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Predictors and Outcome of Patients Readmitted to Intensive Care Unit

Submitted for the partial fulfillment of
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List of Abbreviations

$A\text{-}aDO_2$: Alveolar-arterial Oxygen Difference
AIDS : Acquired Immune Deficiency Syndrome
ALF : Acute liver failure
APACHE : Acute Physiology and Chronic Health Evaluation
ARDS : Acute respiratory distress syndrome
ARF : Acute renal failure
ASU : Ambulatory surgical unit
AUC : Area Under Curve
BC : Before Christ
BD : Base Deficits
BSA : Body surface area
BP : Blood Pressure
BUN : Blood Urea Nitrogen
^oC : Celsius
CABG : Coronary Artery Bypass Graft
CHF : Congestive Heart Failure
CI : Confidence Interval
CPAP : Continuous Positive Airway Pressure
Cr : Creatinine
CRF : Chronic Renal Failure
CRP : C - reactive protein
CVO_2 : Central venous O_2 saturation
CVP : Central Venous Pressure
DCL : Disturbed conscious level
DIC : Disseminated Intravascular Coagulation

List of Abbreviations (Cont.)

DKA : Diabetic ketoacidosis
DM : Diabetes mellitus
DU : Duodenal ulcer
DVT : Deep venous thrombosis
ER : Emergency room
ES : Emergency surgery
EWS : Early Warning Score
FiO_2 : Fractional concentration of inspired oxygen
FRICE : Foundation for Research on Intensive Care in Europe
g : Gram
GCS : Glasgow Coma Scale
GIT : Gastrointestinal tract
Group N : Group of Non- readmitted patients
Group R : Group of Readmitted patients
HCC : Hepatocellular carcinoma
HCO^-_3 : Bicarbonate
Hct : Hematocrite
HD : Hemodialysis
HF : Heart Failure
HR : Heart rate
HRS : Hepatorenal syndrome
HTN : Hypertension
ICU : Intensive Care Unit
iMELD : integrated Model of End-stage Liver Disease

List of Abbreviations (Cont.)

IO : Intestinal obstruction
IQR : Interquartile ratio
ISTH :International Society of Thrombosis and Haemostasis
K^+ : Potassium
L : Liter
LD : Liver Disease
LODS : Logistic Organ Dysfunction System
Log : Logarithm
LOS : Length of stay
MBP : Mean Blood Pressure
MD : Metabolic disturbance
MELD : Model of End-stage Liver Disease
MELD-Na^+: Model of End-stage Liver Disease-sodium
MESO : Model of End-stage Liver Disease to sodium index
mEq/L : Milliequivalent /liter
mg/dl : Milligram/deciliter
µg/h : Microgram/hour
MI : Myocardial Infarction
MIR : Minimizing ICU Readmission Rate
MM : Multiple Myeloma
mmHg : Millimeter mercury
mMol/L : Millimol/litre
MODS : Multiple Organ Dysfunction Score
MPM : Mortality Probability Model

List of Abbreviations (Cont.)

MR : Mitral Regurge
MV : Mechanical Ventilation
n : Number
Na^+ : Sodium
NEMS :Nine Equivalents of Nursing Manpower Use Score
NICE :National Institute for Health and Clinical Excellence
NIV : Non invasive ventilation
NMELD : New Model for End-Stage Liver Disease
NSTEMI : Non ST segment elevation myocardial infarction
NYHA : New York Heart Association
OR : Odd ratio
$PaCO_2$: Partial pressure of carbon dioxide in arterial blood
PACU : Post anesthesia care unit
PaO_2 : Partial pressure of oxygen in arterial blood
PAR : Pressure adjusted heart rate
PE : Pulmonary embolism
PEEP : Positive End Expiratory Pressure
PO : Post operative
PT : Prothrombin time
PVD : Peripheral vascular disease
R1 : First ICU admission of readmitted patients
R2 : The readmission period
RD : Renal Disease
RF : Respiratory failure

List of Abbreviations (Cont.)

RI : Rothman index
ROC curve: Receiver operator characteristic curve
RR : Respiratory Rate
SaO_2 : Arterial oxygen saturation
SAPS : Simplified Acute Physiology Score
SBP : Systolic blood pressure
SD : Standard deviation
SICU : Surgical intensive care unit
SOFA : Sequential Organ Failure Assessment
SPSS : Statistical Package for the Social Sciences
SS : Scheduled surgery
STEMI : ST segment elevation myocardial infarction
SVT : Supraventricular tackycardia
SWIFT : Stability and Workload Index for Transfer
T and T : Track and Trigger
T.bil. : Total bilirubin
Temp : Temperature
TIA : Transient ischemic attack
TIPS : Transjugular Intrahepatic Portosystemic Shunt
TISS : Therapeutic Intervention Scoring System
UOP : Urine Output
VAP : Ventilator-associated pneumonia
WBCs : White Blood Cells
WHD-94 : Weighted Hospital Days scale-94

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Introduction

Prolonged duration of stay in the Intensive Care Unit (ICU) is costly, stressful for patients and families, reduces the number of beds available for other patients and can increase risk for iatrogenic and nosocomial complications ***(Capuzzo et al., 2010)***.

Early discharge from the ICU is not without risk. If patients requiring high intensity care are discharged before they can be safely cared for in a lower acuity care environment, they are at risk for both complications and delayed recognition of clinical deterioration. The former can result in the need for unplanned ICU readmission; the latter can result in patients' death ***(Kramer et al., 2012)***.

Delaying discharge in ICU patients can be a waste of resources and deny the chance to other patients of an ICU bed who may be in awful need of critical care ***(Siddiqui, 2013)***. In that context, the ICU readmission rates and unexpected deaths following discharge, during the same hospital stay, have been used as indicators of healthcare quality ***(Araujo et al., 2013)***.

Determining who is ready for ICU discharge is a daily challenge for ICU leaders, especially in units with high occupancy rates. Traditionally, these decisions are made by

attending physicians, in collaboration with other members of the ICU care team ***(Heidegger et al., 2005)***. Due to the highly subjective nature of these decisions, there is considerable variability in determining discharge readiness ***(Skowronski, 2001)***.

One of the more frequently cited ICU quality measures is readmissions to ICU during the same hospitalization. These events are a significant concern because they carry greater risk for adverse outcomes than other types of ICU admissions ***(Schorr, 2012)***. Furthermore as they are considered a marker of ICU and hospital care quality, ICU readmissions may be used for resource allocation or to compare performance between ICUs ***(Halpern, 2011)***.

Aim of the Work

The aim of this study was to know the outcome of patients readmitted to intensive care unit and to pick up reasons of readmission.

Also, we aimed to get the sensitivity and specificity of supposed predictors as criteria for discharge from ICU, so that strategies for quality of care and criteria for discharge from intensive care unit might be modified.

Review of Literature

I-Criteria for Intensive Care Unit admission:

There is a worldwide shortage of the specialized intensive care beds needed to meet the demand of eligible patients and this is one of the principal factors limiting ICU admissions. The fact that so much is spent on these high-technology resources means that care should be taken to ensure that these beds are occupied by patients with a real likelihood of recovery ***(Simchen et al., 2004)***.

The obvious criteria for ICU admission are that very sick and unstable patients should be treated in the ICU, while stable patients do not require ICU care. However, determining the most unstable patients is a complex task that is subject to high variability depending on the training and experience of the particular physician incharge ***(Boumendil et al., 2012)***.

Intensive care unit admission criteria should select patients, who are likely to benefit from ICU care so; **Griner (1973**) identified two conditions in which ICU care was of no greater benefit than conventional care. These conditions can be referred to as **"too well to benefit"** and **"too sick to benefit"** from critical care services. As defining the **"too well to benefit"** and **"too sick to benefit"** population may