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Review of Studies Done on Pneumonia and Hyponatremia

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Abstract:

Hyponatremia is relatively common in patients admitted with pneumonia, and it is associated with higher disease severity. The precise mechanism is incompletely understood, but the syndrome of inappropriate antidiuretic hormone secretion is felt to play a significant role. Traditional options to manage hyponatremia in such patients are fraught with challenges. The recently approved vasopressin receptor antagonists offer a new option for the management of this challenging condition.

Keywords: Pneumonia, Hyponatremia, Sodium.

Introduction:

Throughout human history Pneumonia has been a common disease the word "pneumonia" originates from the ancient Greek word "pneumon," which means "lung," so the word "pneumonia" becomes "lung disease **(1).**

Hippocrates referred to pneumonia as a disease "named by the ancients". Maimonides (1135–1204 AD) observed the basic symptoms that occur in pneumonia; acute fever, sticking pleurisy pain in the side, short rapid breaths, serrated pulse and cough." This clinical description is similar to those found in modern textbooks, and it reflected the extent of medical knowledge through the middle Ages into the 19th century **(2).**

Edwin Klebs was the first to observe bacteria in the airways of persons having died of pneumonia in 1875 **(3).**

Carl Friedländer and Albert Fraenkel in 1882 and 1884 identified the two common bacterial causes, Streptococcus pneumoniae and Klebsiella pneumonia **(4).**

Sir William Osler, known as "the father of modern medicine", appreciated the death and disability caused by pneumonia, describing it as the "captain of the men of death" in 1918. Osler also described pneumonia as "the old man's friend" as death was often quick and painless when there were much slower and more painful ways to die **(5).**

Epidemiology:-

World Health Organization (WHO) reported that Pneumonia is the single largest infectious cause of death in children worldwide. It accounts for 14% of all deaths of children under 5 years old, killing 740 180 children in 2019 **(6).**

According to the United Nations Children's Fund (UNICEF), every day, at least one child dies every 45 seconds from pneumonia. Almost all of these deaths are preventable **(7).**

The annual incidence of pneumonia requiring hospitalization was found in one study to be 15.7 cases per 10,000 children and higher among children under 2 years of age (**8).**

1. Hyponatremia in pediatric community-acquired pneumonia:

Don M, et al (9), Serum sodium concentration was measured in 108 ambulatory and hospitalized children with radiologically confirmed CAP of variable severity. HN (serum sodium <135 mmol/I) was present in 49 (45.4%) children, and it was mild (> 130 mmol/l) in 92% of the cases. On admission, hyponatremic patients had higher body temperature, white blood cell count, neutrophil percentage, serum C-reactive protein, and serum procalcitonin, and lower calculated osmolality than normonatremic ones.

No association was found with plasma glucose, type of radiological consolidation or etiology of CAP.

2. Hyponatraemia in cases of children with pneumonia :

Afroditi Sakellaropoulou et al (10), the medical files of 54 children (66.4% males), 4.67 ±2.88 years old, were retro-prospectively reviewed. 35/54 (64.8%) children with pneumonia had normal values of sodium at admission, 18/54 (33.3%) had mild hyponatraemia and 1 child (1.9%) moderate hyponatraemia.

Increased heart rhythm and tachypnoea at admission were correlated with lower values of sodium. No differences were found between the two sexes concerning the characteristics of pneumonia or the range of sodium in serum at admission. Acorrelation was found between sodium admission values and C-reactive protein, leukocyte count. Sedimentation rate at admission to hospital. A negative association was also observed between the degree of hyponatraemia and the duration of hospitalization.

3. Hyponatraemia and the inappropriate ADH syndrome in pneumonia:

Dhawan et al. (11), studied serum sodium, plasma osmolality and urinary sodium and osmolality on days 1, 3 and 5 of hospitalization of 100 children aged from 1 month to 12 years admitted with a diagnosis of pneumonia.

Hyponatraemia (serum sodium concentration < or = 130 mmol/I) was found in 31 patients at the time of admission. The probable cause of hyponatraemia in 94% of cases was the syndrome of inappropriate antidiuretic hormone secretion (SIADH). Symptoms and signs indicative of severe pneumonia were two to three times more frequent and the mean duration of tachypnoea, chest-wall retraction and hospital stay about one and a half times longer in children with hyponatraemia.

Four children died (two on day 1, one on day 5 and one on day 8); all four had a serum sodium concentration < or = 125 mmol/l which persisted until death. Of the remaining 27 hyponatraemic children, serum sodium concentrations returned to normal on day 3 in 26, while in one hyponatraemia persisted until day 7.

The recovery from hyponatraemia showed a good correlation with improvement in clinical signs of respiratory distress. The SIADH occurred in about one-third of the children hospitalized for pneumonia, and was associated with a more severe disease and a poorer outcome. Perhaps fluid restriction in these cases may improve the outcome.

4. Frequency and **significance of electrolyte abnormalities in pneumonia:**

Singhi et al (12), studied 264 hospitalized children with pneumonia for serum sodium and potassium concentration, and plasma osmolality on

the day of admission. Urine osmalality and urine spot sodium concentration were measured in those who had a serum sodium less than or equal to 130 mEq/L.

Hyponatremia was found in 27%, hypernatremia in 3.7%. Hypokalemia (serum potassium less than or equal to 3.5 mEq/L) in 19 and 2% had hyperkalemia (serum potassium greater than or equal to 6.5 mEq/L). Of all the hyponatremia, 68% were secondary to syndrome of inappropriate ADH secretion (SIADH).

Hyponatremia was associated with 60% longer hospital stay, two fold increase in complications and the 3.5 times higher mortality compared to that of normonatremia. The above variables were affected further, if hypokalemia coexisted with hyponatremia.

5. Hyponatremia in children hospitalized due to pneumonia:

Wrotek et al (13) reviewed medical records of 312 children (165 boys, 147 girls) aged 33 days to 16 years, hospitalized with CAP, The children were divided into two age-groups: under and over the age of four. Hyponatremia was observed in 104/312 (33.3 %) patients. Children with HN of both age-groups had higher neutrophil count, those aged > 4 had higher WBC, and those aged < 4 had a lower lymphocyte count than children without HN. Hyponatremic children had higher CRP and tended to have higher procalcitonin and duration of hospitalization was longer in hyponatremic compared with non-hyponatremic children. Hyponatremia is seems associated with the disease severity.

6. Hyponatremia In community-acquired pneumonia:

Nair et al. (14) reviewed records of 342 subjects who participated in the Community-Acquired Pneumonia Standardized Order Set study, a 2-year trial of supplemental treatment tools in hospital pneumonia treatment. Hyponatremia (serum sodium concentration <136 mg/dl) was present at hospital admission in 27.9% of patients. The magnitude was generally mild, only 4.1% of patients had serum sodium <130 mEq/L. Patients with hyponatremia had greater initial heart rate, white blood cell count and pneumonia severity index class 4 or 5. Hyponatremia at admission was associated with greater risk for death and increased length of hospital stay.

7. Hyponatremia and hospital outcomes among patients with pneumonia: a retrospective cohort study :

Zilberberg et al. (15), 60 analyzed 7,965 patients with pneumonia, 649 (8.1%) with hyponatremia had higher rates of ICU and Mechanical ventilation in the first 48 hours of hospitalization than patients with normal sodium. Hyponatremia was associated with an increased ICU and hospital lengths of stay and a trend toward increased hospital mortality.

8. Jayaraj patil et al (16): Hyponatremia in pneumonia: hospital based cross sectional study:

Among the electrolyte disorders in the hospitalized patients, hyponatremia Is the most common electrolyte disorder and has been associated with increased mortality. Hyponatremia is usually defined as a serum sodium concentration of less than 135 mEq/L. It is established already that hyponatremia frequently accompanies pulmonary diseases, both infectious and neoplastic. With respect to pneumonia, a single-center cohort study found the incidence of hyponatremia at hospital admission among Community acquired pneumonia (CAP) patients to be 28%, which was associated with notonly prolongation of hospitalization, but also an increase in mortality.

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