Research Article

Effect of Corticosteroid Therapy in Patients With an Acute Exacerbation of Chronic Obstructive Pulmonary Disease Receiving Ventilatory Support

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Abstract
Background: Chronic obstructive pulmonary disease (COPD) is a common, preventable, and treatable disease characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities, usually caused by significant exposure to noxious particles or gases. The chronic airflow limitation that characterizes COPD is caused by a mixture of small airway disease (e.g., obstructive bronchiolitis) and parenchymal destruction (emphysema) the relative contributions of which vary from person to person. **Aim of work:** The aim of the study was to determine the effect of systemic corticosteroids in patients with severe AECOPD admitted to intensive care unit (ICU) Receiving Ventilatory Support. **Patients and methods:** 100 patients with AECOPD leading to hypoxemia and respiratory acidosis with pH < 7.35 and PaCO2 > 45 mm of Hg admitted to the intensive care unit (ICU) who were receiving ventilator support (invasive or noninvasive mechanical ventilation). **Results:** It was noticed that steroid group had significantly lower duration of mechanical ventilation (4.67 ± 2.76 vs. 2.76 ± 1.11 days; *P*= 0.01), ICU stay (5.33 ± 2.87 vs. 7.89 ± 3.36 days; *P*= 0.04), hospital stay (11.65 ± 3.89 vs. 16.67 ± 4.44 days; *P*= 0.03). **Conclusion**: Corticosteroid therapy was associated with significantly lower duration of mechanical ventilation, ICU stay and hospital stay.
Keywords: arterial blood gases, chronic obstructive pulmonary disease,ventilatory support, corticosteroid therapy.

Introduction
Chronic obstructive pulmonary disease (COPD) is a common, preventable, and treatable disease characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities, usually caused by significant exposure to noxious particles or gases. The chronic airflow limitation that characterizes COPD is caused by a mixture of small airway disease (e.g., obstructive bronchiolitis) and parenchymal destruction (emphysema) the relative contributions of which vary from person to person (GOLD, 2019).

By 2010, it had become the third leading cause of mortality worldwide (Lozano et al., 2012). The natural course of COPD is characterized by the occurrence of exacerbations (usually two to three per year) requiring either an emergency visit to hospital or hospitalization (Wedzicha and Seemungal, 2007) Acute exacerbations of COPD (AECOPD) are not only responsible for the largest part of the economic burden associated with COPD, but they also accelerate the decline in lung function and worsen the prognosis of the disease with elevated in-hospital and 1-year mortalities (11% and 40%, respectively), and have a 6-month relapse rate of 50%. COPD exacerbations are usually associated with increases in local and systemic inflammatory response, and are treated with systemic steroids (Wedzicha & Wilkinson 2006).

Current guidelines strongly recommend administration of systemic steroids to hospitalized patients with AECOPD (GOLD, 2019). Recommendations rely on meta-analyses with cumulated effects showing both a significant reduction in the rate of treatment failure, and an increase in the rate of improvement in lung function and dyspnea (Cheng et al., 2012).

However, this recommendation is based on data in non intubated patients where the initiation of

mechanical ventilation (MV) was a marker of treatment failure (Leuppi et al., 2013). Furthermore, In critically ill patients, corticosteroid treatment is a risk factor of infections, hyperglycemia and critical-illness neuromuscular abnormalities, and these conditions are associated with an increased morbidity and mortality. The effect of treatment with systemic corticosteroids in COPD patients with acute exacerbation requiring mechanical ventilation has not been evaluated investigated so it is unknown if the corticosteroids could reduce the duration of mechanical ventilation and the length of intensive care unit (ICU) stay or if, on the contrary, the development of adverse events could lead to a longer time on mechanical ventilation and ICU stay (Chakrabarti et al., 2009).

Aim of the study: The aim of the study was to determine the effect of systemic corticosteroids in patients with severe AECOPD admitted to intensive care unit (ICU) Receiving Ventilatory Support.

Patients and Methods

One hundred 100 patients with AECOPD leading to hypoxemia and respiratory acidosis with pH < 7.35 and $PaCO_2$ > 45 mm of Hg admitted to the intensive care unit (ICU) who were receiving ventilator support (invasive or noninvasive mechanical ventilation) were eligible for inclusion. Patients were randomized to the two treatment groups. Whereas one group received intravenous methylprednisolone (0.5 mg/kg every 6 hours for 72 hours, 0.5 mg/kg every 12 hours on days 4 through 6, and 0.5 mg/kg/d on days 7 through 10) (Control group, n=50), the other group received placebo of normal saline solution (steroid group, n=50).

Inclusion Criteria:

Known to have COPD diagnosed on the basis of previous PFTs (FEV/ FVC < 70% and < 12% bronchodilator response) or clinical history, physical examination, chest radiography, and ABGs (arterial CO_2 retention, elevated bicarbonate), as well as (1) $PaCO_2$ > 45 mmHg and pH < 7.35; and (2) evidence of respiratory muscle fatigue (RR > 22 breaths/min, accessory muscle use, and respiratory distress via direct observation of ICU staff).

Exclusion Criteria:

Patients were not included if they had evidence of pneumonia, were treated for COPD exacerbation with systemic steroids within 30 days prior to screening or had an absolute contraindication to steroids (active gastro duodenal ulcer, severe uncontrolled sepsis, hepatitis or other active viral disease and/or neuromuscular disease).

All patients were subjected to the followings:

(A) Thorough medical history including

1. Age and sex.
2. Marital state.
3. Occupation history.
4. Special habits (Smoking history, History of exposure to biomass fuel).
5. History of chronic cough.
6. History of exertional dyspnea.

(B) Thorough clinical examination including

(1) General examination.

(2) Chest examination (inspection, palpation, percussion and auscultation).

(C) Investigations including

(1) Chest x ray (postero-anterior and lateral views).

(2) Arterial blood gases (ABG).

ABG was obtained on room air using heparinized blood sample from radial artery and analyzed using blood gases analyzer (Rapid lab 850; CHIRON/Diagnostics; critical care systems). Blood gases parameter including PH, arterial oxygen tension (PaO_2), arterial carbon dioxide tension ($PaCO_2$), and oxygen saturation ($Sa\ O_2$) which done at admission, 2nd day, 3rd day, 4th day and 5th day were collected.

(3) Laboratory investigations.

Laboratory investigations including complete blood count (white blood cells (WBCs), heamoglobin (Hb), haematocrite (HCT) and platelets (PLT)), liver function tests (alanine aminotransferase (ALT), aspartate aminotransferase (AST), albuminand total bilirubin, renal function tests (serum creatinine (S.Cr) and urea), Electrolyte (sodium, potassium, calcium and magnesium), random blood sugar and C-Reactive protein.

Statistical analysis

The collected data were revised, organized, tabulated and statistically analyzed using statistical package for social sciences (SPSS) version 23.0 for windows. Data are presented as the Mean ± standard deviation (SD), frequency, and percentage. Categorical variables were compared using the chi-square ($\chi 2$) and Fisher's

exact tests (if required). Continuous variables were compared by the Student t test (two-tailed) and one – way ANOVA test for parametric data with Bonferroni post hoc test to detect differences between subgroups. The level of significance was accepted if the P value < 0.05.

Results

Table (1): Baseline data of studied groups

	Steroid group	Control group	*P* value
Age (years)	55.11± 15.84	58.80 ± 20.71	0.30
Sex			
Male	35 (70%)	37 (74%)	0.17
Female	15 (30%)	13 (26%)	
Body mass index (kg/m^2)	26.56 ± 4.44	26.11± 8.79	0.08
Smoking status			
Ex-smoker	20 (40%)	22 (44%)	0.19
Current smoking	13 (26%)	10 (20%)	
Non-smoker	17 (34%)	18 (36%)	
Diabetes mellitus	18 (36%)	13 (26%)	0.11
Hypertension	14 (28%)	12 (24%)	0.06
Ischaemic heart disease	2 (4%)	4 (8%)	0.94
Clinical data			
SBP (mmHg)	88 ± 14.14	88.56 ± 14.14	0.66
DBP (mm/ Hg)	55.6 ± 11.21	52 ± 13.54	0.31
HR (beat/minute)	113.8 ± 29.1	119 ± 17.03	0.20
RR (cycle/ minute)	41.92 ± 24.1	35.40 ± 5.80	0.44
Temperature (°C)	39.76 ± 7.07	38.58 ± 1.29	0.41

Table 1 shows baseline data of studied patients. Mean age of steroid group was 55.11± 15.84 years and majority (70%) of them were males while mean age of control group was 58.80 ± 20.71 years and majority (74%) of them were males. Mean body mass index of steroid and control group was 26.56 ± 4.44 and 26.11± 8.79 kg/m^2, respectively.

As regarding smoking status of steroid group; 20 (40%), 13 (26%), and 17 (34%) patients were ex-smoker, current smoker and non-smoker, respectively while in case of control group; 22 (44%), 10 (20%), and 18 (36%) patients were ex-smoker, current smoker and non-smoker, respectively.

DM, HTN and IHD presented in 18 (36%), 14 (28%), and 2 (4%) patients of steroid group, respectively and presented in 13 (26%), 12 (24%), and 4 (8%) patients of control group, respectively. both studied groups had insignificant differences as regarding baseline data (*P*> 0.05).

Table (2): Causes of exacerbation in studied groups

	Steroid group	**Control group**	***P* value**
Causes of exacerbation			
Respiratory infection	40 (80%)	39 (78%)	0.09
Cardiac failure	8 (16%)	7 (14%)	
Sepsis	1 (2%)	2 (4%)	
Post-operative	1 (2%)	1 (2%)	
Other causes	0	1 (2%)	

Table 8 causes of exacerbation in studied groups. Respiratory infection was the most frequent cause of acute exacerbation (80% of steroid group and 78% of control group) followed by cardiac failure (16% of steroid group and 14% of control group). other causes were summarized at table 8.

Table (3): Baseline laboratory data of studied patients

Variables	Steroid group	Control group	*P* value
CBC			
HB (mg/dl)	10.20 ± 2.41	11.22 ± 1.81	0.28
TLC (x 10^6/ml)	15.20 ± 7.90	16.66 ± 7.07	0.49
Hct (%)	33.76 ± 7.63	35.95 ± 5.78	0.26
Platelets (x 10^6/ml)	208.88 ± 78.01	209.8 ± 116.9	0.97
Kidney function			
Urea (µmol/l)	15.72 ±13.20	15.46 ± 10.65	0.94
Creatinine (µmol/l)	148.02 ± 55.09	169.84 ± 78.1	0.54
Liver function			
Bilirubin (mg/dl)	2.28 ± 1.11	5.46 ± 2.33	0.07
Albumin (mg/dl)	22.54 ± 3.84	23.5 ± 7.22	0.57
AST (U/L)	98.08 ± 22.34	128.75 ± 54.3	0.53
ALT (U/L)	58.04 ± 19.45	93.83 ± 35.9	0.27
Electrolytes			
Sodium (µmol/l)	133.8 ± 4.60	133.20 ± 6.44	0.72
Potassium (µmol/l)	4.03 ± 0.50	4.33 ± 0.55	0.33
Calcium (mg/dl)	9.01 ± 0.76	8.83 ± 1.11	0.56
Magnesium (µmol/l)	2.28 ± 1.22	1.96 ± 0.35	0.12
RBS (mg/dl)	190.92 ± 66.02	188.2 ± 80.51	0.89
CRP (mg/dl)	66.41 ± 36.54	65.63 ± 30.67	0.97

Table 3 shows the baseline laboratory in studied groups. It was noticed that liver and renal impaire-ment at admission was insignificantly higher in control group. It was also noticed that baseline hemoglobin level and leucocytic count were insignificantly lower in steroid group. All base line laboratory data had insignificant differences between both group.

Table (4): Arterial blood gases of studied patients

Variables	Steroid group	Control group	*P* 1 value
pH			
At admission	7.32 ± 0.03	7.32 ± 0.02	0.12
2nd day	7.34 ± 0.03	7.33 ± 0.03	0.88
3rd day	7.34 ± 0.06	7.34 ± 0.04	0.50
4th day	7.35 ± 0.03	7.35 ± 0.03	0.11
5th day	7.35 ± 0.02	7.35 ± 0.02	0.09
PCO_2			
At admission	66.64 ± 22.60	67.36 ± 21.65	0.45
2nd day	59.50 ± 16.31	66.54 ± 15.48	0.02
3rd day	55.16 ± 10.62	60.33 ± 11.23	0.03
4th day	54.11 ± 10.11	61.01 ± 10.09	0.01
5th day	50.09 ± 8.98	61.01 ± 11.65	0.01
SO_2			
At admission	71.13 ± 8.02	71.48 ± 10.58	0.93
2nd day	92.25 ± 6.91	88.54 ± 7.92	0.04
3rd day	92.38 ± 2.65	88.04 ± 9.74	0.03
4th day	93.11 ± 3.33	89.11 ± 10.11	0.04
5th day	93.33 ± 3.09	89.33 ± 8.90	0.01
P_{aO2}/ FiO_2			
At admission	1.83 ± 0.52	2.02 ± 0.56	0.21
2nd day	1.46 ± 0.63	1.50 ± 0.73	0.83
3rd day	2.36 ± 1.05	2.34 ± 1.18	0.21
4th day	2.33 ± 1.09	2.36 ± 1.09	0.99
5th day	2.55 ± 1.11	2.51 ± 1.01	0.09

In both groups there were significant improvembt in parameters of arterial blood but steroid group showed significantly higher oxygen saturation and lower PCO_2 over time of study in comparison to control group

Table (5): Change in CRP and leucocytic count in studied patients

Variables	Steroid group	Control group	*P* 1 value
Leucocytic count (x 10^9/l)			
At admission	15.20 ± 7.90	16.66 ± 7.07	0.49
2nd day	17.61 ± 3.17	13.33 ± 6.03	0.01
3rd day	17.34 ± 5.06	13.34 ± 5.04	0.04
4th day	18.35 ± 6.03	11.35 ± 8.03	0.01
5th day	18.95 ± 4.02	12.35 ± 4.02	0.04
C-reactive protein (mg/dl)			
At admission	66.41 ± 36.54	65.63 ± 30.67	0.97
2nd day	65.63 ± 30.67	67.54 ± 15.48	0.65
3rd day	55.16 ± 10.62	69.33 ± 11.23	0.03
4th day	44.11 ± 10.11	70.01 ± 10.09	0.01
5th day	30.09 ± 8.98	70.91 ± 11.65	0.01

It was noticed that CRP was significantly lower in steroid group in 3rd, 4th, and 5th day but leucocytic count was significantly higher in steroid all over time in comparison to control group.

Table (6): Change in random blood sugar and insulin dose in studied patients

Variables	Steroid group	Control group	*P* 1 value
RBS (mg/dl)			
At admission	190.92 ± 66.02	188.2 ± 80.51	0.89
2nd day	198.2 ± 80.51	187.33 ± 46.03	0.01
3rd day	197.34 ± 35.06	185.34 ± 45.04	0.03
4th day	199.35 ± 36.03	186.35 ± 48.03	0.03
5th day	210.95 ± 44.02	183.35 ± 54.02	0.04
Insulin dose (U/day)			
At admission	11.41 ± 6.14	10.63 ± 1.67	0.11
2nd day	13.63 ± 3.37	7.54 ± 3.48	0.04
3rd day	15.16 ± 9.62	9.33 ± 1.23	0.03
4th day	22.11 ± 10.01	7.01 ± 1.09	0.01
5th day	22.19 ± 8.98	7.91 ± 1.05	0.01

It was noticed that in comparison to control group, steroid group had significantly higher RBS and daily insulin dose throughout the 5-day study period.

Table (7): Change in PEEP in studied patients

PEEP (cm of water)	Steroid group	Control group	*P* 1 value
At admission	7.89 ± 1.90	7.88 ± 1.98	0.80
2nd day	7.65 ± 1.65	7.66 ± 1.05	0.81
3rd day	6.89 ± 1.77	6.60 ± 1.75	0.33
4th day	6.77 ± 1.56	6.40 ± 1.22	0.83
5th day	6.09 ± 2.02	6.11 ± 1.09	0.98

It was noticed that that both groups showed significant improvement in PEEP with no insignificant differences between both groups.

Table (8): Outcome in studied patients

	Steroid group	Control group	P 1 value
Duration of MV (day)	2.76 ± 1.11	4.67 ± 2.76	0.01
ICU stay (day)	5.33 ± 2.87	7.89 ± 3.36	0.04
Hospital stay (stay)	11.65 ± 3.89	16.67 ± 4.44	0.03
Re-intubation	4 (8%)	5 (10%)	0.98
Mortality	2 (4%)	3 (6%)	0.43

It was noticed that steroid group had significantly lower duration of mechanical ventilation (4.67 ± 2.76 vs. 2.76 ± 1.11 days; *P*= 0.01), ICU stay (5.33 ± 2.87 vs. 7.89 ± 3.36 days; *P*= 0.04), hospital stay (11.65 ± 3.89 vs. 16.67 ± 4.44 days; *P*= 0.03). Re-intubation with 48 hours required in nine patients in the study, five of them from control group. Three patient from control group and two patients from steroid group were deteriorated and died.

Table (9): Adverse events in studied patients

	Steroid group	Control group	*P* value
Superinfection	6 (12%)	5 (10%)	0.65
GIT upset	3 (6%)	3 (6%)	0.60
Arterial hypertension	3 (6%)	2 (4%)	0.42
Hyperglycaemia	17 (34%)	5 (10%)	0.01
Ventilator associated pneumonia	4 (8%)	5 (10%)	0.40

Table 9 shows the adverse events in studied groups. The most frequent events in steroid group was hyperglycaemia (34%) followed by superinfection (12%) while in case of control group, the most frequent events were ventilator associated pneumonia (10%) and hyperglycaemia (10%). Both groups had insignificant differences as regarding adverse events with exception of significantly higher hyperglycaemia in steroid groups

Discussion

COPD is a major health problem and leading cause of morbidity and mortality worldwide. The burden of the disease is expected to rise in future. World Health Organization has predicted that by 2020, COPD will be the 5th most prevalent disease worldwide and will be among the three leading causes of death (Lopez and Murray, 1998).

Acute exacerbations of COPD (AECOPD) are largely responsible for the morbidity and mortality associated with the disease. AECOPD cause worsening respiratory insufficiency and increased resistive load on ventilatory muscles leading to respiratory failure requiring emergency treatment with the potential for prolonged hospitalization in acute hospital beds often more than once a year (Andersson et al., 2002).

Current guidelines strongly recommend administration of systemic steroids to hospitalized patients with AECOPD (GOLD, 2019). Recommendations rely on meta-analyses with cumulated effects showing both a significant reduction in the rate of treatment failure, and an increase in the rate of improvement in lung function and dyspnea (Cheng et al., 2012) However, This recommendation is based on data in non intubated patients where the initiation of mechanical ventilation (MV) was a marker of treatment failure (Leuppi et al., 2013) Furthermore, In critically ill patients, corticosteroid treatment is a risk factor of infections, hyperglycemia and critical-illness neuromuscular abnormalities, and these conditions are associated with an increased morbidity and mortality. The effect of treatment with systemic corticosteroids in COPD patients with acute exacerbation requiring mechanical ventilation has not been evaluated investigated so it is unknown if the corticosteroids could reduce the duration of mechanical ventilation and the length of intensive care unit (ICU) stay or if, on the contrary, the development of adverse events could lead to a longer time on mechanical

ventilation and ICU stay (Chakrabarti et al., 2009).

The aim of this study was to determine the effect of systemic corticosteroids in patients with severe AECOPD admitted to intensive care unit (ICU) Receiving Ventilatory Support.
This study was conducted in One hundred patients with AECOPD admitted to the intensive care unit (ICU) in Al-azhar university hospital. Patients were randomized to the two treatment groups. Whereas one group received intravenous methylprednisolone, the other group received placebo of normal saline solution.

This study showed that mean age of steroid group was 55.11± 15.84 years, While mean age of control group was 58.80 ± 20.71 years. The age of our patients groups fall within the range reported by (El-Shabrawy & Eldamanhory 2017) with the mean age of patients with AECOPD was 56.97± 5.22 years.

This study included (70%) males and (30%) females of steroid group, While in control group (74%) was males and (26%) was females. which showed male sex predominance. For many years COPD was considered a disease of men, with higher global prevalence in men than in women. In the study done by Dal Negro et al., (2015) on 1,216 Patients 72.4% were males and 27.6% were females (314). In another study by Kumar & Rai (2015) male to female ratio was 1.5:1 (Kumar and Rai, 2015).

Tobacco smoke is by far the most important risk factor for COPD worldwide. In our patients groups the smoking status among steroid group patients was (26%) current smokers, (40%) ex-smokers and (34%) non –Smokers. While, in control group, (20%) current smokers, (44%) ex-smokers and (36%) non-Smokers this should raise our concern about the other risk factors for the development of COPD and in addition to smoking cessation programs, effort should be directed to control other risk factors. It is helpful, conceptually, to think of a person's exposures in terms of the total burden of inhaled particles. Each type of particle, depending on its size and composition, may contribute a different weight to the risk and the total risk will depend on the integral of the inhaled exposures. For example, tobacco smoke (active and passive tobacco smoke), outdoor and indoor air pollution, and occupational exposures probably act additively to increase a person's risk of developing COPD (Mannino and Buisto, 2007). Recent data from the US NHANES III survey indicate that occupation can be an important risk factor for COPD (Martinez et al., 2015). The fraction of COPD attributable to work was estimated as 19.2% overall and 31.1% in never-smokers (Mannino and Buisto, 2007).

A subject's socioeconomic background plays an important role that is not only the result of exposure to tobacco and occupational hazards. Whether, the effect is due to impaired growth of lungs and airways or an increased rate of infection is not clear. In developing countries, indoor air pollution, due to the use of biomass or heating and cooking, may pose a significant particulate burden and contribute to COPD, especially in females (Pauwels et al., 2001).

Results in the current study indicated that corticosteroid therapy was associated with significantly lower duration of mechanical ventilation (4.67 ± 2.76 vs. 2.76 ± 1.11 days; P= 0.01), ICU stay (5.33 ± 2.87 vs. 7.89 ± 3.36 days; P= 0.04), hospital stay (11.65 ± 3.89 vs. 16.67 ± 4.44 days; P= 0.03).

The magnitude of the treatment effect on the duration of mechanical ventilation and ICU stay is similar to that reported regarding the duration of hospitalization in clinical trials of patients with exacerbated COPD. In the study by (Alia et al., 2011) reported a reduction in the length of mechanical ventilation from 4 days in the placebo group to 3 days in the corticosteroid group, Length of ICU stay from 7 days in the placebo group to 6 days in the corticosteroid group and Length of hospital stay was longer in placebo group from 15 days to 13 days in corticosteroid group. Davies et al., 20 reported that the median length of hospital stay in patients treated with corticosteroids was significantly shorter than in those receiving placebo (7 days vs 9 days; P=.03). Niewoehner et al., (1999) found that the average length of hospitalization was significantly longer in the placebo group than in the corticosteroid group (9.7 days vs 8.5 days; P=.003).

Wood-Baker et al., (1998) reported a reduction in the length of hospitalization from 9.5 (5.2)

days in the placebo group to 8.1 (4.4) days in the corticosteroid group.

In this trial, the decline in C-reactive protein levels was faster in patients who were treated with corticosteroids in 3rd, 4th, and 5th with p value of (0.03, 0.01 and 0.01) respectively.
Corticosteroids are very potent inhibitors of inflammation. This finding has been also reported in randomized controlled trials evaluating the efficacy of corticosteroid therapy in patients with community acquired pneumonia.40-42 Changes in the immune response may contribute to the reduction in the duration of mechanical ventilation. In a study by Alia et al., (2011) showed similler results with significant decline of C-reactive protein levels started in the 4^{th} day.

Our study showed that the most frequent ADVERSE events in steroid group was hyperglycaemia (34%), also It was noticed that in comparison to control group, steroid group had significantly higher RBS and daily insulin dose throughout the 5-day study period.

Hyperglycemia is a known complication of corticosteroid treatment (Steinberg et al., 2006). In a study by Alia et al., (2011) reported that there was significant increase of hyperglycemic episodes in patients treated with corticosteroid. Corticosteroid treatment was not associated with an increased risk of gastrointestinal upset, superinfections, Hypertention, or Ventilator associated pneumonia in our study. Similar findings have been reported in a recent systematic review on the benefits and risks of the use of corticosteroids in patients with severe sepsis and septic shock43 and in a randomized trial on the use of corticosteroids in patients with persistent acute respiratory distress syndrome (Steinberg et al., 2006).

Conclusion

• Corticosteroid therapy was associated with significantly lower duration of mechanical ventilation, ICU stay and hospital stay.
• The decline in C-reactive protein levels was faster in patients who were treated with corticosteroids.
• Most frequent ADVERSE events in steroid group was hyperglycaemia (34%), also It was noticed that in comparison to control group, steroid group had significantly higher RBS and daily insulin dose throughout the 5-day study period

Recommendation

Smokers must be advised at each visit to doctor to stop smoking and discuss with them hazards of smoking and begin a plan for smoking cessation.
Use of systemic corticosteroids in patients with severe AECOPD admitted to intensive care unit (ICU) Receiving Ventilatory Support.

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