ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25jun1094

Classic Bartter Syndrome with Refractory Hypokalemia: A Pediatric Case Report

Dr. Shaik Khadeer Ahamed[1]*; Shravani Vanga[2]; Sreeteja Panjala[3]; Chandraprakash Gollapelli[4]; Dr. Rama Rao Tadikonda[5]

[1,2,3,4,5] Departement of Pharm D
CMR College of Pharmacy
Medchal, Hyderabad, India

*Corresponding Author:
Dr. Shaik Khadeer Ahamad

Publication Date: 2025/06/24

Abstract: Bartter syndrome, a rare inherited renal tubular disorder characterized by impaired salt reabsorption in the loop of Henle's thick ascending limb. This causes hypokalemia, metabolic alkalosis, and normal to low blood pressure by causing an excessive loss of sodium, potassium, and chloride through the urine. The condition is genetically heterogeneous, with at least five subtypes linked to mutations in genes encoding ion transporters and channels such as NKCC2, ROMK, ClC-Kb, and the calcium-sensing receptor. The goals of Management focus on correcting electrolyte imbalances, minimizing renal damage, and improving growth and development. This is A case of an 8-month-old female child, presented with acute dehydration, lethargy, vomiting, and diarrhea. She had prior NICU and hospital admissions for neonatal abdominal distension and bronchiolitis with failure to thrive. Laboratory workup revealed metabolic alkalosis with hypokalemia, hyponatremia, and hypochloremia, along with high urinary electrolyte losses. Genetic testing confirmed Bartter syndrome type III. Management included potassium and magnesium supplementation (oral and IV), electrolyte monitoring, and supportive care such as IVF DNS, oral rehydration salts, zinc, and vitamin D. After electrolyte correction, serum potassium improved, though cholelithiasis was incidentally detected, for which ursodeoxycholic acid was prescribed. The patient remains on regular follow-up with ongoing electrolyte monitoring and potassium chloride therapy.

Keywords: *Classic Bartter Syndrome, Metabolic Alkalosis, Hypokalemia, Growth Retardation, Failure to Thrive.*

How to Cite: Dr. Shaik Khadeer Ahamed; Shravani Vanga; Sreeteja Panjala; Chandraprakash Gollapelli; Dr. Rama Rao Tadikonda (2025) Classic Bartter Syndrome with Refractory Hypokalemia: A Pediatric Case Report. *International Journal of Innovative Science and Research Technology*, 10(6), 1615-1617.
https://doi.org/10.38124/ijisrt/25jun1094

I. INTRODUCTION

An inadequate salt reabsorption in the thick ascending limb of the loop of Henle causes Bartter syndrome. Which is an inherited renal tubular condition characterized by metabolic alkalosis, hypokalemia, and salt deprivation. Different forms of Bartter syndrome are caused by mutations in a number of genes that encode the channels and transporters involved in salt reabsorption in the thick ascending limb (1). Phenotypically, BS can be classified as antenatal (aBS) and classic form of BS (cBS) based exclusively on the time of onset and characteristic symptoms (2,3). This syndrome, presumed to follow an autosomal recessive inheritance pattern, is characterized by juxtaglomerular cell hyperplasia associated with hypokalemic, hypochloremic metabolic alkalosis, elevated plasma renin activity and aldosterone levels, and normotension. It is clinically and histologically distinguishable from salt-wasting chronic glomerulonephritis, notably by the preservation of sodium balance under sodium-restricted conditions and the absence of a renal sodium leak. A hallmark biochemical feature is increased urinary excretion of prostaglandin E. Administration of prostaglandin synthetase inhibitors results in suppression of renin and aldosterone secretion and normalization of serum potassium concentrations (4).Bartter syndrome (BS) encompasses five genetically distinct types characterized by dysfunction in renal ion transport mechanisms. Type I, due to SLC12A1 mutations, affects the NKCC2 cotransporter in the thick ascending limb, presenting neonatally with polyhydramnios, prematurity, and marked salt loss. Type II involves KCNJ1 mutations impairing the ROMK channel, with similar severe antenatal features. Type III, the classic form, results from CLCNKB mutations

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25jun1094

impacting ClC-Kb in distal tubules, with more variable and often later-onset manifestations. Type IV is subdivided: Type IVa arises from BSND mutations affecting both ClC-Ka and ClC-Kb, leading to salt loss and sensorineural deafness, while Type IVb involves concurrent CLCNKA and CLCNKB mutations, also causing deafness and progressive renal impairment. Type V, the rarest and X-linked, results from CASR mutations, producing typical BS features with additional hypercalciuria (5).

Here we are discussing classic bartter syndrome, Patients with Bartter Syndrome Type 3 (BS3) typically present in infancy or early childhood with Hypokalemia, Salt Wasting (Excessive loss of sodium through urine), Polyuria, Polydipsia, Growth Retardation. Hypochloremia (low chloride levels) is often more pronounced in BS3 compared to types I and II, likely due to the expression of ClC-Kb in various parts of the nephron, contributing to chloride depletion. Nephrocalcinosis (calcium deposits in the kidneys) may be present but occurs less frequently than in types I and II BS (6,7).

II. CASE DESCRIPTION

An 8-month-old female child, 3rd in birth order, born out of 3rd degree consanguineous marriage presented with dull look and dehydration, the child was apparently asymptomatic 5days back and then developed the symptoms of decreased activity since 5 days associated with increased sleep or drowsiness. c/o vomiting since 3days 5-6 episodes a day, non-bilious, non-projectile, content food (milk). c/o loose stools since3 days 2-3 episodes a day, yellow colored. On admission the child has shown the signs of dehydration, and the vitals were found to be in normal range.

The child has a history of NICU admission i/v/o abdominal distention at birth for 1 day, and hospital admission at the age of 3months diagnosed for LRTI -bronchiolitis with Failure To Thrive (FTT) features for 12 days in routine investigations, child has metabolic alkalosis with hyponatremia, hypokalemia, hypochloremia, with increase in urine electrolytes, potassium correction has been performed. Upon genetic analysis it is confirmed to BARTTER SYNDROME type III. Initially syrup potassium chloride was used with dose of 0.5 ml PO which further increased to 4ml TID, (15ml/20 mEq) after confirmational diagnosis. Routine follow up has been done while evidence of cholelithiasis (2 calculi of 4-5 mm) has found in a routine USG abdomen and ursodeoxycholic acid orally is indicated for 6months.

Initial serum electrolytes levels were found to be significantly low that is sodium-125mEq/L, Potassium- 2 mEq/L, chloride- 65 mEq/L, and Hypochloremic metabolic alkalosis were found on ABG analysis.

The child was initially indicated with IVF DNS at 16cc/hour, syrup zinc at 5ml/PO/OD, and oral rehydration salt and lactobacillus sporogenes sachets. Syrup potassium chloride at 5mEq/kg/day, vitamin d3 drops of 1ml/PO/OD (400IU). And i/v/o serum potassium 2mEq/L; flat T-wave potassium correction was initiated at 2mEq/kg/hour, infusion of 42ml/hour over 1 hour as of calculated dose (4.2kg weight, 1ml of stock solution =0.2mEq) and monitoring the electrolyte levels and ECG. I/v/o persistent hypokalemia magnesium correction has been indicated at 50mg/kg calculated dose of 210mg over 1 hour over cardiac monitoring continue ECG. Electrolyte correction has been done for 3 times of potassium correction, and 2 times magnesium correction. The serum electrolyte levels following potassium correction and magnesium correction for persistent hypokalemia are sodium 128, potassium-3, chloride-80. Syrup potassium chloride at 5mEq/L/day has been continued. Regular checkup and monitoring of the serum electrolytes and pH levels were scheduled timely for its management.

III. DISCUSSION

A gene mutation affecting the ion transport in the loop of Henle at the thick ascending limb causes Bartter syndrome type III, often known as classic Bartter syndrome, an autosomal recessive condition. Mutations in the CLCNKB gene, which codes for the ClC-Kb chloride channel, are commonly associated with classic Bartter syndrome. This gene mutation results in hypokalemia and hypochloremic metabolic alkalosis by impairing salt reabsorption at the tubular level, which raises potassium and chloride excretion. Raised prostaglandin E_2 levels contribute to greater salt loss through the kidneys, whereas raised renin and aldosterone levels cause secondary hyperaldosteronism. In this case, the child presented with the hypokalemia and hypochloremic alkalosis (8).ClC-Kb is essential for controlling the distal tubule's reabsorption of electrolytes and chlorides. Its role is crucial for preserving appropriate ion balance and avoiding excessive renal electrolyte loss, which is affected by mutation of this gene leading to classic Bartter syndrome (9) Polyuria, polydipsia, vomiting, dehydration, failure to thrive, and electrolyte imbalances brought on by salt wasting, such as hypokalemia, hypochloremic metabolic alkalosis, elevated serum renin and aldosterone levels, and elevated urine chloride concentration, are common clinical manifestations of patients often present in infancy. In this instance, the patient has presented with definitive manifestations, including dehydration, vomiting, failure to thrive, and electrolyte imbalances with hypokalemia and hypochloremic alkalosis (10).

Diagnosis is confirmed through clinical evaluation, laboratory tests, and genetic analysis. Treatment aims to correct electrolyte imbalances and address underlying pathophysiology, Oral potassium chloride which helps in normalizing the potassium levels in serum that are lost through salt wasting and sodium chloride to correct deficiencies. Addressing hypomagnesemia, which may exacerbate potassium wasting. Nonsteroidal anti-inflammatory drugs (NSAIDs), such as indomethacin, to reduce elevated prostaglandin E_2 levels and decrease renal salt wasting. Spironolactone to counteract the effects of secondary hyperaldosteronism. With appropriate management, patients often show improvement in electrolyte levels and growth parameters (11). For children with BS, the prognosis can be favorable if they receive treatment and diagnosis early. Optimal long-term results require routine monitoring of growth metrics, renal function, and electrolytes.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25jun1094

IV. CONCLUSION

Bartter syndrome remains challenging to manage, as there is currently no complete cure. Individuals with this condition face a significant risk of developing serious health issues if they don't receive treatment, and chronic kidney disease is a leading cause of morbidity and death. Growth and development deficits can be avoided by recognizing and treating the problem early in childhood. Prompt action guarantees appropriate care, lowering the possibility of long-term issues. The degree of receptor failure affects the overall prognosis. Most people can, however, continue to lead normal lives in spite of these difficulties provided they consistently follow their recommended treatment.

Table 1 Serum Electrolyte Levels

Serum Electrolytes	**Serum Electrolyte Levels**		
	Normal Limits	***Presented Value at Time of Admission***	***Presented Value after 5 Days***
Sodium (Na^+)	135-145mEq/L	117 mEq/L	130 mEq/L
Potassium(K^+)	3.5-5.0mEq/L	2.2 mEq/L	3 mEq/L
Chloride(Cl^-)	98-106mEq/L	68 mEq/L	80 mEq/L
Calcium(Ca^{2+})	8.5-10.5 mg/dL	10 mg/dL	9.5 mg/dL
Magnesium(Mg^{2+})	1.7-2.2mg/dL	1.9 mg/dL	2 mg/dL
Phosphate(PO_4^{3-})	2.5-4.5mg/dL	3.6 mg/dL	4.2 mg/dL

REFERENCES

[1]. Cunha TDS, Heilberg IP. Bartter syndrome: causes, diagnosis, and treatment. Int J Nephrol Renovasc Dis. 2018 Nov 9;11:291-301. Doi: 10.2147/IJNRD.S155397.

[2]. Kömhoff M, Laghmani K. Pathophysiology of antenatal Bartter's syndrome. Curr Opin Nephrol Hypertens. 2017 Sep;26(5):419-425. Doi: 10.1097/MNH.0000000000000346.

[3]. Han Y, Lin Y, Sun Q, Wang S, Gao Y, Shao L. Mutation spectrum of Chinese patients with Bartter syndrome. Oncotarget. 2017 Sep 27;8(60):101614-101622. Doi: 10.18632/oncotarget.21355.

[4]. Bartter FC. Bartter's syndrome. Urologic Clinics of North America. 1977 Jun 1;4(2):253-61.

[5]. Qasba RK, Bucharles ACF, Piccoli MVF, Sharma P, Banga A, Kamaraj B, Nawaz FA, Kumar HJ, Happy MA, Qasba RK, Kogilathota Jagirdhar GS, Essar MY, Garg P, Reddy ST, Rama K, Surani S, Kashyap R. Bartter Syndrome: A Systematic Review of Case Reports and Case Series. Medicina (Kaunas). 2023 Sep 11;59(9):1638. Doi: 10.3390/medicina59091638.

[6]. Mrad FCC, Soares SBM, de Menezes Silva LAW, Dos Anjos Menezes PV, Simões-E-Silva AC. Bartter's syndrome: clinical findings, genetic causes and therapeutic approach. World J Pediatr. 2021 Feb;17(1):31-39. Doi: 10.1007/s12519-020-00370-4. Epub 2020 Jun 1.

[7]. Bokhari SRA, Zulfiqar H, Mansur A. Bartter Syndrome. [Updated 2023 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK442019

[8]. Leclercq F, Leclercq B. Hypokalemic Metabolic Alkalosis. [Updated 2023 Jun 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK545258

[9]. Krämer BK, Bergler T, Stoelcker B, Waldegger S. Mechanisms of Disease: the kidney-specific chloride channels ClCKA and ClCKB, the Barttin subunit, and their clinical relevance. Nat Clin Pract Nephrol. 2008 Jan;4(1):38-46. doi: 10.1038/ncpneph0689.

[10]. Zulfiqar H, Bokhari SRA, Mansur A. Bartter Syndrome. [Updated 2023 Sep 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK442019

[11]. Al Shibli A, Narchi H. Bartter and Gitelman syndromes: Spectrum of clinical manifestations caused by different mutations. World J Methodol. 2015 Jun 26;5(2):55-61. doi: 10.5662/wjm.v5.i2.55.