



## INCIDENCE, RISK FACTORS AND IMPACT ON OUTCOME IN OBSERVATIONAL STUDY OF DELIRIUM IN CARDIAC ICU.

### Cardiology

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### ABSTRACT

**Introduction:** Many Patients admitted to Cardiac ICU (CICU) are easily prone to Delirium, that can lead to potentially severe consequences like Cognitive Impairment and increased risks of mortality. Delirium depends on the duration of hospital stay and discharge, contrary mainly affected to the patients on mechanical ventilation, which becomes the potential reason for longer duration. Studies suggest, Delirium is a widely discussed topic, when comes to the management of the patient in Cardiac ICU. During the Rounds, it is mandatory to focus on the diagnosis of delirium and must be validated using Confusion Assessment Method (CAM). These methods not only prevent the risk of the delirium and also enhances the use of the other preventive measures like the basis of the treatment, environmental factors, quiet time, sleep promotion, family support, communication with the patient, pain and dyspnea. When confirmed with delirium, pharmacological prophylaxis must be used as soon as possible. Most often, communication between Doctor, Nurse and Patient drives the most of the depression and acute delirium, but when delirium becomes critical with severe agitation or weaning from invasive mechanical ventilation. Thus, it is very important to identify the risk, complexity of the patients and clinical case scenarios of delirium in Cardiac ICU. Strategic Efforts were done to improve the identification of the patient at risk during admission, during stay at Cardiac ICU and during discharge and orders to improve the mental state of delirium patient. In this article, we provide a panorama of the incidence, risk factors, and impact on outcome of delirium in a Cardiac Intensive Care Unit (CICU).

**Methods:** In this case study, total of 211 patients were observed for sign and symptoms in Cardiac ICU for Delirium. We aimed to determine the incidence, risk factors, and impact on outcome of delirium in a Cardiac Intensive Care Unit (CICU) in CHL Multispeciality Hospital and Research Center, Chandrapur using a prospective observational study.

**Patients:** All consecutive patients admitted to the CICU between April 2021 and June 2021 were included if they were aged more than 18 years, had an ICU stay of more than 24 h and no psychiatric history. Patients eligible for the study were evaluated by the medical staff to detect delirium using the CAM.

**Results:** In a 3-month period, 211 Patients were admitted in Cardiac ICU of CHL Multispeciality Hospital and Research Center. Out of which 198 were included in our observational study. The incidence of delirium at the end of the study was 21%. The number of delirious patients were 43 and non-delirious were 155. Age played an Important factor where 86% of Delirious patients were old aged. The LOS (Length of Stay) for Delirious and non-delirious patients were  $6 \pm 1$  vs  $5 \pm 1$  respectively. The SAS (Riker Agitation Scale) has the value of  $4 \pm 1$  vs  $3 \pm 0.5$ , CAM (Confusion Assessment Method) has the value of  $6 \pm 1$  vs  $3 \pm 1$  and DDS (Delirium Detection Score) was  $5 \pm 1$  vs  $3 \pm 1$  for delirious vs non-delirious patients. The SAPS II (Simplified Acute Physiology Score II) Score for delirious patients was  $23 \pm 1$  and  $20 \pm 2$ . The Incidences like Removal of Catheters were more frequent in this study with 20% in delirious patients and <1% Incidence in non-delirious patients. Removal of ET Tube had the Incidence of 5% vs <1%, Removal of Urinary Catheter 7% vs <1%, Removal of Ryle's Tube 7% vs <1%, respectively for delirious vs non-delirious patients.

### KEYWORDS

Delirium; Confusion Assessment Method, Cardiac Intensive Care Unit; Risk Factors, Prevention and Management.

### INTRODUCTION

Delirium is a clinical syndrome that occurs as an acute neurocognitive disorder, when there is presence of any disease or process that disturbs the internal homeostasis. Delirium is characterised by a minor or major disturbance in presentation, attention and awareness of the patient about his surroundings. [1,2] Delirium is usually a reversible acute onset and transient fluctuation that occurs abruptly. [1] Patient may display the symptoms of altered language, psychotic features and fluctuation in his consciousness. [2]. Delirium, in its hyperactive state shows the great state of agitation and can be seen most commonly in Cardiac ICUs [3]. On the other hand, Hypoactive delirium occurs frequently but, because of its bad prognosis, it becomes really hard for a clinician to recognize. Studies on Delirium suggest that the Incidence of Delirium in CICU is between 11% and 87%. [4, 5] The majority of the age group affected by delirium is the elderly people [6] and the patients having precognitive impairment [7], Terminal Disorder [8], Major surgery like PTCA (Percutaneous Transluminal Coronary Angioplasty) or CABG (Coronary Artery Bypass Graft) [9]. Sometimes it depends on the psychological and social history of the patient, for example Severity of illness, Comorbidities, Hysterical Reaction [10], Tobacco Withdrawal [11], and several critical treatments like DC Cardioversion, CPR and Some Cardiac Emergency Situations [12, 13-16]. When a patient suffers from delirium, it not only results in bad outcome but also increases the stay of the patient in ICU, Prolongs the Mechanical Ventilation, Increased Cognitive impairment and higher chances of mortality. At the ICU of CHL Multispeciality Hospital, Chandrapur, we believe that incidence and risk factors for delirium may be different, as the number of alcoholic patients is very less likely to be admitted, additionally with maximum

the patient is intubated for 5 days, depending on the improvement. Also, 90% percent of the patient has the stay for 3-7 days, mainly operated for PTCA and PPI (Permanent Pacemaker Implantation). Also, for motivation and increasing will power bed side visits are allowed for fixed time for each patient, that significantly reduces the chance of delirium. This study is aimed to determine the incidence, risk factors, and impact on outcome of delirium in a CICU.

### PATIENTS

We conducted a prospective and observational study in Cardiac ICU of CHL Multispeciality Hospital and Research Center, Chandrapur. Admissions are received from casualty and IPD (Inpatient Department) with an average of  $1,203 \pm 20$  per year.

Visits of relatives are fixed on time and which plays an important role in improving the psychological factors of loneliness, demotivation, will power, homesickness and fear. All patients admitted from April 2021 and June 2021 were included in this study, with the age above 18 years and ICU Stay more than 24 hours. Patients who were deceased, with history of dementia or psychosis were excluded from this study as it was very difficult to access the delirium in this parameter. Consent of patient was not taken as the nature of study is Observational.

### METHODS:

Patients were eligible for study during their stay, that is more than 24 hours in ICU, they were then observed and assessed until their discharged by the medical staff to detect the delirium. The delirium was detected using the Confusion Assessment Method (CAM) [17]. We also considered the factors like sedation level via Riker Agitation-

Sedation Scale (SAS) [18]. The SAS is a scale ranging from 1 to 7, where Level 1 refers to the patient with no response on verbal communication or any physical stimulation and Level 7 refers to the very violent patient, who pulls out the catheter, IV Line or ET tube. Every patient was evaluated daily during the rounds. If the SAS Score was equal or greater to 4, then patient was assessed for delirium using CAM.

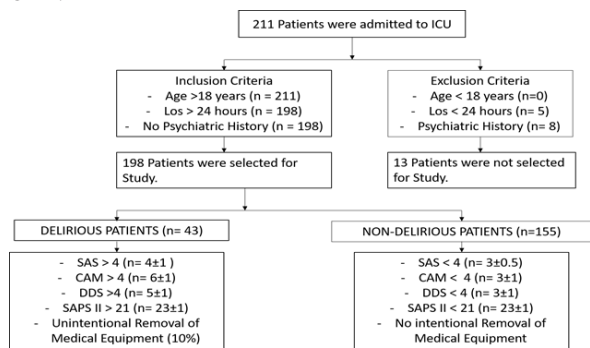


Figure 1. Flow diagram of Patient Selection in Observational Study

Using CAM, patients were then assessed for disorganised thinking or altered level of consciousness. During Daily Rounds, Patients were then given the score of Delirium Detection Score (DDS), this score evaluated 5 items: Agitation, anxiety, hallucination, orientation and paroxysmal sweating. [19] If the CAM Score was equal or greater to 4, then patient was diagnosed for delirium.

## DATA COLLECTION:

There are many risk factors and contradictions associated with delirium were already documented and categorised into the factors before the ICU admission and other triggering factors for the critical illness of the patient. This categorisation was then changed on the basis of the preventative and therapeutic involvement. The information was collected through the history taking which focused on General Condition, Chief Complaints, History of Present Illness, Past Medical History, Diet History, Therapeutic diet, Family History, Psychological History, Physical Examination.

Table 1. Patients History and Characteristics.

| FACTORS                              | Delirious Patients |           | Non-Delirious Patients |           | P      |
|--------------------------------------|--------------------|-----------|------------------------|-----------|--------|
|                                      | MEAN               | %         | MEAN                   | %         |        |
| Age above 18 years                   | 43                 | 20%       | 155                    | 80%       | --     |
| Average Age                          | 62±10              | --        | 54±6                   | --        | 0.005  |
| Incidence in Old Age Population      | 37                 | 86%       | 20                     | 12%       | --     |
| Gender (Male/Female)                 | 37 / 6             | 86% / 14% | 111 / 44               | 72% / 28% | --     |
| SAPS II                              | 23±1               | --        | 20±2                   | --        | 0.005  |
| Hypertension                         | 36±1               | 83%       | 84±2                   | 54%       | 0.001  |
| T2DM                                 | 23±1               | 53%       | 67±2                   | 43%       | 0.001  |
| Renal Disease                        | 6±1                | 13%       | 10±1                   | 6%        | 0.001  |
| Breathlessness                       | 28±1               | 65%       | 52±2                   | 33%       | 0.005  |
| Alcohol                              | 10±1               | 23%       | 6±1                    | 4%        | 0.0001 |
| Smoking or SA                        | 20±1               | 47%       | 10±1                   | 6%        | 0.0001 |
| Reason for Admission for Cardiac ICU |                    |           |                        |           |        |
| Post-PTCA                            | 10                 | 23%       | 47                     | 20%       | --     |
| Post-CAG                             | 2                  | 5%        | 15                     | 10%       | --     |
| Post-PAMI                            | 3                  | 7%        | 47                     | 20%       | --     |
| Medical Management                   | 28                 | 65%       | 77                     | 50%       | --     |

SAPS II - Simplified Acute Physiology Score II; T2DM - Type 2 Diabetes Mellitus; SA - Substance Abuse; PTCA - Percutaneous Transluminal Coronary Angioplasty, CAG - Coronary Angiography, PAMI - Primary Angioplasty for Myocardial Infarction.

## STATISTICAL ANALYSIS:

treatments, Simplified Acute Physiology Score II (SAPSII), Duration of Stay in ICU and Duration of Mechanical Ventilation. The analysis of the data was and Nursing Assessment that included patients Vitals and GCS Score. After Admission the information was collected through the Laboratory Investigations, done statistically through the SPSS 18.0 (English) Software. The data presented in the figures along with the numbers and the percentage are in the mean±standard deviation and median (25–75 percentiles interquartile ranges, IQR) for the easy categorisation in the study. The Cohort study is based on the two possible outcomes: with delirium and never delirium. Chi Square test and Fisher's Exact Probability were used to differentiate the difference between the two-cohort possible outcome. The risk factors were analysed using the binary logistic regression. Any outcome with the Probability lesser than 0.20 were considered as the sign of the risk regression and other variable outcomes were analysed for the occurrence of delirium because of multiple stated risks. The significance level was set to the probability less than 0.05.

## RESULTS:

In a 3-month period, 211 Patients were admitted in Cardiac ICU of CHL Multispecialty Hospital and Research Center. Out of which 198 were included in our observational study [Figure 1]. Factors that were considered during the admissions were Age more than 18 years (n = 43 vs 155), Cardiac ICU Length of Stay more than 24 hrs (n = 43 vs 155), Dementia or Psychosis (n = 10 vs 3), Use of Steroids (n = 32±1 vs 15±1) and sedation (n = 34±1 vs 24±1), Presence of Breathlessness (n = 28 vs 67), cardiac arrest (n = 8 vs n = 5), mechanical ventilation (n = 8 vs n = 2), hypertension (n = 36 vs 84), Average Age (n = 62±10 vs 45±6) and SAPS (n = 23±1 vs 20±2). History of patients and characteristics are presented in [Table 1]. The recorded incidence of delirium was 21% and the mean DDS was 5±1 vs 3±1. Delirium was mixed in 13, hyperactive 18, and hypoactive in 12. The median onset of delirium was 3 days (IQR) with a median duration of 3±1 days (IQR). During the stay, delirious patients were significantly older with average age of (n = 62±10 vs 45±6 P<0.05), marking the incidence of (n = 37 / 87% vs 20/12%; P). They had higher SAPS II Score of (n = 23±1 vs 20±2), hypertension (n = 28±1 vs 57±2), hypotension (n = 15±1 vs 68±2), hyponatremia (n = 10±1 vs 17±1), hypernatremia (n = 5±1 vs 3±1) and Breathlessness (n = 32±2 vs 72±2) [Table 2]. Patient who received the frequent doses of Midazolam (n = 34±1 vs 24±1), analgesics (n = 27±3 vs 62±5) and Steroids (n = 32±1 vs 15±1) were higher in the delirium group [Table 2]. In the multivariate risk regression analysis, Hypertension (OR = 3.2 95% CI: 1.5825 – 6.5085 P = 0.0012), Breathlessness (OR = 7.75 95% CI: 3.134 – 19.201 P = 0.0001), steroids (OR = 4.31, 95% CI: 2.3081 – 8.0762 P = 0.001), and sedation (OR = 3.35, 95% CI: 1.5773 – 7.1298 P = 0.00017) were the main focused independent risk factors for delirium [Table 3].

## IMPACT OF DELIRIUM:

Delirium could be clearly noted in old aged patients. Delirium could be significantly marked by the incidence of unintentional removal of catheters (20% vs. <1%; P<0.005), Endotracheal Tubes (5% vs. <1%; P<0.005), and urinary catheters (7% vs. <1%; P<0.005), Ryle's Tube or Nasogastric Tube Removal (7% vs <1%; P<0.005) [Table 4]. Removal of catheters by patients was the most common form of delirium seen in our ICU. Length of stay, severely affected patients by alternation of circadian rhythm. [Table 4].

## DISCUSSION:

The incidence of delirium at the end of the study was 21%. According to the study, Delirium was purely associated with the stay of patient in ICU and Longer duration of Mechanical Ventilation. Study also represents that there was a possible chance of relationship of delirium and mortality, since there wasn't any such case, we could not explore further. In a multivariate risk analysis, Hypertension, Diabetes, Sedation, Age and Seriousness of disease (0–5), were independent risk factors for delirium. In the presented study, the incidence rate of the delirium is in within normal range as reported by previous literature [20–23]. However, many studies showed there was higher chance of incidence, this was totally dependent on differences in the way of understanding the topic, type of ICU population (medical or surgical ICU), severity of disease, and diagnosis tool used [24,25]. In addition, there was a greater chance of incidence of delirium at night than day and some patients having hypoactive delirium may not be detected in our study because of its complexity of diagnosis in ventilated patient.

Table 2. Univariate Analysis of risk factors of delirious and non-delirious patients.

|                        | Delirious Patients | Non-Delirious Patients | P      |
|------------------------|--------------------|------------------------|--------|
| Anaemia                | 5±1                | 4±1                    | 0.0001 |
| Hypertension           | 28±1               | 15±1                   | 0.001  |
| Hypotension            | 15±1               | 68±2                   | 0.001  |
| Dehydration            | 6±1                | 3±1                    | 0.001  |
| Overhydration          | 4±1                | 2±1                    | 0.001  |
| Hyponatremia           | 10±1               | 5±1                    | 0.001  |
| Hypernatremia          | 17±1               | 3±1                    | 0.001  |
| Hypokalaemia           | 20±1               | 42±1                   | 0.001  |
| Hyperkalaemia          | 6±1                | 16±1                   | 0.005  |
| Hypoglycaemia          | 3±1                | 16±1                   | 0.001  |
| Hyperglycaemia         | 16±1               | 66±2                   | 0.001  |
| MEDICATIONS            |                    |                        |        |
| Sedation (Midazolam)   | 34±1               | 24±1                   | 0.001  |
| Analgesics             | 27±1               | 62±2                   | 0.0001 |
| Steroids               | 32±1               | 15±1                   | 0.0001 |
| Anticonvulsants        | 10±1               | 6±1                    | 0.001  |
| Antihypertensives      | 36±1               | 84±2                   | 0.001  |
| Antidiabetics          | 23±1               | 67±2                   | 0.001  |
| Mechanical Ventilation | 8±1                | 20±1                   | 0.001  |

\*Conditional Caused in ICU. Not a part of History

**Table 3. Multivariate Analysis of risk factors of delirious and non-delirious patients.**

|                | Odds Ratio | Confidence Level | P       |
|----------------|------------|------------------|---------|
| Hypertension   | 3.2        | 1.5825 – 6.5085  | 0.0012  |
| Breathlessness | 7.75       | 3.134 – 19.201   | 0.0001  |
| Steroids       | 4.31       | 2.3081 – 8.0762  | 0.001   |
| Sedation       | 3.35       | 1.5773 – 7.1298  | 0.00017 |

In addition, there was a greater chance of incidence of delirium at night than day and some patients having hypoactive delirium may not be detected in our study because of its complexity of diagnosis in ventilated patient. We also excluded patients with the history of delirium. The mean DDS Score was  $8 \pm 2$ , and 30% of patients developed delirium in the 3-6 day. This incidence rate was perfect match with other published studies [26]. This was related to the high percentage of patients ventilated and deeply sedated during the 1st or 2nd day. The mean duration of delirium was near to  $2 \pm 1$  days, which also matches the previous findings [27, 28, 29]. In this study, hyperactive and hypoactive delirium incidence rate was in same frequency of mixed subtype was least common. This distribution was different in the previous literature with increased frequency of mixed subsets [30]. There were some dominating factors like Length of Stay, Use of Steroids and sedation, Presence of Breathlessness and mechanical ventilation, hypertension and Age. Contradictory, many studies does not suggest that age is a major predictor of delirium [31]. Also, a study strongly suggested that patients above 65 years of the age are easily diagnosed to have delirium [32]. In our study, age Increased the risk of delirium by 2-fold although our patients had no psychosis or delirium history. This could be explained by the frequent ups and downs of metabolic disturbances and hypoxemia along with psychological stress and altered circadian rhythm in a Cardiac ICU. Mechanical Ventilation was an important risk for delirium in our patients. These findings were also tallied and found similar to the published study by Shi et al [33]. These patients were particularly exposed to psychological disturbances because of hypoxemia, hypercapnia, and tobacco withdrawal. Also, breathless patients are treated with Steroids, which itself increases the risk of delirium in our study. Majority of the patient admitted to CICU, had the history of HTN, and was considered the highest risk factor for delirium. Hypertension could also possibly alter the cognitive performance. On the other hand, Increased Hypertension along with Cerebral hypoperfusion and cerebral hypoxia makes it greater increased risk factor for causing delirium in Cardiac

**Table 4. Clinical Complications**

|                                         | Delirious Patients | Non-Delirious Patients | P      |
|-----------------------------------------|--------------------|------------------------|--------|
| Duration of Mechanical Ventilation      | $8 \pm 1$          | $2 \pm 0.1$            | 0.0001 |
| Cardiac ICU Length of Stay              | $6 \pm 1$          | $5 \pm 1$              | 0.0001 |
| <b>Complications</b>                    |                    |                        |        |
| Unintentional catheter Removal          | 20%                | <1%                    | <0.005 |
| Urinary Catheter Removal                | 7%                 | <1%                    | <0.005 |
| Ryle's Tube or Nasogastric Tube Removal | 7%                 | <1%                    | <0.005 |
| Unintentional Endotracheal Tube Removal | 5%                 | <1%                    | <0.005 |

ICU [34]. The other two risk factors presented were Use of Steroids and Sedative. Sedative drugs like Pentazocine and Midazolam were frequently used in Cardiac ICU. Sedation increased the risk of delirium by 5-fold. The absence of sedation can improve the health of the patient and prevent from Delirium, but sedations like Midazolam was given to ventilated patient, who has the 6-7 SAS. Some studies suggested that trauma and post-operative patients, midazolam was given as a common sedation, which increased the risk by 2-3 folds. That's why there have been many studies considering the alternative of midazolam for prevention from Delirium. Dexmedetomidine seemed to be the best choice, but could be used frequently. Use of Corticosteroids in breathless patients could possibly increase the risk, but the "n" number of patients were less.

Relationship between delirium and long-term mortality was not considered and was beyond the scope of study. Thus, Delirium and Mortality could not be discussed. Mortality due to delirium has been reported in many studies [35]. Our study found that longer stay of a patient increased the risk of delirium. [36]. In our patients, we focused on decreasing the length of mechanical ventilation. Our results are better and comparable than those of the studies [37].

Our study also presents the limitations. (1) The study presented was done only in one Cardiac ICU, so other studies could have the different perspective or results. The side effects were little less. (2) We may have missed a case of delirium as hypoactive case could not be diagnosed or there may be chances of missing case due to any emergency in ICU. (3) Doses of sedatives and steroids used in the Cardiac ICU is very less, so the definite relationship could not be established effectively. (4) Also, we didn't assess the long-term outcome to detect cognitive impairment. Thus, we can say CICU environment can be a place for acute delirium. Many studies, topics and risks were beyond the scope of this paper and need to be more studies in the same scope. Future studies should focus on the management and the therapeutic in addition in to the conditional detailing with neurology. Future studies should also describe the prevention and effect on the cases of incidence of delirium.

## CONCLUSION:

In the study conducted, there was 21% of incidence of delirium in Cardiac ICU among ventilated and non-ventilated patients. Length of Stay, Use of Steroids and sedation, Presence of Breathlessness and mechanical ventilation, hypertension, Age and SAPS are the important risk factors for delirium. Delirium is primarily based on Length of stay of patients in Cardiac ICU. At CHL Multispeciality Hospital and Research Center, Chandrapur, we focus on shorting the stay of the patients in ICU, as the patient becomes stable and shifting them to IPD for observation. Furthermore, Mortality in ICU was unaffected by delirium.

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