Pattern of electrolytes in a cohort of critically ill COVID-19 patients

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Introduction…

- COVID-19 pandemic caused by the novel coronavirus (SARS-CoV-2), is an emerging rapidly evolving situation.
- At the end of 2019, a novel coronavirus was identified as the cause of a cluster of pneumonia cases in Wuhan, a city in the Hubei Province of China.
- The disease is designated as COVID-19, which stands for coronavirus disease 2019.

- The virus that causes COVID-19 is mentioned severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
- As this virus spread rapidly across the globe, and the WHO subsequently declared COVID-19 (Coronavirus disease 2019) as a pandemic on March 11, 2020.
- It is a potentially fatal disease with multisystem involvements.

- In the pulmonary system, SARS-CoV-2 induces severe pneumonia and causes acute respiratory distress syndrome.

- Though its primary target is the respiratory system, it may have an impact on various parts of the body including the cardiac, nervous, renal, gastrointestinal and coagulation systems.

- In early COVID-19 studies, some evidence has been provided that electrolyte disorders may also be present upon patient's presentation, including sodium, potassium, chloride and calcium abnormalities.

- Patients with COVID-19 often had gastrointestinal symptoms such as diarrhea and vomiting.

- Collectively, the impacts on RAS and gastrointestinal system by COVID-19 probably lead to disruptions of homeostasis of electrolytes and pH.

- Different electrolytes imbalance, may have important implications on management and outcome of critically ill COVID19 patients.

- So, in this study, we aimed to analyze the electrolytes pattern of severe COVID 19 infection and there outcome.

Methodology

Study design: **Cross sectional study**

Study place: **Department of Critical Care Medicine (CCM), BIRDEM General Hospital, Dhaka.**

Study Duration: **5 months (1st July to 10th November, 2020)**

Sample Size: **70**.

Study Procedure

- Admission data of total **70** cases of RT-PCR positive COVID 19 patients, who were critically ill were enrolled in this study.

- We collected patients demographic features (age, sex), comorbidities, history of COVID related symptoms, treatment protocol, requirements of mechanical ventilation, length of ICU stay, electrolyte values including sodium, potassium, chloride, magnesium and corrected calcium.

- Other biochemical parameters including aspartate aminotransferase, alanine aminotransferase, s.creatinine, creatine kinase, lactate dehydrogenase (LDH), D-dimer, albumin, ferritin, C-reactive protein (CRP) and blood counts also collected.

- The level of electrolytes were classified as normal, hypo or hyper according to laboratory reference range

Here normal reference values of different electrolytes are

- Sodium: **135-145** mmol/L,
- Potassium: **3.5-5** mmol/L,
- Chloride: **95-105** mmol/L,
- Magnesium: **1.5-2** mmol/L and
- Calcium: **8.5 – 10.2** mg/L.

(We calculated the corrected calcium levels based upon serum albumin levels).

- Statistical analysis were carried out using SPSS version 19.
- We included the variables -age, gender, comorbidities, length of ICU stay in multivariate analysis.

- Results are given as Mean ± Standard Deviation. A value of $p < 0.05$ was considered statistically significant.

- The outcome was defined as survival (transferred or discharged) and death at ICU.

Results

Table I: Distribution of COVID-19 positive cases according to age (N=70)

Age group (years)	Frequency (n)	Percentage (%)
<50	7	10.
51 - 60	22	31.42
61 - 70	24	34.3
71 - 80	14	20.0
>80	3	4.3

[redacted]

Table II: Individual electrolyte imbalance among COVID-19 positive cases (N=70)

	Frequency (n)	Percentage (%)
Hyponatraemia	**54**	**77.1**
Hypokalaemia	**35**	**50.0**
Hypocalcemia	**20**	**28.6**
Hypomagnesaemia	**11**	**15.7**
Hypermagnesaemia	**5**	**7.14**

Table III: Co morbidities:

Co morbidity	Frequency (n)	Percentage (%)
DM	66	94.3
HTN	60	85.7
Asthma	13	18.6
COPD	10	14.3
IHD	16	22.9
CKD	10	14.3
ESRD	6	8.6
CLD	4	5.7

Table IV: Distribution of COVID-19 positive cases according to length of ICU stay (N=70)

Length of ICU stay (days)	Frequency (n)	Percentage (%)
1 - 5	28	40.0
6 - 10	34	48.6
11 - 15	6	8.6
16 - 20	2	2.9

Table V: Distribution of COVID-19 positive cases according to outcome (N=70)

	Frequency (n)	Percentage (%)
Survival (Transferred/Discharged)	34	48.57%
Death	36	51.42%

Table VI: Outcome comparison in relation with individual electrolyte imbalance (N=70)

	Survived (n=34)	Death (n=36)	p-value
Hyponatraemia	21 (61.8)	33 (91.7)	0.003
Hypokalaemia	15 (44.1)	20 (55.6)	0.339
Hypocalcaemia	8 (23.5)	12 (33.3)	0.522
Hypomagnesaemia	3 (8.8)	8 (22.2)	0.225
Hypermagnesaemia	2 (5.9)	3 (8.3)	1.000

Summery

- A total 70 critically ill, RT-PCR positive for COVID 19 patients were included in this study.
- Among them, 58.57 % (n= 41) were male and 41.42% (n=29) were female, mean age was 62.9 ± 13.3.years, other age distribution shown in table I.
- Different types of co-morbidities were shown in a tabulated form (Table III).

Regarding clinical symptoms:

- 98.6% (n=69) had respiratory distress,
- 97.1% (n=68) had cough,
- 94.3% (n= 66) had history of fever
- And 10.0 % (n=7) presented with unconsciousness.

- Total 82.85% (n=58) had different electrolytes abnormalities and only 17.14% (n=12) had normal electrolytes level during admission period.

- Here most frequent electrolyte imbalance was hyponatraemia (77.1%, n=54) and other electrolytes abnormalities were shown in table II.

- Mean length of ICU stay were 6.4 ± 3.4 days (Table IV).

- Among 70 COVID patients, 48.57% (n=34) were transferred to the isolation ward or discharged at home, considered as survival and 51.42% (n=36) died at ICU. (Table VI)

- Among 48.57% (n=34) survival cases, we found, 61.8% (n=21) had hyponatraemia, 44.1% (n=15) had hypokalaemia, 23.5% (n=8) had hypocalcaemia and 8.8% (n=3) had hypomagnesaemia.

- Among 51.42% (n=36) death cases, we found, 91.7% (n=33) had hyponatraemia, 55.6% (n=20) had hypokalaemia, 33.35 (n=12) had hypocalcaemia and 22.2% (n=8) had hypomagnesaemia. (Table VI)

- In this study p-value is significant in case of hyponatraemia in terms of outcome. Here showed hyponatraemia is associated with poor outcome in COVID 19 patient. (Table VI)

Limitations & Recommendation

- We evaluated only a limited number of electrolyte influences on disease prognosis in a single center. To get more information, multi centered analysis should be done.
- Here, etiology of electrolyte abnormalities were not assessed.
- Only critically ill COVID -19 patients were evaluated. So, these data does not represent the all COVID -19 patient.

Conclusion

- Here, we found that, hyponatraemia was the most predominant electrolyte abnormality.
- Among 36 death cases, around 92% had hyponatraemia.
- In 34 survived cases, nearly 62% had hyponatraemia.
- From our study, it showed that hyponatraemia also associated with poor outcome in critically ill COVID-19 patients.

Conclusion (contd.)

- So, base line electrolyte assessment would be beneficial for evaluating the risk of severity of COVID-19.
- More study of electrolytes in COVID-19 cases with multi center approach is needed.
- Serial electrolyte analysis throughout the course of illness in COVID may give more information about the disease progression

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