

RENAL FAILURE IN SYMPTOMATIC PERINATAL ASPHYXIA

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ABSTRACT

The study included seven term newborns developing acute renal failure due to symptomatic perinatal asphyxia in early neonatal period. Its diagnosis was based on clinical and biochemical indices. Urinary output, serum and urinary sodium, potassium and creatinine, and blood urea nitrogen were evaluated in all of them. All the patients had oliguria not responding to fluid challenge and/or diuretic therapy, high serum K, FeNa of $>2.5\%$ and RFI of >3 indicative of intrinsic renal disease. The condition was associated with a very high mortality.

Key words: *Symptomatic perinatal asphyxia, Acute renal failure.*

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Received for publication May 10, 1990;

Accepted March 8, 1991

Human fetus is particularly vulnerable to any interference with normal blood supply. Asphyxia of the fetus may initiate a chain of physiological disturbances affecting every organ and tissue in the body resulting in wide variety of otherwise unrelated clinical symptoms in newborn infants. Till McCance and Widdowson's study(1), the kidney was not considered to be a site of pathology. Since clinical presentation of renal failure is subtle, the identification of renal failure in asphyxia remained quite difficult. Later on, there have been only a few studies(2-7) which proved the relationship of perinatal asphyxia and development of acute renal failure (ARF). This is the first study reported from our country on ARF in perinatal asphyxia.

Material and Methods

Seven term neonates with ARF due to symptomatic perinatal asphyxia were admitted to the Neonatal Special Care Unit of the Department of Pediatrics, K.G. Medical College, Lucknow. Symptoms in them included change in the sensorium, apneic spells, seizures, abnormal movements, pupillary changes, bulging fontanel, etc. None of them had any congenital abnormality or infection and no nephrotoxic drug was administered to them. Forty two healthy term neonates served as controls.

Apgar score was recorded at 1, 5, 15 and 30 minutes in all. Gestational age was assessed by the date of last menstrual period or Dubowitz scoring system(8) and their intrauterine growth on Lubchenco growth charts(9). They were followed for 96 hours or more after birth and their clinical condition was observed especially for classifying them in Sarnat stages (excluding EEG)(10).

Urine output measurements were done

in all. A drop set severed at its counting chamber was used to collect the urine in male babies. Polythene bags fixed around the perineum were used in female babies. In the latter, samples contaminated with stool were discarded. They had oliguria or anuria which did not respond to fluid challenge and/or diuretic therapy. Serum and urinary sodium, potassium, creatinine and blood urea nitrogen estimations were done in two phases—phase 1 from birth to 48 hours of age and phase 2 for next 48 hours. Serum and urinary electrolytes and creatinine were measured by using autoanalyser. Creatinine estimation was done by Jaffe's method(11) and blood urea nitrogen by the method of Natelson *et al.*(12). From these values, glomerular filtration rate (GFR), fractional excretion of sodium (FeNa%) and renal failure index (RFI) were calculated. On the basis of various studies(13-15), criteria of ARF in these cases included urine output less than 1 ml/kg/hour or anuria which did not respond to fluid challenge and/or diuretics, serum creatinine ≥ 1.8 mg/dl or peak serum urea nitrogen concentration ≥ 40 mg/dl or hematuria and/or proteinuria.

Results

Obstetrical data and clinical assessment of these seven cases of ARF are given in Table I. Antepartum hemorrhage (APH) was present in one case and *liquor amnii* was meconium stained in three of them. Three of them were delivered by lower segment cesarean section (LSCS) and two each were delivered normally or by forceps.

Urine examination showed proteinuria in 4 cases, and hematuria (5-20 RBC/HPF), hyaline casts and WBC in 3 cases each. Biochemical data in ARF due to symptomatic perinatal asphyxia is given in Table II. All the values were significantly deranged in both the phases of study group when compared with controls and no improvement was noted when values of phase 1 and phase 2 were compared (Table II). Five out of these 7 cases of ARF belonged to Sarnat Stage III while none was in the Stage I (Table I).

Discussion

Kidney is very sensitive to oxygen

TABLE I—Clinical and Obstetrical Data

| S.No. | Sex | Birth weight | Sarnat stage (end stage reached) | | | Age at death (days) |
|-------|-----|--------------|----------------------------------|----------|-----------|---------------------|
| | | | Stage I | Stage II | Stage III | |
| 1* | F | 3.5 | — | — | + | — |
| 2° | F | 2.2 | — | + | — | 11 |
| 3° | M | 2.0 | — | + | — | 12 |
| 4° | M | 2.7 | — | — | + | 9 |
| 5° | M | 2.6 | — | — | + | 11 |
| 6° | F | 3.0 | — | — | + | 12 |
| 7° | F | 2.9 | — | — | + | 13 |

* — Improved ° — Expired

TABLE II—Biochemical Data

| Parameters | Control (n = 42) Mean \pm SD | ARF Mean \pm SD Phase 1 (n = 7) | Mean \pm SD Phase 2 (n = 7) |
|--------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|
| | 1 | 2 | 3 |
| Serum Na ⁺ (mEq/L) | 135.7 \pm 0.68 (134.2 -- 137.0) | 128.28 \pm 04.5 (121.0 -- 134.0) | 128.0 \pm 4.35 (122.0 -- 134.0) |
| Serum K ⁺ (mEq/L) | 4.06 \pm 0.21 (3.80 -- 4.5) | 7.16 \pm 0.59 (6.2 -- 7.9) | 7.20 \pm 0.84 (6.20 -- 7.90) |
| Serum creatinine (mg/dl) | 1.10 \pm 0.14 (0.9 -- 1.5) | 3.13 \pm 0.14 (2.6 -- 3.8) | 3.10 \pm 0.81 (2.0 -- 4.2) |
| Serum urea N ₂ (mg/dl) | 5.87 \pm 0.58 (4.85 -- 7.00) | 62.81 \pm 15.37 (44.74 -- 85.23) | 72.42 \pm 16.59 (47.72 -- 85.09) |
| Urine output (ml/kg/day) | 1.18 \pm 0.06 (1.07 -- 1.35) | 0.72 \pm 0.27 (0.23 -- 0.93) | 0.67 \pm 0.18 (0.33 -- 0.87) |
| GFR | 26.20 \pm 1.45 (23.60 -- 30.0) | 4.47 \pm 2.64 (4.81 -- 12.07) | 7.79 \pm 2.65 (5.91 -- 13.46) |
| FeNa% | 0.134 \pm 0.007 (0.13 -- 0.15) | 3.25 \pm 1.53 (2.96 -- 4.94) | 4.82 \pm 2.22 (2.07 -- 8.56) |
| RFI | 0.175 \pm 0.01 (0.16 -- 0.19) | 4.08 \pm 1.18 (3.97 -- 5.93) | 5.41 \pm 2.54 (3.05 -- 7.29) |

Figures in parantheses indicate ranges.

deprivation. Within 24 hours of an ischemic episode, renal insufficiency may occur, which if prolonged may even lead to irreversible cortical or medullary necrosis(16,17).

In the present study, all cases had low Apgar scores at 5 minutes which remained low in 2 patients even at 30 minutes. All the cases needed resuscitation at birth. They had also shown severe effects of asphyxia clinically, as 5 out of 7 cases had reached Sarnat Stage III, while none was in Stage I (Table I).

Oliguria was a cardinal feature even in the first 48 hours (phase 1) in all the cases. In microscopic examination of urine, RBC and casts were present in three of them

which was also observed by various other workers(2-4) who felt that urinary casts were strong indicators of hypoxic ischemic renal injury.

Owing to the efficiency of the placenta as kidney, plasma electrolytes and blood urea nitrogen are often normal following birth. These may be abnormal if anoxia preceding delivery is prolonged(4).

Reduced value of serum sodium and increased value of serum potassium, serum creatinine and blood urea nitrogen were found consistently in all the cases which correlated with the findings of other studies(4,18). However, high BUN or creatinine values do not differentiate pre renal uremia from ischemic renal disease

for which FeNa and RFI are better indices(19). All the cases had RFI of >3 and FeNa% $>2.5\%$. Mathews *et al.*(19) observed that FeNa % $>2.5\%$ and RFI of $>2.5\%$ were indicative of ischemic renal disease, while Srivastava *et al.*(15) have mentioned that RFI of >3 indicates intrinsic renal damage.

Except one patient, who showed some improvement, none of our cases survived. A high mortality has been reported by others as well(4,6). It may be concluded that newborns with clinical effects of perinatal asphyxia such as those entering Sarnat Stage III are at a great risk of developing ARF. In cases of symptomatic perinatal asphyxia, presence of oliguria not responding to diuretic therapy especially in association with high BUN and or serum creatinine is strongly predictive of development of ARF. Persistence of these changes and FeNa $>2.5\%$ and RFI >3 are indicative of ischemic renal damage which carries a poor outcome.

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NOTES AND NEWS

**National Workshop for Supertrainers
on
RECENT ADVANCES IN HUMAN LACTATION AND
BREASTFEEDING MANAGEMENT**

A National Workshop for "Supertrainers on Recent Advances in Human Lactation and Breastfeeding Management" will be held from 24-11-1991 to 3-12-1991 at Mahatma Gandhi Institute of Medical Sciences, Sevagram, Wardha. This workshop is being conducted under the joint auspices of Indian Academy of Pediatrics (IAP), Federation of Obstetrical and Gynecological Societies of India (FOGSI) and Association for Consumers' Action on Safety and Health (ACASH).

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| <i>IAP Co-ordinator</i> | : | Dr. (Mrs.) Pushpa Chaturvedi, Sevagram |
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