mortality	**No. of Patients**	**%**
Recovered	85	85.0
Death	15	15.0
Total	100	100.0

Table 7 shows that of the 100 participants 15 had died and 85 survived.

Table 8: INCIDENCE OF MORTALITY IN RELATION TO BLOOD GLUCOSELEVELS

	Death					
	Recovery ((n=85)		Death (n=15)		Total (N=100)	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
Hyperglycaemia	40	83.3	8	16.7	48	100.0
Hypoglycaemia	8	88.9	1	11.1	9	100.0
Glucose Variability	9	69.2	4	30.8	13	100.0
Eluglycemia	28	93.3	2	6.7	30	100.0

Table 8 shows that 16.7 % of patients with hyperglycemia , 11.1 % of patients with hypoglycemia , 30.8% of patients with glucose variability and 6.7 % of patients witheuglycemia died , p value >0.05 not significant.

Graph 9: DURATION OF HOSPITAL STAY IN SURVIVOR IN RELATION TOBLOOD GLUCOSE LEVELS

	Hyper Glycemi (n=40)		Hypoglycaemi (n=8)		Glucose Variability (n=9)		Euglycemia (n=28)		Sig.
	N	%	N	%	N	%	N	%	
4 – 6 Days	0	0	1	12.5	0	0.0	20	71.4	$\chi 2 = 68.205^{**}$;(p = 0.000) ; df= 12; Highly Significant
7 – 9 Days	6	15.0	4	50.0	3	33.3	5	17.9	
10 – 12 Days	10	25.0	3	37.5	0	0.0	0	0.0	
13 - 15Days	21	52.5	0	0	5	55.6	3	10.7	
> 15Days	3	7.5	0	0	1	11.1	0	0.0	
Total	40	100	8	100	9	100	28	100	F-test
Mean	12.78 ±3.512 Days		8.13±1.885Days		12.44 ±4.503 Days		6.14 ±2.953 Days		24.105**P=0.000

****P<0.001; Highly significant;**

Table 9 shows the duration of hospital stay among survivors in relation to blood glucose levels. Mean duration of stay in euglycemic patients was 6.14 ± 2.953 days, in hyperglycaemic patients were 12.78 ± 3.512 days, in hypoglycaemia 8.13±1.885 days and in glucose variability 12.44 ± 4.503 days.

Table 10: DURATION OF ICU STAY IN SURVIVORS IN RELATION TO BLOOD GLUCOSE LEVELS

	Hyper Glycemi (n=40)		Hypoglycaemi (n=8)		Glucose Variability (n=9)		Euglycemia (n=28)		Sig.
	N	%	N	%	N	%	N	%	
First Day	5	12.5	0	0.0	0	0.0	20	71.4	$\chi 2$ = 72.742**;(p = 0.000) ; df= 18;Highly Significant
2 Day	1	2.5	5	62.5	0	0.0	4	14.3	
3 Day	8	20.0	3	37.5	3	33.3	3	10.7	
4 Day	19	47.5	0	0.0	4	44.4	1	3.6	
5 Day	4	10	0	0.0	1	11.1	0	0.0	
6 Day	2	5.0	0	0.0	1	11.1	0	0.0	
7 Day	1	2.5	0	0.0	0	0.0	0	0.0	
Total	40	100	8	100	9	100	28	100	F-test
Mean	3.65 ± 1.37 Days		2.38±0.52 Days		4.00 ± 1.00 Days		1.46 ± 0.84 Days		24.680** P=0.000

**P<0.001 ; Highly significant;

T able 10 shows the duration of ICU stay in survivors in relation to blood glucose levels. The mean duration of ICU stay in euglycemic patients was 1.46 ± 0.84 days, in hyperglycaemic was 3.65 ± 1.37 days , in hypoglycaemic 2.38±0.52 days and in glucose variability was 4.00 ± 1.00 days.

Table 11: DURATION OF WARD STAY IN SURVIVORS IN RELATION TO BLOOD GLUCOSE LEVELS

	Hyper Glycemi (n=40)		Hypoglycaem (n=8)		Glucose Variability (n=9)		Euglycemia (n=28)		Sig.
	N	%	N	%	N	%	N	%	
0 - 3 Days	0	0.0	1	12.5	1	11.1	8	28.6	2 = 43.344**;(p =

4 - 6 Days	8	20.0	3	37.5	2	22.2	17	60.7	0.000) ; df= 9; Highly Significant
7 - 9 Days	11	27.5	4	50.0	1	11.1	0	0.0	
10 & Above Days	21	52.5	0	0.0	5	55.6	3	10.7	
Total	40	100	8	100	9	100	28	100	F-test
Mean	9.13 ± 2.57 Days		5.75±1.49 Days		8.44 ± 3.97 Days		4.68 ± 2.39 Days		17.417** P=0.000

****P<0.001 ; Significant;**

Table 11 demonstrates the duration of ward stay among survivors in relation to their blood glucose levels. Euglycemic patients had a mean ward stay of 4.68 ± 2.39 days, in hyperglycaemic 9.13 ± 2.57 Days, in hypoglycaemic 5.75 ± 1.49 days, and in glucose variability patients 8.44 ± 3.97 Days.

Table 12: DISTRIBUTION OF SEPSIS SEVERITY IN STUDY POPULATION

Sepsis Severity	No. of Patients	%
Sepsis	47	47.0
Severe Sepsis	37	37.0
Sepsis in shock	16	16.0
Total	100	100.0

Table 12 shows the severity of sepsis in the study population of which 47 % had sepsis, 37 % had severe sepsis and 16 % was in septic shock.

Table 13: ASSOCIATION OF AGE WITH SEPSIS SEVERITY

Age	Sepsis Severity							
	Sepsis		Severe Sepsis		Sepsis in shock		Total	
	No. of Patients	%	No. of Patients	%	No. of Patients	%	No. of Patients	%
2 - 4 Months	18	38.3	18	48.6	5	31.3	41	41.0
5 - 7 Months	13	27.7	8	21.6	7	43.8	28	28.0

8 - 10 Months	10	21.3	9	24.3	4	25.0	23	23.0
> Above 10 Months	6	12.8	2	5.4	0	.0	8	8.0
Total	47	100.0	37	100.0	16	100.0	100	100.0
Chi-square	$\chi 2 = 5.982^{@}$; (p = 0.425) ; df= 6;							

Table 13 shows the relation of sepsis severity to age and concluded that sepsisseverity is not related to age (p = 0.425; not significant).

Table 14: ASSOCIATION OF GENDER WITH SEPSIS SEVERITY

Gender	**Sepsis Severity**							
	Sepsis		**Severe Sepsis**		**Sepsis in shock**		**Total**	
	No. of Patients	%	No. of Patients	%	No. of Patients	%	No. of Patients	%
Male	24	51.1	20	54.1	7	43.8	51	51.0
Female	23	48.9	17	45.9	9	56.3	49	49.0
Total	47	100.0	37	100.0	16	100.0	100	100.0
Chi-square	$\chi 2 = 0.475^{@}$; (p = 0.789) ; df= 2;							

@ -Not significant;

Table 14 compares the severity of sepsis based on gender and found that there is nosignificant relation between gender and sepsis severity (p > 0.05, not significant).

Table 15: ASSOCIATION OF AGE WITH MORTALITY.

Age	**Recovery**		**Death**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**
< 6 Months	47	55.3	11	73.3	58	58.0
> 6 Months	38	44.7	4	26.7	42	42.0
Total	85	100.0	15	100.0	100	100.0
Chi-square	$\chi 2 = 1.703^{@}$; (p = 0.192) ; df= 1; Not Significant					

Table 16 demonstrates the relation of age groups less than 6 months and more than 6 months with mortality and found that it is not significant (P=0.192 , not significant).

Table 16: ASSOCIATION OF HEMOGLOBIN LEVELS WITH MORTALITY

Group Statistics					Mean Difference	t-value (p-value)
	Death	N	Mean ± S.D	S.E		
HB	Recovery	85	10.500 ±2.372	0.257	1.893	2.967**(0.004)
	Death	15	8.607 ±1.613	0.416		

**significant at 0.01 level; (P<0.01)

Table 16 shows that hemoglobin levels below 8.6 g/dl in infants with sepsis isassociated with increased mortality p <0.05 , statistically significant.

Table 17: ASSOCIATION OF CLUTURE POSTIVITY AND MORATLITY

Culture	Death					
	NIl		Death		Total	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
Positive	29	34.1	8	53.3	37	37.0
Negative	56	65.9	7	46.7	63	63.0
Total	85	100.0	15	100.0	100	100.0
Chi-square	$\chi 2 = 2.020^{@}$; (p = 0.155) ; df= 1; Not Significant (P > 0.05)					

Table 17 shows that of the total 15 deaths 8 were culture positive and 7 were culture negative. p>0.05 , statistically not significant.

Table 18: ASSOCIATION OF NICU ADMISSION WITH MORTALITY

NICU	Outcome					
	Recovery		Death		Total	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
Yes	8	9.4	7	46.7	15	15.0
Nil	77	90.6	8	53.3	85	85.0
Total	85	100.0	15	100.0	100	100.0

Chi0square	$\chi 2 = 13.879^{**}$; (p = 0.000) ; df= 1; Significant (P<0.001)

Table 18 shows that of the study subjects 15 had NICU admission, of which 7 died and 8 recovered, $p < 0.05$ suggest that there is a significant relation between NICU admission and death in infants with sepsis.

Table No. 19 ASSOCIATION OF SEPSIS SEVERITY WITH MORTALITY

Sepsis Severity	Death					
	Recovery		Death		Total	
	No. of Patients	%	No. of Patients	%	No. of Patient	%
Sepsis	46	54.1	1	6.7	47	47.0
SevereSepsis	33	38.8	4	26.7	37	37.0
Sepsis inshock	6	7.1	10	66.7	16	16.0
Total	85	100	15	100	100	100
Chi-square	$\chi 2 = 34.931^{**}$; (p = 0.000) ; df= 2; Highly Significant (**P<0.001)					

Association between mortality and sepsis severity .Of the 47 patients with sepsis 1 died, ,of the 37 patients with severe sepsis 4 died, and of the16 patients with septic shock 10 died, p value was <0.001 (highly significant).

DISCUSSION

Sepsis involves a systemic inflammatory response syndrome (SIRS) in presence of infection, leading to septic shock and Multi organ system dysfunction. Most deaths caused by infections are due to sepsis. Sepsis is the most common cause of death in children worldwide. Its mortality rate in children in developing countries ishigher than fifty percent.

In general, glucose dysregulation is related to negative outcomes in critically ill patients and has multi-system complications. High glycaemic variability commonly observed in critically ill children remains an unsolved matter and controversial field for paediatric critical care practitioners. Stress hyperglycaemia, hypoglycaemia and high fluctuations within blood glucose values can occur critically ill infants with sepsis.[6]

Prolonged and persistent hyperglycaemia during critical illness is harmful .Glucose overload caused by an increased hepatic output of glucose. Glucogenolysis is primarily triggered by catecholamines and maintained under the influence of epinephrine and cortisol. Gluconeogenesis is activated by glucagon more than epinephrine and cortisol. Furthermore, among large numbers

of inflammatory mediators secreted during acute illness, TNF-α may promote gluconeogenesis by stimulating glucagon production. Moreover, skeletal muscles and adipocytes are unable to take up glucose, which is related to the change in insulin signalling and down regulation of type 4 glucose transporters (GLUT-4). Glucose overload can exaggerate oxidative free radical injury in cases of sepsis hypoglycaemia in critically ill patients may occur spontaneously or can be triggered by iatrogenic factors such as the result of insulin infusion, interruption of infusion of a nutritional solution. Spontaneous hypoglycaemia include end-stage liver failure and adrenal failure during the septic shock. The mechanism of brain injury after severe hypoglycaemia is complex and associated with decreased glycolytic flux, lower tissue levels of lactate and pyruvate, shortage of acetyl CoA, increased levels of aspartate and a decreased level of glutamate in brain tissue. Meanwhile, both (glutamate and aspartate) are increased in extracellular space. The extracellular aspartate released during hypoglycaemia damages neurons by a toxic mechanism. The other mechanisms are NADPH oxidase dependent.[7]

Blood glucose regulation and variability is the complex mechanism which, in critically ill infants, is changed especially during sepsis. It is a result of an increased secretion of cytokines, hormones and altered physiological regulatory pathways of blood glucose. The exact mechanism is still mostly hypothetical and remains unknown.

However, high glucose variability is associated with poor outcome among critically illinfants.
In the present study attempt is made to study the signifance of blood glucose levels as a prognostic predictor in infants with sepsis.

The study is done in the department of paediatrics, Government General Hospital Ananthapur between January 2021- June 2022 over a period of 18 months.

Study was done in 100 infants with sepsis of which 41 % of the subjects were from age groups 2-4 months, 28% from 5-7 months, 23% from 8-10 months, 8% from more than 10 months.

In our study 51 % of the subjects were males and 49% were females. Jyotsna Mishra et al in their study on the profile and outcome of paediatric patients with sepsis found a male predominance with 61 % male and 39 % female. Mukesh Bhatta et al in a similar study in paediatric sepsis found a male predominance with 58 % male and 42 % female.[8]

In the present study all the children presented with decreased activity (100 %) followed by poor feeding (95%), fever 93 %, fast breathing 54% and organomegaly was found in 50 % of the study population. In our study majority of the patients presented with pneumonia (40%) followed by sepsis without focus 27%, meningitis 16%, gastrointestinal infections 14%, osteomyelitis 2% and UTI 1%, which is similar to Prakash Mohan Jeena et al in their study on South African infants with sepsis found most common presenting complaints were not feeding well (100%),

fast breathing in 54% and 54% had pneumonia, 15 % had sepsis without focus.

In this study we classified patients as sepsis, severe sepsis and sepsis in shock based on International paediatric sepsis consensus conference. It was found that 47% of the study subjects had sepsis, 37% had severe sepsis and 16% was in septic shock. Andrea Wolfer Et Al in their study on incidence of mortality due to sepsis found 7.9% of ICU patients had sepsis, 1.6% had severe sepsis and 2.1% had septic shock, lower incidence of sepsis and septic shock in this study may be due to higher age group of the study population when compared to our study.

In the present study 48% of the study subjects had hyperglycaemia, 30% had euglycemia, 13% had glucose variability and 9% had hypoglycaemia. Eliotte Hirshberg et al in their study on association of blood glucose levels with mortality and duration of stay in criticaly ill children found a similar incidence of 56.1 % hyperglycaemia,9.7% of hypoglycaemia and 6.8% glucose variability . Kupper A. Wintergerst in their study on glucose levels in criticaly ill children found the prevalence of hypoglycaemia to be 18.6%.Suzanne Sap Ngo Um Et al in their study on blood glucose levels on admission in acutely ill children observed that prevalence of hyperglycaemia was 31.53% and hypoglycaemia was 3.45%, the lower incidence of hypoglycaemia in their study compared to present study may be due to higher age group of their study population.[9]

Incidence of mortality in this study was 15 %, of which 86.6% of the patients had dysglycemia. Of the total deaths 53.3 %(n=8) had hyperglycaemia, 6.7% (n=1) had hypoglycaemia, 26.7% (n=4) had glucose variability and 13.3 %(n=2) were euglycemic. Ricardo G Branco Et al in their study on glucose levels and risk of mortality in paediatric septic shock subjects found a mortality rate of 49.1 % and the peak glucose levels of more than 178 mg/dl is associated with 2.59 times higher risk of mortality, the higher rate of morality in this study when compared to present study may be due to increased severity of sepsis in their study population. Suzanne Sap Ngo Um Et al [16] in their study found that subjects with dysglycemia was 7.4 times more likely to die when compared to subjects with normal glucose levels.

In this study duration of total hospital stay in infants with sepsis who survived, in relation to their blood glucose levels was assessed and it is found that the mean duration of stay in hyperglycaemic subjects were 12.78 days, hypoglycaemic subjects were 8.13 days, in glucose variability subjects were 12.44 days and in euglycemic subjects the mean duration of stay was 6.14 days. It showed that the duration of hospital stay is longer in septic infants with dysglycemia when compared to septic infants with euglycmeia and it was statistically significant ($P<0.001$). Eliotte Hirshberg et al in their study on alterations in glucose homeostasis in the paediatric intensive care unit found that criticaly ill children with normoglycemia had a mean duration of hospital stay of 5.9 days, hyperglycaemic subjects had a mean hospital stay of 7.2 days, hypoglycaemic subjects had a mean stay of 8.5 days and patients with glucose variability had a mean stay of 18.8 days which is comparable toour study.

In this study duration of ICU stay in infants with sepsis who survived, in relation to their blood glucose levels was assessed and it is found that the mean duration of ICU stay in hyperglycaemic subjects were 3.65days, hypoglycaemic subjects were 2.38 days, in glucose variability subjects were 4 days and in euglycemic subjects the mean duration of ICU stay was 1.46 days. It showed that the duration of ICU stay is longer in septic infants with dysglycemia when compared to septic infants with euglycmeia and it was statistically significant (P<0.001). Kupper A. Wintergerst Et al in their study on Association of Hypoglycaemia, Hyperglycaemia, and Glucose Variability with Morbidity and Death in the Paediatric Intensive Care Unit concluded that patients with highest glucose quintile had longer median PICU stay.

In this study duration of ward stay in infants with sepsis in relation to their blood glucose levels was assessed and it is found that the mean duration of stay in hyperglycaemic subjects were 9.13 days, hypoglycaemic subjects were 5.75 days ,in glucose variability subjects were 8.44 days and in euglycemic subjects the mean duration of stay was 4.68 days. It showed that the duration of ward stay is longer in septic infants with dysglycemia when compared to septic infants with euglycmeia and it was statistically significant (P<0.001).

In the present study total culture positive cases were i.e., 37 %, compared to Jyotsna Mishra et al in their study found a culture positivity of 28%. In the present study significance of age and sepsis severity was assessed and foundto be not significant.

Relation between gender and sepsis severity showed 54.1 % males and 48.9% females had severe sepsis, 43.8% males and 56.3% females had septic shock. The severity in females may be attributed to late presentation of female children due to social causes, however the difference is not statistically significant.

In this study 73.3 % of deaths occurred in the age group of less than 6 months and 26.7 % of death occurred in infants more than 6 months of age, p value > 0.05, not statistically significant of the total 15 deaths, 7 patients had a history of NICU admission i.e, 46.7% of death had history of NICU admission, p value < 0.05, which is statistically significant.

In this study mortality and sepsis severity was assessed and it showed that 66.7% (n=10) had septic shock , 26.7% (n=4) had severe sepsis and 6.7% (n=1) had sepsis and p value was < 0.05 which is statistically significant.

In the present study it is observed that mean Hb levels of survivors was 10.5g/dl and non-survivors it is 8.6 g/dl, which is statistically significant. The culture positivity rate in the current study was 37% and is not associated with increased mortality (p>0.05), however Tarak R Hazwani in their study had a culture positivity of 14.3% and added that higher mortality is seen in children with culture positive sepsis.[10]

CONCLUSION

Majority of the infants with sepsis had dysglycemia. Dysglycemic subjects had increased risk of mortality, however the difference was not statistically significant. Subjects with dysglycemia had longer duration of hospital stay and the observation was statistically highly significant'. Among the dysglycemic subjects, infants with hyperglycemia and glucose variability had longer stay followed by hypoglycemic subjects.

LIMITATIONS

- It is a single centric observational study with small sample size
- Only immediate outcome in the form of survival and duration of hospitalstay was assessed. Morbidity in the form of neurological sequelae was not assessed.

REFERENCES

1. Donati A, Damiani E, Domizi R, Botticelli L, Castagnani R, Gabbanelli V, Nataloni S, Carsetti A, Scorcella C, Adrario E, Pelaia P. Glycaemic variability, infections and mortality in a medical-surgical intensive care unit. Critical Care and Resuscitation. 2014 Mar;16(1):13-23.
2. Krinsley JS. Glycemic variability: a strong independent predictor of mortality in critically ill patients. Critical care medicine. 2008 Nov 1;36(11):3008-13.
3. Chao WC, Tseng CH, Wu CL, Shih SJ, Yi CY, Chan MC. Higher glycemic variability within the first day of ICU admission is associated with increased 30-day mortality in ICU patients with sepsis. Annals of intensive care. 2020 Dec;10(1):1-0.
4. Zhang X, Zhang J, Li J, Gao Y, Li R, Jin X, Wang X, Huang Y, Wang G. Relationship between 24-h venous blood glucose variation and mortality among patients with acute respiratory failure. Scientific Reports. 2021 Apr8;11(1):1-6.
5. Burns CM, Rutherford MA, Boardman JP, Cowan FM. Patterns of cerebral injury and neurodevelopmental outcomes after symptomatic neonatal hypoglycemia. Pediatrics. 2008 Jul;122(1):65-74.
6. Arhan E, Öztürk Z, Serdaroğlu A, Aydın K, Hirfanoğlu T, Akbaş Y. Neonatal hypoglycemia: a wide range of electroclinical manifestations and seizure outcomes. european journal of paediatric neurology. 2017 Sep 1;21(5):738-44.
7. Du Y, Liu C, Li J, Dang H, Zhou F, Sun Y, Xu F. Glycemic Variability: an independent predictor of mortality and the impact of age in pediatric intensive care unit. Frontiers in pediatrics. 2020 Jul 31;8:403.
8. Dong M, Liu W, Luo Y, Li J, Huang B, Zou Y, Liu F, Zhang G, Chen J, Jiang J, Duan L. Glycemic Variability Is Independently Associated With Poor Prognosis in Five Pediatric ICU Centers in Southwest China. Frontiers in nutrition. 2022;9.
9. Kyle UG, Coss Bu JA, Kennedy CE, Jefferson LS. Organ dysfunction is associated with hyperglycemia in critically ill children. Intensive care medicine. 2010 Feb;36(2):312-20.

10. Pérez DV, Jordan I, Esteban E, García-Soler P, Murga V, Bonil V, Ortiz I, Flores C, Bustinza A, Cambra FJ. Prognostic factors in pediatric sepsis study, from the Spanish Society of Pediatric Intensive Care. The Pediatricinfectious disease journal. 2014 Feb 1;33(2):152-7.