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ELECTROLYTE IMBALANCE IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: Chronic obstructive pulmonary disease [COPD] is characterized by progressive airflow limitation and tissue destruction that is not fully reversible. Acute exacerbations are often associated with electrolyte disorders caused by either as a result of the treatment or the disease process. The aim of the study was to determine the effect of electrolyte imbalance in Acute Exacerbation of COPD patients.

Methodology: A Descriptive study was conducted in the Pulmonology Department, Pushpagiri Medical College Hospital over a period of 6 months from October 2022- March 2023. Sixty-three patients with AECOPD who satisfied both the inclusion and exclusion criteria were selected. Serum electrolytes were analyzed from the date of admission and routinely checked until discharge.

Results: The study showed that COPD is significantly associated with electrolyte imbalance. Low levels of Serum sodium(133±4mEq/L) and potassium (3±0.7mEq/L) were found in subjects with AECOPD. HTN along with DM was the most common comorbidity among COPD patients. Majority of the patients with electrolyte imbalance were prescribed with corticosteroids. Confusion, headache along with fatigue were typically found in patients with hyponatremia, whereas muscle cramps was seen in hypokalemic patients.

Conclusion: The study suggest that hyponatremia and hypokalemia are prevalent electrolyte abnormalities in AECOPD patients. Routine monitoring and early correction of serum electrolytes are necessary to provide improved outcome to the patients.

Keywords: COPD; exacerbations; electrolyte imbalance; corticosteroids, hyponatremia; hypokalemia

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is characterized by progressive airflow limitation and tissue destruction that is not fully reversible **[1]**. The airflow limitation in and out of the lungs occurs due to abnormalities in the small airways of the lungs **[2]**. It is currently the third most prevalent cause of illness and mortality worldwide, and its prevalence rises with age. Around 3.2 million people globally died from COPD in 2015, and there were 174 million people worldwide with COPD. COPD is caused by prolonged exposure to noxious particles and gases. The most prevalent cause of COPD is exposure to tobacco smoke. Other causes include long-term exposure to environmental or occupational smoke, alpha-1 antitrypsin (AAT) deficiency etc. **[3]**. The two principal conditions of COPD include: Chronic bronchitis and Emphysema. In chronic bronchitis, cough lasts for at least three months of the year for at least two consecutive years. In emphysema, there is an abnormal persistent enlargement of airspaces distal to the terminal bronchioles, accompanied by the destruction of lung parenchyma without fibrosis, loss of elasticity and closure of small airways **[1]**.

An acute exacerbation of COPD is described as an event in the natural course of illness characterised by a shift in the baseline dyspnoea, cough or sputum which is beyond the normal day-to-day variations that start abruptly and lasts for a short time and sometimes lead to a change in patient's usual pharmaceutical regimen with underlying COPD. COPD exacerbation is associated with substantial electrolyte disturbance caused by either as a result of the treatment or the disease process such as hyponatremia or hypokalemia **[4]**. The systemic response to hypercapnia has the consequence of decreasing renal blood flow, which causes

water retention and salt retention which ultimately results in oedema and hyponatremia. The cause of hypokalemia in COPD may be long-term steroid therapy, metabolic alkalosis, or respiratory acidosis **[5]**. A study conducted in Pokhara, Nepal among 100 COPD patients concluded that hyponatremia and hypokalemia were prevalent electrolyte disorders with AE of COPD patients. Similarly, a study conducted in Kolkata, India among 64 patients of AE of COPD showed significantly lower levels of serum sodium and serum potassium in AECOPD subjects than their healthy counterparts. The diagnosis of electrolyte imbalance poses a major challenge for the clinicians because of its variation in frequency and different etiologies, Routine monitoring of electrolytes (Na^+ and K^+) and early detection of derangements is important to avoid poor outcomes as well as to improve quality of life of the patients.

MATERIALS AND METHODS

The study design was hospital based, descriptive study. Patients with COPD admitted in the Department of Pulmonary Medicine during the study period and who satisfied the inclusion and exclusion criteria was the study population. The study was conducted for a period of 6 month in a tertiary care setting. The sample size is calculated using the following formula:

$$n = \frac{(Z_{1-\alpha/2})^2 \times S^2}{d^2}$$

The sample size for the study is calculated and found to be 63. Inclusion criteria were: Patients having COPD admitted in the pulmonology department, patients who are willing to participate in the study and both female and male patients above 40 years. Patients having chronic renal failure, liver failure and diabetic ketoacidosis were excluded from the study.

OBJECTIVES

1. To understand the clinical and pharmacological profile of patients presenting with Acute Exacerbation of COPD, with electrolyte imbalance.

BRIEF PROCEDURE OF THE STUDY

A descriptive study was conducted in the Department of Pulmonary Medicine in Pushpagiri Medical College hospital over a period of 6 months after getting approval from the Institutional Ethical Committee. The study included a total of 63 patients. All patients with AECOPD aged above 40 years were included. A brief introduction about the study was given to all the patients. A written informed consent form was obtained from the patient or caregiver. Serum electrolytes levels were analyzed from the date of admission and were routinely checked until discharge. All patient data was collected from the case sheet and was recorded using patient data collection proforma. Patient

demographic details like age, gender etc., risk factors, comorbidities and information about drug treatment (generic and trade name, formulation, route of administration, dose, frequency) were collected.

RESULTS AND DISCUSSION

The present study aimed to determine the effect of electrolyte imbalance in Acute Exacerbation of COPD patients.

1. **Distribution of patients with electrolyte imbalance**

The study showed that 71.43% of COPD patients had electrolyte imbalance, whereas 28.57% did not. The result was found to be statistically significant for both sodium and potassium levels. *[p value: 0.04 and 0.001]*. This co-relates with the results of the study conducted by Md Haroon ur Rashid *et al* (2018) **[5]** which showed that electrolyte disorders are a common associated finding in subjects with severe COPD exacerbation that should be corrected promptly to avoid fatal outcomes.

2. **Distribution of patients with type of imbalance**

In our study population (63), hyponatremia was reported in 20 patients (44.4%), hypokalemia in 16 (35.56%) patients and 9 (20%) patients had both hypokalemia and hyponatremia. This is similar to the findings of Chandra Prasad Acharya *et al* (2020) **[6]** which showed that COPD patients were mostly associated with hyponatremia followed by hypokalemia. Hyponatremia in COPD is due to the systemic response to hypercapnia leading to sodium and water retention. Hypokalemia in COPD can occur due to respiratory acidosis, metabolic alkalosis or long- standing steroid therapy **[5]**.

3. **Distribution of comorbidities and electrolyte imbalance**

Electrolyte imbalance was commonly seen in patients with hypertension along with diabetes mellitus (90.91%) followed by hypertension (88.89%). This result is similar to the results of the study conducted by Arif Kadri Balci *et al* (2013) **[7]** which showed that hypertension and diabetes mellitus were most frequently associated with electrolyte imbalances.

4. **Pharmacological profile**

Majority of the patients (12.38%) were prescribed with corticosteroids, being the first line therapy for AECOPD, followed by Anti-cholinergics (11.98%) and β2 agonists (11.58%). This is similar to the findings of the study conducted by Yanan Cui *et al* (2014) **[8]** which showed that most commonly prescribed drugs were Corticosteroids, LABA and LAMA.

5. **Distribution of symptoms in patients with hyponatremia**

Confusion and headache along with fatigue (25.81%) were the most frequently seen symptoms in patients with hyponatremia followed by fatigue (22.58%). This correlates with the findings of a study

conducted by Kian Peng Goh (2004) **[9]** which showed that nonspecific symptoms (such as headache, lethargy, and nausea) typically do not manifest until the plasma sodium level falls below 120 mmol per L (mEq per L).

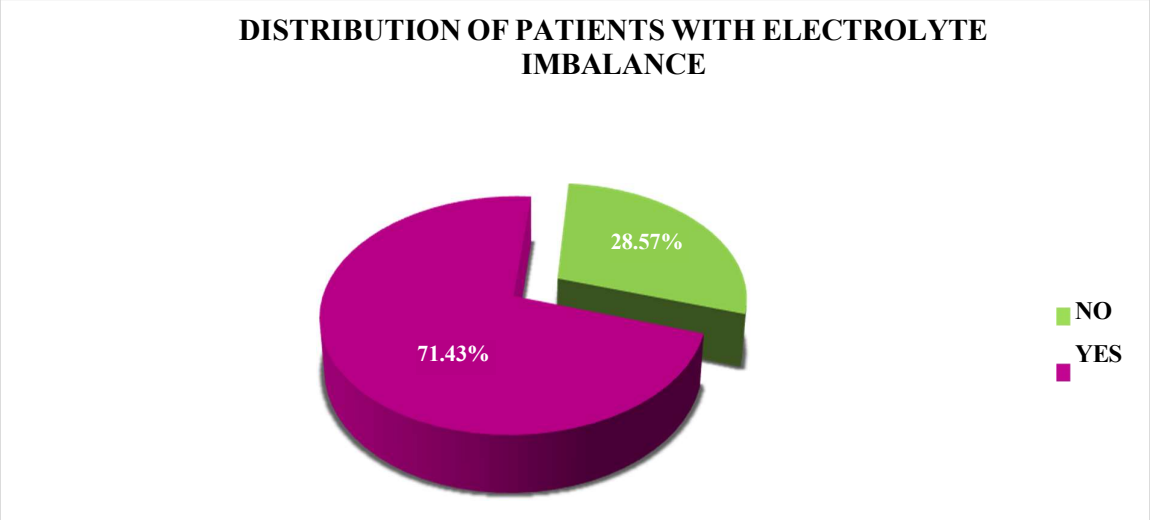
6. Distribution of symptoms in patients with hypokalemia

Muscle cramps (37.5%) were the most frequently seen symptom in patients with hypokalemia followed by constipation (29.17%). This is similar to the findings of Efstratios Kardalas *et al* (2018) **[10]** which showed hypokalemic symptoms can vary from leg cramps, GI problems like constipation to cardiovascular problems like arrhythmias. Symptoms resolve with correction of hypokalemia.

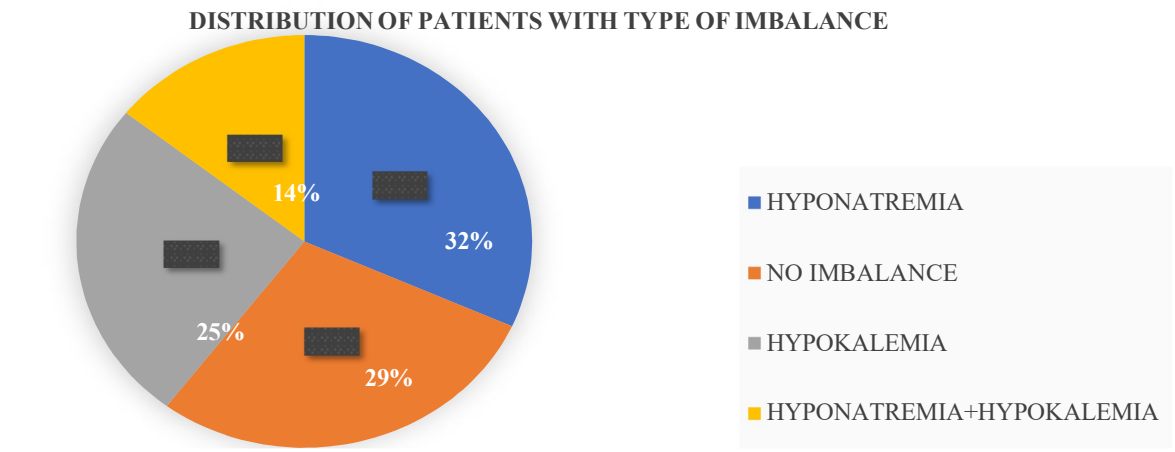
DISTRIBUTION OF PATIENTS WITH ELECTROLYTE IMBALANCE

IMBALANCE	FREQUENCY	PERCENTAGE
YES	45	71.43%
NO	18	28.57%
TOTAL	63	100%
Na- Mean±SD -133±4mEq/L, t value--2.102, P Value-0.04 K- Mean±SD - 3±0.7mEq/L, t value-3.4350, P Value-0.001		

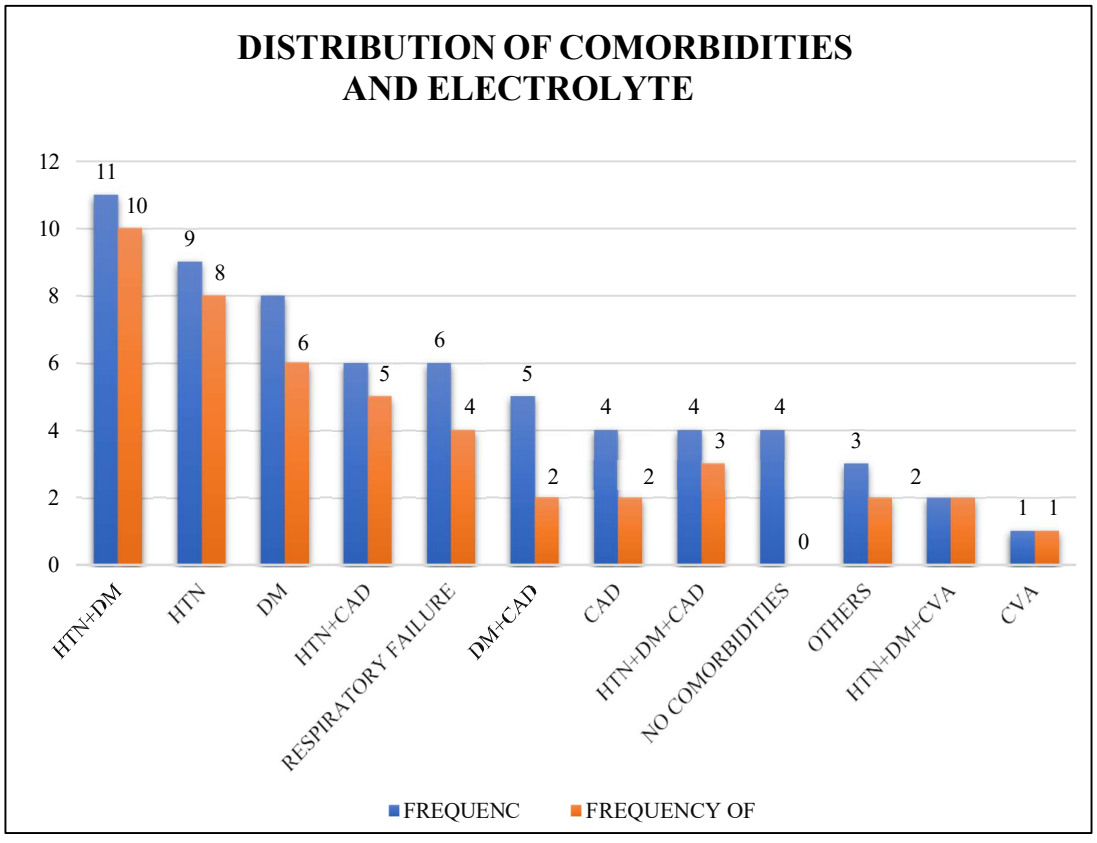
*** Significant**



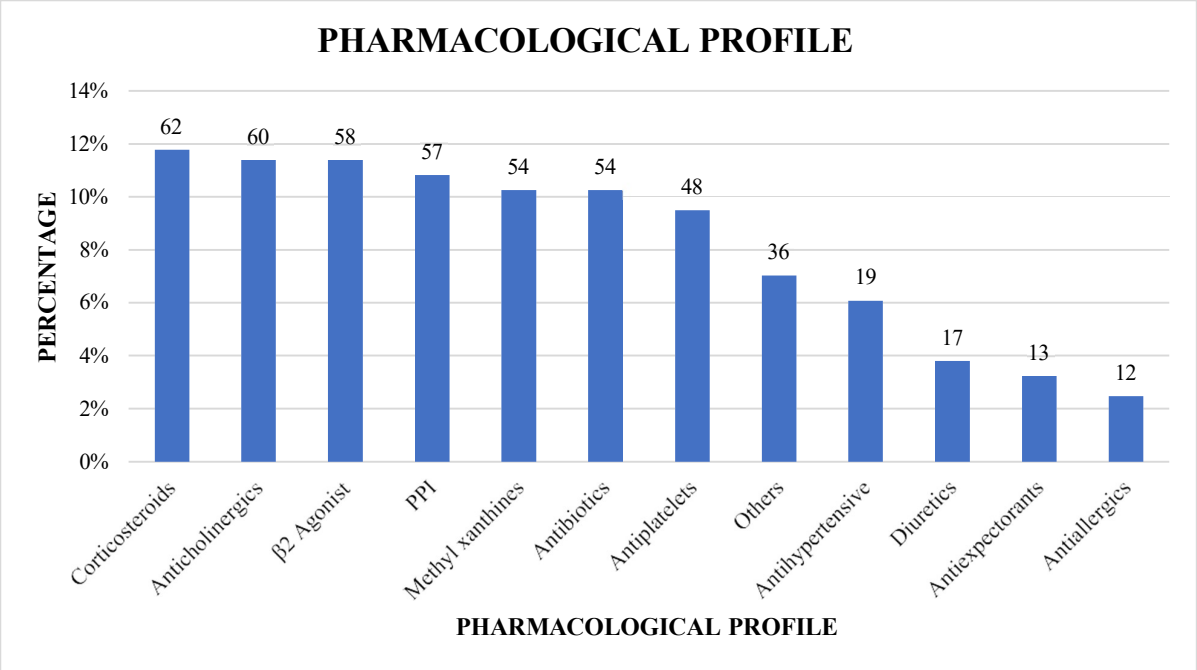
DISTRIBUTION OF PATIENTS WITH TYPE OF IMBALANCE



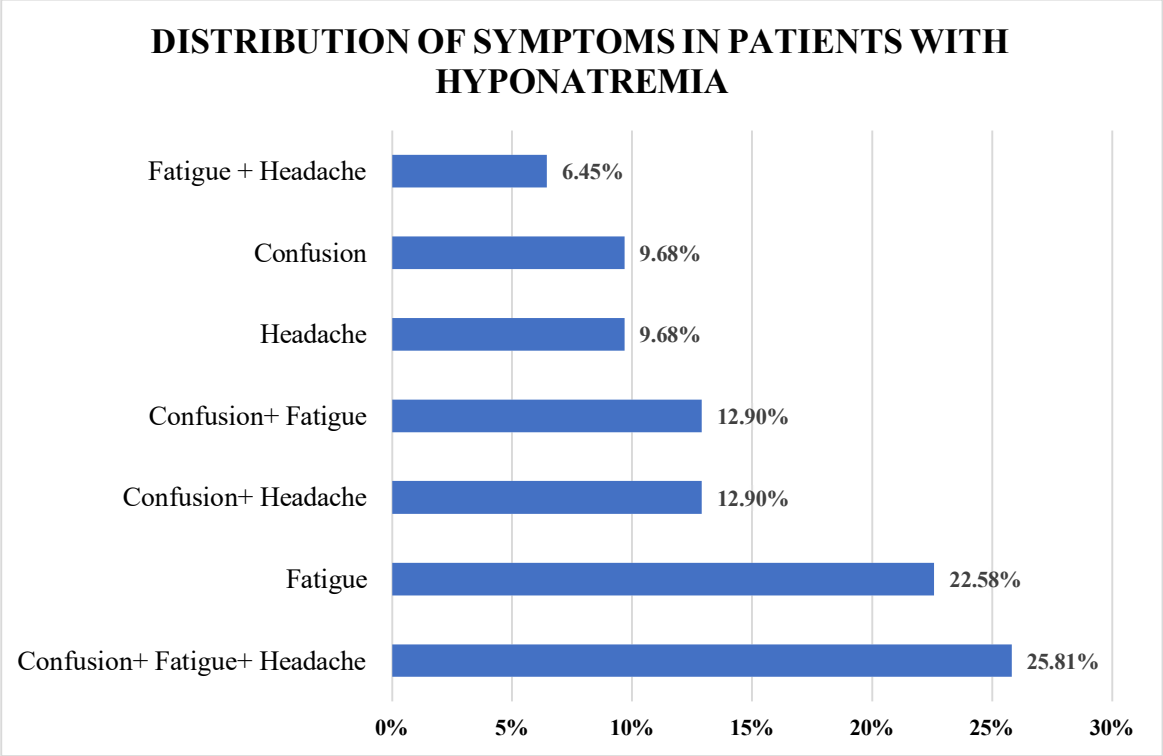
DISTRIBUTION OF COMORBIDITIES AND ELECTROLYTE IMBALANCE



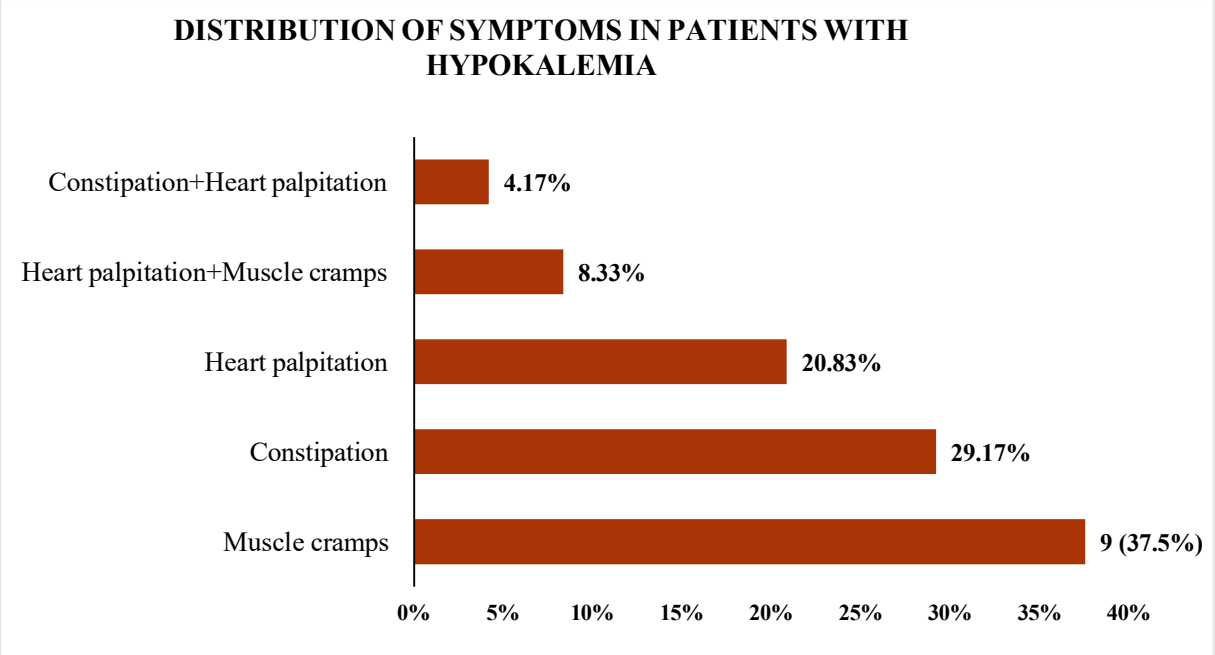
PHARMACOLOGICAL PROFILE



DISTRIBUTION OF SYMPTOMS IN PATIENTS WITH HYPONATREMIA



DISTRIBUTION OF SYMPTOMS IN PATIENTS WITH HYPOKALEMIA



CONCLUSION

COPD is one of the major causes of morbidity and mortality worldwide. The prevalence of COPD is increasing with smoking, industrialization and age. Exacerbations are the most common causes of hospital admission and re admission and the economic and social burden associated with them are immense. AECOPD is commonly associated with electrolyte disturbances. The diagnosis of electrolyte imbalance poses a major challenge for the clinicians because of its variation in frequency and different etiologies.

The study results showed that AECOPD was significantly associated with electrolyte imbalances; hyponatremia being more common than hypokalemia. The most common symptoms in patients with hyponatremia are fatigue and confusion along with head ache. Muscle Cramps were mostly seen in patients with hypokalemia. Majority of the patients had hypertension along with DM as comorbidities. Corticosteroids being the first line therapy for AECOPD, was the most commonly prescribed drug. Corticosteroids produced deranged serum electrolyte levels.

The study concludes that hypokalemia and hyponatremia are common electrolyte disorders in AECOPD patients. Suspicion should be raised by evaluating the symptoms and risk factors and then subsequently confirmed by serum electrolyte analysis. Routine monitoring of electrolytes (Na^+ and K^+) and early detection of derangements is important to

avoid poor outcomes as well as to improve quality of life of the patients.

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Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship and / publication of this article.

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Ethical Consideration

Institutional Research/ Human Ethics Committee approval was obtained with IEC no: PCP/IEC-02B/26/PD-2022 PCP/IEC-02B/27/PD-2022 PCP/IEC-02B/28/PD-2022 PCP/IEC-02B/29/PD-2022

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