Role of Mechanical Ventilation in Management of Heart Failure

An Essay

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Yasser Mohammed Mahmoud

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List of Abbreviations

Abb.	Mean
ACC	American college of cardiology
ACPE	Acute cardiogenic pulmonary edema
ADHERE	Acute decompensated heart failure national registry
ADHF	Acute decompensated heart failure
AHA	American heart association
AHF	Acute heart failure
Ang	Angiotensin
ANP	Atrial natriuretic peptide
APA	Aminopeptidase A
APN	Aminopeptidase N
APRV	Airway pressure release ventilation
ARDS	Acute respiratory distress syndrome
ASV	Adaptive servo ventilation
BiPap	Bilevel positive airway pressure
BNP	Brain natriuretic peptide
CAD	Coronary artery disease
CaO_2	Total arterial oxygen content
CCP	Critical closing pressure
CHF	Congestive heart failure
CMR	Cardiac magnetic resonance
CMV	Controlled mandatory ventilation
CO	Cardiac output
COP	Critical opening pressure
COPD	Chronic obstructive pulmonary disease
CPAP	Continuous positive airway pressure
CRT	Cardiac resynchronization therapy
CSR	Chyne stokes respiration- central sleep apnea
DCM	Dilated cardiomyopathy
DHF	Diastolic heart failure
ED	Emergency department
EHFS	Euro-Heart failure survey

Abb.	Mean
EPAP	Expiratory positive airway pressure
FiO_2	Inspired fraction of oxygen
FRC	Functional residual capacity
HF	Heart failure
HF-PEF	Heart failure with preserved ejection fraction
HF-REF	Heart failure with reduced ejection fraction
HOCM	Hypertrophic obstructive cardiomyopathy
HPV	Hypoxic pulmonary vasoconstriction
I/E ratio	Inspiratory/ Expiratory ratio
ICU	Intensive care unit
IPAP	Inspiratory positive airway pressure
IPPV	Intermittent positive pressure ventilation
IRAP	Insulin-regulated aminopeptidase
ITP	Intra-thoracic pressure.
LA	Left atrium
LH	Left side of the heart
LV	Left ventricle
LVEF	Left ventricular ejection fraction
LVESP	Left ventricle end systolic pressure
LVESV	Left ventricle end systolic volume
LVSVV	Left ventricle stroke volume variations
MI	Myocardial infarction
MR	Mitral regurge
MV	Mechanical ventilation
NAVA	Neutrally adjusted ventilator assist
NEP	Neutral endopeptidase
NHLBI	National Heart, Lung, and Blood Institute
NIPPV	Non-invasive positive pressure ventilation
NIV	Non-invasive ventilation
OSA	Obstructive sleep apnea
PA	Pulmonary artery
PaO_2	Arterial partial pressure of oxygen
PAP	Positive airway pressure
PAV	Proportional assist ventilation
Paw	Airway pressure

Abb.	Mean
PCV	Pressure controlled ventilation
PEEP	Positive end expiratory pressure
PH	Pulmonary hypertension
PpL	Pleural pressure
PPV	Positive pressure ventilation
PRVC	Pressure regulated volume control
PS	Pressure support
PSV	Pressure support ventilation
PVD	Patient ventilator dys-synchrony
PVR	Pulmonary vascular resistance
RA	Right atrium
RAS	Renin angiotensin system
RAWP	Right atrial wedge pressure
RH	Right side of the heart
RV	Right ventricle
RVESP	Right ventricle end systolic pressure
RVESV	Right ventricle end systolic volume
SAC	Systemic arterial compliance
SaO_2	Arterial oxygen saturation
SBT	Spontaneous breathing trial
$ScvO_2$	Central venous oxygen saturation
SHF	systolic heart failure
SV	Stroke volume
SvO_2	Mixed venous oxygen saturation
SVR	Systemic vascular resistance
TFM	Total face mask
VR	Venous return
Vt	Tidal volume
WHO	World health organization
WOB	Work of breathing

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Introduction

Introduction

Heart failure is a common condition, affecting up to 3 per cent of the population aged 45 and older, and is associated with high mortality and poor quality of life. Major diagnostic and therapeutic advances have been made over the past three decades, but international and national audits suggest that many patients are incompletely investigated and treated ***(Davis, 2012).***

Pulmonary edema secondary to acute left ventricular failure is a medical emergency in which effective measures to stabilize cardiorespiratory function are critically important to assure the best possible outcome. Pulmonary edema increases the work of breathing and affects arterial hypoxemia which may rapidly alter cardiac performance in unfavorable direction by way of detrimental cardiopulmonary interactions. When such a development is in progress, pharmacological support of circulatory function may not be sufficient to prevent further deterioration of the patient's condition. Therefore specific therapy for respiratory failure must be instituted without delay ***(Mebazaa, et al., 2008).***

In chronic heart failure, bronchial pneumonia is still a common cause of death, and any infectious process occurring in the setting of decompensated heart failure may well be an indication for hospitalization and more aggressive therapy. ***(topol, et al., 2002).*** Evidence is accumulating of an important association between sleep-disordered breathing and CHF. Either obstructive sleep apnea (OSA) or, more commonly, Chyne-Stokes respiration with central sleep apnea (CSR-CSA) has been detected in as many as 50% of patients with chronic CHF ***(Gehlbach and Geppert, 2004).***

Patients who do not have a response to initial therapy often require tracheal intubation and ventilation, with the associated potential for complications ***(Gray et al., 2008).***

In recent decades, non-invasive ventilation (NIV) with positive pressure has been widely used to treat both hypoxemic acute respiratory failure (ARF) and hypoxemia-hypercapnia frequently seen in patients with acute heart failure. NIV does not require oro-tracheal intubation and has proved being useful in the treatment of various forms of ARF. Patients with ARF due to acute lung edema generally benefit from the use of NIV (CPAP and BiPap). Early use reduces the number of intubations and complications, enhances clinical and blood gas parameters, and hospital survival rates ***(Carratala and Masip, 2010).***

Aim of the Work

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The aim of this study is to highlight the importance and outcome of mechanical ventilation, whether invasive or non-invasive, in management of heart failure.

Chapter (1)

Overview of Heart Failure