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ORIGINAL ARTICLE

ROLE OF ENVIRONMENTAL FACTORS IN NON ASPHYXIAL RENAL FAILURE IN NICU

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ABSTRACT: OBJECTIVE: To study the role of environmental factors in non asphyxial acute renal failure during summer months (April, May 2013) in neonates admitted to NICU. **METHODS:** The study was conducted in our NICU. 35 neonates out of 240, with fever, poor sucking and decreased urine output were admitted to the nursery from April to May 2013 were evaluated for presence of ARF (cases). Sepsis was diagnosed on the basis of either a positive sepsis screen (immature: total (I: T) neutrophil ratio > 0. 2, μ -ESR > age in days + 2 mm or >15 mm, CRP> 6mg/dl, TLC<5000 cells/mm3; 2 or more positive) or a positive blood culture in symptomatic neonates. ARF was defined as blood urea nitrogen (BUN) >20mg/dl on two separate occasions at least 24 hours apart or a serum creatinine level more than 1. 5gm/dl for at least 24-48 hours, if mothers renal function is normal. Oliguria was defined as urine output <1ml/Kg/hr. **RESULTS:** 35 out of 240 neonates (14.5%) had ARF; only 20% was oliguric. The mean gestation of neonates with ARF was 38±2weeks (94%), males (71%). Factors including gestational age, weight, onset of sepsis, culture positivity, associated meningitis, prior administration of nephrotoxic drugs, mode of delivery, establishment of lactation, extramural or intramural were subjected to analysis for prediction of cause of ARF in neonates; sepsis, atmospheric temp and poor feeding by LSCS mothers causing dehydration were found to be a major predictor. ARF had recovered in 32 out of 35 neonates (91.4%); two babies succumbed to the disease, and 1 was referred to higher center. **CONCLUSION:** General incidence of ARF in our study was high in the months of April and May (14.5%), 2013 when compared to other studies (1-8%) and also when compared to 0 cases in the month of November and December. This shows that seasonal variation like temperature and humidity has got an influence on ARF. Non oliguric ARF was commoner than oliguric ARF. Aggressive management is needed for better outcome. Dehydration and sepsis are a very important cause of non oliguric renal failure among neonates during summer months which can be easily prevented by proper, adequate counselling of mothers by pediatricians.

KEYWORDS: Acute renal failure, dehydration, environmental factors, breast feeding.

INTRODUCTION: In the last decade, published data on neonatal renal failure has increased and various studies show an incidence of acute renal failure (ARF) in Neonatal Intensive Care units ranging from 1-8%.[1-5] This is attributed to the following factors:

1. Prolonged survival of seriously ill new borns with improved resuscitation and ventilatory support.
2. Increased awareness of renal failure and importance of monitoring urine output and serial measurements of blood urea and serum creatinine in neonates.
3. Antenatal diagnosis of renal anomalies by ultrasonography, many of which lead to renal failure in neonates.
4. Use of nephrotoxic drugs and increased incidence of gram negative sepsis.

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5. Increased survival of premature neonates at a higher risk of renal failure due to physiological immaturity of renal function, sudden adaptation to extra uterine life and exogenous stress factors which break down the homeostasis of body function regulated by the placenta in fetal life.

These are the various causes of acute renal failure in neonates. In addition to these causes; dehydration plays a major role in causing acute renal failure in neonates.

Published data on neonatal renal failure in India is scanty, also there are no studies showing the relation between environmental factors and acute renal failure in neonates. Hence this study was undertaken to study the role of environmental factors in ARF.

OBJECTIVE: To study the role of environmental factors in non asphyxial acute renal failure during summer months (April, May 2013) in neonates admitted to NICU.

METHODS: The study was conducted in our NICU. 35 neonates out of 240, with fever, poor sucking and decreased urine output was admitted to the nursery from April to May 2013 were evaluated for presence of ARF (cases). Sepsis was diagnosed on the basis of either a positive sepsis screen (Immature: total (I: T)[6] neutrophil ratio > 0. 2, μ -ESR > age in days + 2 mm or >15 mm, CRP> 6mg/dl, TLC<5000 cells/mm^3; 2 or more positive) or a positive blood culture in symptomatic neonates. ARF was defined as blood urea nitrogen (BUN) >20mg/dl[7] on two separate occasions at least 24 hours apart or a serum creatinine level more than 1. 5gm/dl for at least 24-48 hours, if mothers renal function is normal. Oliguria was defined as urine output <1ml/Kg/hr.[8]

OBSERVATION AND RESULTS: INCIDENCE OF ACUTE RENAL FAILURE IN NICU:

Total no of admissions to NICU of both the hospitals-240.

Total no of acute renal failure cases-35.

Incidence-14. 5 %.

INCIDENCE OF ACUTE RENAL FAILURE AMONG INTRAMURAL CASES:

Total no of deliveries of both the hospitals-600.

Intramural acute renal failure cases-20.

Incidence-3. 3%.

	APRIL, MAY 2013			NOV, DEC 2013		
	ARF	**NON ARF**	**TOTAL**	**ARF**	**NON ARF**	**TOTAL**
Male	25	135	**160**	0	123	**123**
Female	10	70	**80**	0	104	**104**
	35	205	**240**	0	227	**227**

Table 1: Sex Distribution

Out of 35 cases of acute renal failure, 25 were males and 10 were females.

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	APRIL, MAY 2013			NOV, DEC 2013		
	ARF	NON ARF	TOTAL	ARF	NON ARF	TOTAL
Term	33	163	**196**	0	150	**150**
Preterm	2	42	**44**	0	77	**77**
	35	205	**240**	0	227	**227**

Table 2: Gestational Age

Out of the 35 babies admitted with acute renal failure, 33 were term n only 2 were preterm.

	APRIL, MAY 2013			NOV, DEC 2013		
	ARF	NON ARF	TOTAL	ARF	NON ARF	TOTAL
Intramural	20	92	**112**	0	137	**137**
Extramural	15	113	**128**	0	90	**90**
	35	205	**240**	0	227	**227**

Table 3: Place of Birth

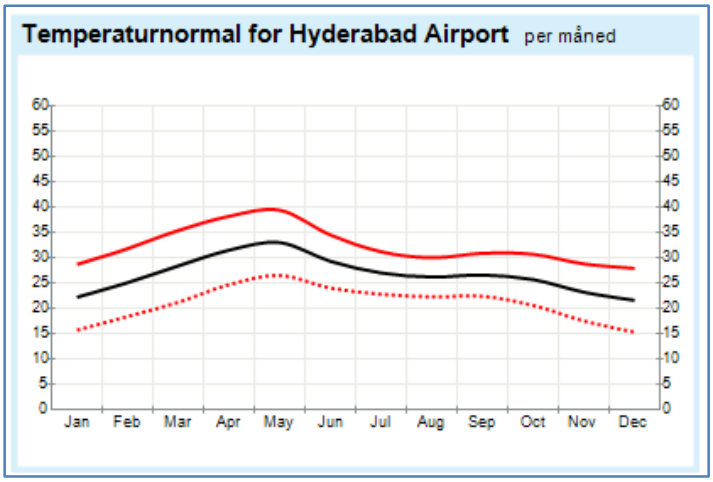
Out of the 35 cases, 20 babies were born in our hospital and 15 from other hospitals in Gulbarga.

	Number
Established	15
Not established	20
	35

Table 4: Lactation

Out of 35 ARF cases, lactation was established in only 15 babies.

TEMPERATURE IN GULBARGA



This graph shows that highest temperature in Gulbarga is in the month of April and May.

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	APRIL, MAY 2013			NOV, DEC 2013		
	Number	**NON ARF**	**TOTAL**	**ARF**	**NON ARF**	**TOTAL**
Present	5	103	**108**	0	120	**120**
Absent	30	102	**132**	0	87	**87**
	35	205	**240**	0	227	**227**

Table 5: SEPSIS

Out of the 35 acute renal failure cases, only 5 babies had late onset sepsis and 3 out of them had culture positive.

	NUMBER	%
Oliguria	7	20
non oliguria	28	80
	35	100

Table 6: URINE OUTPUT

Oliguric renal failure was seen in only 7 babies (20%) when compared to 28 babies who presented with non oliguric renal failure.

	Number	NON ARF	TOTAL	NOV, DEC 2013		
				ARF	**NON ARF**	**TOTAL**
LSCS	23	53	**76**	0	74	**74**
NVD	12	152	**164**	0	153	**153**
	35	205	**240**	0	227	**227**

Table 7: Maternal history

Out of the 35 babies, 65. 7% were born by LSCS and 34. 2 by normal vaginal delivery.

	Number	NON ARF	TOTAL	NOV, DEC 2013		
				ARF	**NON ARF**	**TOTAL**
Primigravida	27	167	**194**	0	177	**177**
Multigravida	8	38	**46**	0	50	**50**
	35	205	**240**	0	227	**227**

Table 8

Out of the 35 cases of acute renal failure, 27 babies were born to primi mothers and the rest 8 were born to multigravida mothers.

	Number	% age
BOLUSES	35	100
DIURETICS	35	100
PERITONEAL DIALYSIS	7	20

Table 9: TREATMENT

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Out of the 35 cases, all required intravenous fluids and diuretics as the treatment modality. Only 7 babies required peritoneal dialysis as an intervention.

	Number	NON ARF	TOTAL
Improved and discharged	32	179	**211**
Referred	1	2	**3**
Death	2	24	**26**
	35	205	**240**

Table 10: OUTCOME

Out of the 35 acute renal failure cases admitted, 32 babies improved and were discharged. Only 2 succumbed to the disease and 1 was referred to higher centre.

DISCUSSION: The neonatal kidney is particularly vulnerable to the effects of hypo perfusion since the renal vascular resistance and plasma renin activity are high. Consequently, renal blood flow is proportionately more reduced in neonates.

Dehydration can operate through a variety of mechanisms in producing renal failure. It can cause renal failure by shock, DIC, hemorrhage, cardiac failure and through ATN. Dehydration can be caused due to adverse climatic conditions (increased temperature and humidity) or poor feeding techniques or lactation.

While dehydration has been said to be one of the important predisposing causes of ARF, the actual incidence of renal failure in all dehydration cases is not documented. In this present study, of the 35 cases of ARF, 30 had pure dehydration with no other predisposing factor for ARF.

The present study has analyzed ARF in relation to dehydration due to the adverse climatic condition. The mean temperature in Gulbarga was 39-40^{o}C. To the best of our knowledge, no such study focusing on ARF in dehydration has been published till date.

The general incidence of acute renal failure in NICU attached to Basaveshwara teaching and general hospital and Sangameshwar General Hospital is 14.5%, which is higher than the national standards of 1-8%.[1-5] Incidence of ARF among intramural cases of both the hospitals is 3. 3%.

In the present study out of 35 cases, 25 (71%) were males and 10 (29%) were females.

According to the gestational age-33 were term babies and only 2 were preterm.

Out of 35 cases, 20 babies (57.14%) were intramural and 15 babies (42.8%) were extramural.

The present study contradicts the general perception that ARF in neonates is commonly oliguric. Only 20 % was oliguric whereas 80% of the majority was non oliguric. Previous studies done by Jayashree et al[6] on birth asphyxia patients found 69. 2% of ARF to be oliguric. In a study by Pereira et al[7] on 20 cases of ARF (out of which 18 had sepsis), the incidence of oliguria was 80%.

Mode of delivery and parity played a role in this present study. 23 (65%) babies were born by LSCS and 27 babies (77%) were born to primi mothers. This can be explained by poor lactation post c section and also poor feeding techniques in primi mothers.

All the cases were treated with boluses and furosemide injections. Only 7 babies (20%) required peritoneal dialysis in addition to the above treatment, and only 2 out of 35 cases succumbed to ARF.

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CONCLUSION:

- General incidence of ARF in our study was high in the months of April and May (14. 5%), 2013 when compared to other studies (1-8%) and also when compared to 0 cases in the month of November and December. This shows that seasonal variation like temperature and humidity has got an influence on ARF.
- Non-oliguric ARF was commoner than oliguric ARF.
- Aggressive management is needed for better outcome.

RECOMMENDATIONS:

WHAT WE KNOW ALREADY?

- ARF is common in summer months with adverse climatic conditions (temperature and humidity.
- No proven data available regarding the same.

WHAT TO DO?

- Early interventions to reduce incidence of ARF during peak summer months has to be initiated.
- Interventions can be in the form of formula feeds/intra venous fluids along with exclusive breast feeding.
- Frequent breast feeding and improved breast feeding counseling to be advised during summer months.
- Further studies with intervention as above need to be done.

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