Singapore Med J 1998; Vol 39(10):468-470

# Congenital Sodium Diarrhoea in an Indian Girl

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## ABSTRACT

**We report the case of a newborn Indian girl with congenital sodium diarrhoea (CSD) who presented typically in utero, in whom diagnosis was made from markedly raised stool sodium in the presence of an alkaline stool. Treatment with sodium citrate normalised her metabolic and electrolyte status but resulted in transient uremia necessitating supplementation with sodium bicarbonate instead. She died at 11 weeks old following re-admission in a moribund state with grossly increased abdominal distension. Her fatal outcome in infancy suggests that CSD has a wide spectrum of clinical severity.**


**Keywords: congenital sodium diarrhoea, congenital chloride diarrhoea, secretory diarrhoea, sodium citrate**

## INTRODUCTION

Congenital sodium diarrhoea is a very rare cause of secretory diarrhoea. It was first described in a 9-year-old girl by Holmberg and Perheentupa in 1985[1]. Two other cases have also been reported[2,3]. All the 3 patients were treated with appropriate electrolyte supplements with good outcome and the children's growth was normal in spite of profuse watery diarrhoea.

We report the case of a newborn Indian girl with congenital sodium diarrhoea who presented typically but had a fatal outcome in early infancy.

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## CASE REPORT

The patient was the second child born to healthy non-consanguinous parents. An elder sibling was well. There was no family history of protracted diarrhoea. The mother had three previous miscarriages and this pregnancy was complicated by polyhydramnios. Fetal intestinal distension was seen on an ultrasound scan at 30 weeks of gestation. Pregnancy was complicated by premature labour for which she received dexamethasone to accelerate fetal lung maturity. Elective lower segment Caesarean section was performed at 32 weeks of gestation because of fetal abdominal distension. The patient had a birth weight of 1810 grams and Apgar scores of 4 at 1 minute and 6 at 5 minutes.

At birth, the patient's abdomen was noted to be soft but moderately distended with visible bowel loops. Bowel sounds were present and there was no organomegaly. No meconium was passed; instead, watery diarrhoea began immediately after birth. The profuse diarrhoea resulted in dehydration and a weight loss of 20% within the first 3 days of life.

Plain abdominal radiographs revealed gaseous distension of the small intestines and barium meal radiographs demonstrated no structural abnormality apart from the distended bowel loops. A rectal suction biopsy showed no coarse fibres on acetylcholinesterase staining, excluding Hirschsprung's disease. Blood cultures were sterile while the stool was negative for bacterial enteric pathogens, ova, cysts and parasites.

The child developed severe metabolic acidosis (arterial pH 7.06, plasma bicarbornate 7.8 mmol/L), marked hyponatremia (116 mmol/L), marked hypochloridemia (88 mmol/L) and mild hypokalemia (2.8 mmol/L) on day 4 of life with no evidence of abnormal urinary sodium loss (urine sodium 12 mmol/L, potassium 3 mmol/L, chloride 10 mmol/L, pH of 5.0). She was managed with parenteral fluids, including supplementation with sodium bicarbonate, potassium and sodium chloride.

Despite fasting, abdominal distension and watery diarrhoea persisted with daily stool volumes ranging from 80 – 150 mL/kg/day. Stool electrolytes confirmed raised stool sodium (92 mmol/L) with potassium 50 mmol/L and chloride 72 mmol/L. Stool pH was 8.5. Repeat stool electrolytes were sodium 133 mmol/L, potassium 59 mmol/L and chloride 76 mmol/L. Patient was started on formula feeds from day 11, supplemented with oral sodium citrate 8.8% (6 – 16 mL/kg/day) and potassium chloride. However, she developed raised serum urea levels (25.8 mmol/L) while receiving sodium citrate supplements, prompting further investigations into her renal function. The renal ultrasound scan and $^{99m}$Tc – diaminotetraethylpenta-acetic acid (DTPA) renogram were both normal. Moreover, when a catheter was introduced into the rectum, no radioactive tracer was detected in the stool. Urea levels normalised when the sodium citrate supplement was replaced with 5% sodium bicarbonate.

She developed neonatal jaundice which resolved following phototherapy for 10 days. Her liver enzymes were normal. An asymptomatic ejection systolic murmur was heard on day 18 and a secundum atrial septal defect was detected on two-dimensional echocardiogram. She thrived slowly, regaining birth weight only on day 43 of life. Serum immunoglobulin levels were normal and a urine La Brosse test was

negative over 3 consecutive days. Her subsequent neonatal course was uneventful and weight gain was appropriate while on formula feeds supplemented with 5% sodium bicarbonate and potassium chloride. She was discharged on day 58 of life with a weight of 2075g.

Three weeks after discharge, she was re-admitted for a one-day history of poor feeding and vomiting. Clinically, she was very ill, grunting and hypotensive. There was marked increase in abdominal distension with absence of bowel sounds. Laboratory investigations confirmed severe metabolic acidosis (arterial pH 7.16, plasma bicarbonate 8.8 mmol/L), hyperkalemia (potassium 8.5 mmol/L) and disseminated intravascular coagulation. She was resuscitated with intravenous fluids, mechanically ventilated and given antibiotics and inotropic support. Plain abdominal radiographs (Fig 1) revealed grossly distended small and large bowel loops filled with gas with no air-fluid levels or pneumoperitoneum. Blood culture taken during admission was sterile. She died one day after admission despite intensive care support. Her parents declined request for a post-mortem examination.

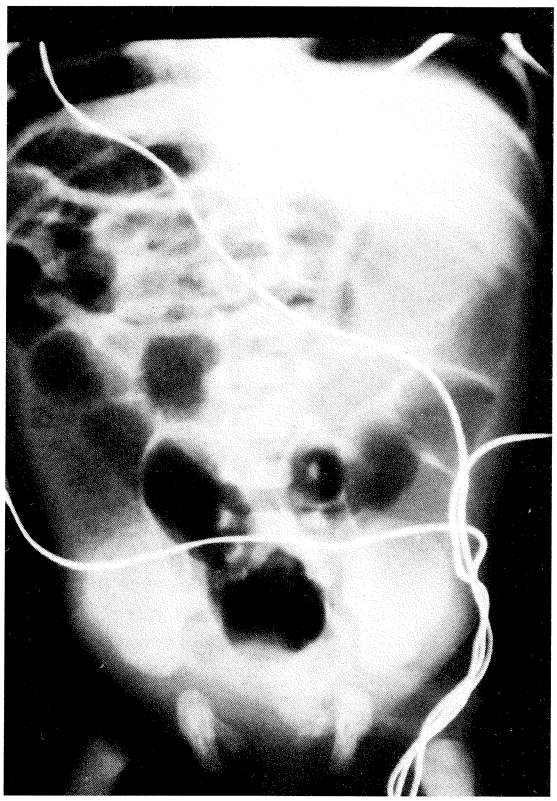

**Fig 1** – Abdominal radiograph showing dilated small and large bowel loops filled with gas without air-fluid levels.

## DISCUSSION

To our knowledge, this is the first case of congenital sodium diarrhoea reported in Asia. Like previous reports[1-3], the presence of polyhydramnios and fetal intestinal distension provided evidence for an intra-uterine onset. Because profuse watery diarrhoea began immediately after birth and persisted despite fasting, malabsorption syndromes were unlikely to have been present. Other causes of secretory diarrhoea secondary to septicaemia, intestinal infestation and enteritis were excluded through appropriate cultures. It would have been useful to assay the gastrointestinal hormones[4], however, our patient died before they could be assayed.

Diagnosis of congenital sodium diarrhoea in our patient was based on the stool sodium loss (92 mmol/L) in excess of stool chloride loss (72 mmol/L) and an alkaline stool (pH 8.5), as previously reported[1-3]. This was in contrast to congenital chloride diarrhoea[5-8] in which stool chloride loss generally exceeded stool sodium loss in association with an acidic stool resulting from defective $Cl^-/HCO_3^-$ exchange mechanism. Keller et al[9] described an 18-month old boy with familial protracted sodium-losing diarrhoea who perished from intercurrent infection. Their patient differed from ours and those of others[1-3] since he had no history of polyhydramnios and his diarrhoea only began from the third day of life.

The pathogenetic mechanism underlying congenital sodium diarrhoea had been reportedly due to defective sodium/proton exchange, which was demonstrated in brush border membrane vesicle studies obtained by jejunal biopsy[2,3]. The defect was presumably partial in the 9-month-old child described by Fell et al[3], since he spontaneously recovered. We had planned to perform a jejunal biopsy for ultra structural studies similar to those done in other reports[2,3] but her early demise precluded this.

Although several similarities existed in the clinical presentation between our patient and those of others[1-3], there were apparent differences in her response to therapy and outcome. Sodium citrate supplements were given on the basis of previous reports[1,2] but resulted in raised serum urea levels which normalised only upon its withdrawal. We postulate that the use of citrate led to increased production of aspartate via the citric acid cycle, resulting in increased formation of urea through its entry into the urea cycle[10]. It was unlikely that the patient's immature renal function contributed to defective excretion of urea since the $^{99m}Tc$ – diaminotetraethylpenta-acetic acid (DTPA) renogram confirmed normal renal function. Moreover, there was no tracer detected in the stool collected through a rectal catheter suggesting absence of recto-vesical fistula. Supplementation with 5% sodium bicarbonate resulted in correction of electrolyte imbalance, acidosis and appropriate weight gain. We conclude that 5% sodium bicarbonate supplementation is preferable to sodium citrate and does not result in significant gaseous abdominal distension.

The early demise of our patient at 11 weeks of life differed from the generally good outcome reported by others[1-3]. Although an autopsy had not been performed, there were signs of intestinal obstruction, as evidenced by gross increase in abdominal distension, vomiting and absence of bowel sounds. Volvulus was documented in 6 patients with congenital chloride diarrhoea and was attributed to voluminous filling of intestinal loops[5]. It was likely that a similar mechanism operated in our patient, leading to her moribund state on her re-admission.

Our patient with congenital sodium diarrhoea had a typical presentation. However her fatal outcome suggests that this disorder has a wide spectrum of clinical severity, ranging from those who recovered[3] spontaneously to those who died in early infancy.


## ACKNOWLEDGEMENT

We thank Drs Phua Kong Boo and Ooi Boo Chye, for their invaluable advice, Dr Anette S Jacobsen for her surgical expertise, medical and nursing staff of the Department of Neonatology, Singapore General Hospital for their encouragement, and Ms Dorothy Loh for her secretarial assistance.


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