The mean (SD) time taken in tip confirmation by using bedside ultrasound was 5.1(1.2) minutes, *X*-ray it was 28 (8.1) minutes (P<0.001). The catheter tip was in an optimal position in the first attempt in 30 (91%) neonates after the ultrasound and confirmed by *X*-ray. In these three cases (9%) the tip of the PICC catheter was in the right atrium after first attempt confirmation. There was no inter-observer variation in the interpretation of the result.

Previous studies [4-8] have also shown that the mean time taken in confirmation of tip by using ultrasound is significantly less than standard care. The accuracy of ultrasound was also comparable with radiography. By using ultrasound, we can reduce radiation exposure, and ensure lesser handling of babies.

Bedside ultrasound is an accurate and time-efficient modality to guide the insertion and confirmation of the tip of the PICC line. However, training of neonatologists in ultrasound may be required before routine use of this modality.

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Infantile Cardiac Beriberi in Rural North East India

Twenty eight exclusively breastfed infants presented between 1 July, 2017 and 30 June, 2018 with acute heart failure syndrome, with 23 (92%) showing dramatic clinical resolution of shock within 24 hours of receiving intravenous thiamine (100 mg) bolus. Our findings raise awareness for addressing this neglected nutritional disease in North East India.

Keywords: *Heart Failure, Infantile Beriberi, Thiamine*.

The cardiac form of infantile beriberi is a fulminant disease, affecting exclusively breastfed infants of mothers with thiamine deficiency. The classical description is a well thriving infant presenting in acute cardiac failure succumbing to the illness within four hours, if left untreated [1]. Laos has documented widespread thiamine deficiency in communities, causing a peak in infant mortality in the third month of life [2]. The overall infant mortality rates in the Karen refugee camp in Thailand reduced from 183 to 78 per 1000 live births after early diagnosis and management of infantile beriberi [3]. We report on infantile beriberi as a preventable cause of death among infants from rural North East India.

The study was conducted in a charitable hospital in Karimganj district of Assam, which has an infant mortality rate of 69 per 1000 live births in 2012-13 (National average, 42/1000 live births). A retrospective review of medical records was conducted for all infants who were discharged between 1 July, 2017 and 30 June, 2018 with a diagnosis of infantile beriberi. Infantile beri beri was diagnosed when an otherwise well, exclusively breastfed infant presented with a thiamine responsive acute cardiac failure syndrome [1].

A total of 28 infants with a mean (SD) age 69 (29.1) days and weight 3.84 (1.26) kg from rural Assam and Tripura were diagnosed with infantile beriberi during the study duration. The commonest complaints were short history of vomiting, breathlessness and poor feeding. All infants presented in a critically ill state with prolonged capillary refill time (93%), tachycardia (93%), seizures (36%) and severe respiratory distress (92%). The capillary blood gas of all infants showed severe high anion-gap metabolic acidosis (***Table* I**).

Table I Laboratory Abnormalities in Infants With Cardiac Beriberi (*N*=28)

Variable	*Value, median (IQR)*
Hemoglobin (g/dL)	8.2 (7.7-9.9)
Leukocyte count (per mm^3)	20510 (15410-27030)
Platelet count (per mm^3)	297000 (15410-27030)
Blood sugar (mg/dL)	115 (70-206)
pH	6.9 (6.7-7.1)
HCO3 (mmol/L)	5.2 (4.8-7.8)
Base excess	-26.6 (-23.05 to -29.0)
Anion gap	42.25 (30.9-43.0)

Of these, 25 (89%) received 100 mg of intravenous thiamine bolus within one hour of admission, followed by 100 mg intravenously for a minimum of seven days till discharge. Infants also received other treatment modalities as per the pediatric protocol for treatment of shock in the hospital. 20 infants (71%) required inotropes. Twenty three infants (92%) showed dramatic recovery, with features of shock resolving within 24 hours, and were initiated on breast feeds within two days. All 14 infants (50%) requiring invasive ventilation could be weaned within 60 hours, with 12 infants (86%) being extubated in the first 24 hours. There was a rapid improvement in the capillary blood gas measurements within 4-8 hours of bolus thiamine, with mean (SD) pH improving from 6.9 (0.22) to 7.35 (0.11) and mean (SD) base excess from –24.3 (6.69) to –3.8 (5.69).

The three infants who did not receive parenteral thiamine died within half an hour of admission while of those who received parenteral thiamine, two infants died. One of these due to a ventilator-associated adverse event. All infants who survived were discharged after a mean (SD) in-patient stay of 7 (2.81) days. They were prescribed 10 mg per day of thiamine supplements; 17 babies (74%) were subsequently reviewed and found to be well.

The presentation of infants in this case series corroborates with the classical description of infantile cardiac beriberi in literature, including a cohort from Kashmir [5]. Moreover, we have previously documented peripheral neuropathy with or without cardiomyopathy among peripartum women [6]. Since the clinical manifestation of beriberi in infants reflects poor maternal stores, communities in North East India are at risk populations, explaining the prevalence of this nutritional disease.

All infants presented in an acute critically ill state and none had documented fever or history of fluid loss to account for shock. The dramatic therapeutic response to parenteral thiamine administration in 92% of infants along with the rapid clinical deterioration of the three infants who did not receive it, favors the diagnosis of cardiac beriberi. *X*-ray done on five babies revealed cardiomegaly at admission, which disappeared after five days of thiamine. The diagnosis could have been strengthened using echocardiography, and determining RBC transketolase activity, which were not available at our institute. Subsequent to the study, echocardiography in other such infants has demonstrated features of pulmonary hypertension, which responded after thiamine administration.

Although infantile beriberi was believed to have been eliminated from India [7], there is emerging evidence to suggest that beriberi still continues to be a cause of preventable infant mortality among Indian children [4,8]. In places with high infant mortality and peak age of deaths at three months of age, beriberi needs to be considered in the differential diagnoses of infants presenting with unexplained shock.

Being a fatal but preventable and easily treatable disease, these observations on infantile beriberi require a strong public health response. Education campaigns and thiamine supplementation in pregnant and post partum women are possible strategies. Prospective studies using data from population surveys and nutritional assessments to identify the factors contributing to the epidemic in these high-risk populations are being planned with the National Institute of Nutrition, Government of India.

Ethical Clearance: Local research committee of MCL General Hospital; 27 June, 2017.
Contributions: ST: RMK conceptualized and designed the study, developed protocol; ST: collected and analyzed data, reviewed literature and prepared initial manuscript; RMK & VAI: Manuscript review; VAI: performed echocardiogram on some babies included in study. All the authors approved the final version of the manuscript.
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