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Incidence and risk factors of delirium post primary percutaneous coronary intervention

Esraa Mohamed Ahmed[1], Mervat Anwar Abd-Alziz[2] & Mona Abd-AlaziemAhmed[3]
[1.] Professional nurse at Heart Hospital, Assiut University Egypt,
[2.] Professor of Critical Care and Emergency Nursing Department, Faculty of Nursing, Assuit, University Egypt,
[3.] Assistant Professor of Critical Care and Emergency Nursing Department, Faculty of Nursing, Assuit University Egypt

Abstract:
Background: Delirium is a syndrome characterized by an acute change in attention, awareness and cognition is caused by a medical condition that cannot be better explained by a pre-existing neurocognitive disorder. Delirium is a frequent complication in patients admitted to intensive cardiac care units (ICCU) with potentially severe consequences including increased risks of mortality, cognitive impairment and dependence at discharge, and longer times on mechanical ventilation and hospital stay. **Aim of the study:** To assess incidence and risk factors of delirium post primary percutaneous coronary intervention. **Setting:** the study was done in the coronary care unit at Assiut University Heart Hospital. **Study design :descriptive** research design used in the present study. This sample includes 60 patients. **Tools:** Three tools were used for data collection, **Tool I:** patient assessment questioner, **Tool II:** Assessment of delirium risk factor **tool III:** Assessment of delirium scale **Results:** the result showed that incidence of delirium was 83% and revealed that more than half of patients were aged above 50 years and more than two thirds of the patients were male, more than half of patients were smoking , more than two thirds of the patients were respiratory acidosis and hyperkalemia , near to half were discharged to home, more than one third were transferred to department and less than one third was died. **Conclusion:** The present study concluded that incidence of delirium among patients under study was 83%. and the most associated risk factors for development among patients were advanced age, smoking, respiratory acidosis, electrolyte imbalance, chest pain, hypoxia and respiratory infection. **Recommendations:** It recommended to continuously assess patients for delirium risk factors in order to develop delirium preventive measures, which influence patients outcomes and patient with delirium after primary percutaneous coronary intervention should have a great attention from nurses' staff to prevent risks as bleeding , hematoma.

Keywords: Delirium, Primary percutaneous Coronary intervention & Risk factors.

Introduction
Delirium is an acute neurological disorder that involves cognition and attention. It is very common in the context of urgent settings, and it can be very serious and problematic. Delirium is an acute complex brain dysfunction associated with poor clinical outcomes, hospital stays become long, slower recovery, and recurrent readmissions **(Saviano, et al, 2023).**

Patients could present, hallucinations, lethargy, altered behaviors, confusion, restlessness ,alteration in language, memory impairment, impaired level of consciousness, inattention. Comorbidities, advanced age, psychoactive drugs (combined with altered pharmacodynamics and pharmacokinetics due to aging), depression, previous history of alcohol abuse and previous neurological diseases could contribute to this complex condition. Moreover, infections, sepsis, organ failure, and surgical problems (cardiac, thoracic, orthopedic, abdominal.) can cause the onset of delirium **(Saviano, et al, 2023)**.

Primary percutaneous coronary intervention (PPCI) considers the default therapy for patients with ST-segment elevation myocardial infarction (STEMI), owing to its capacity for timely the infarcted artery reopening. However, abrupt reperfusion of coronary blood flow can cause myocardial and vascular injury. This phenomenon, known as ischemia–reperfusion injury (IRI), is reported to account for up to 50% of final myocardial infarct size, and may counteract the beneficial effects of primary PCI **(He, et al, 2023).**

Prior studies have explored the risk factors and impact of delirium in a specific population, mainly in patients with ST-elevation myocardial infarction (STEMI) or those with known underlying dementia. PCI has evolved over time with increased expertise, new techniques, conscious sedation, and shorter length of procedures. These developments might positively impact rates of post-procedural delirium and alter the clinical phenotype of patients at highest risk for delirium in the contemporary era **(Park, et al, 2023)**.

Coronary heart disease therapy mainly contains coronary artery bypass graft surgery and percutaneous coronary intervention (PCI). For coronary heart disease patients, postoperative delirium has been the most extensively investigated after coronary artery bypass graft surgery. The incidence of delirium in individuals with acute STsegment elevation myocardial infarction (STEMI) within 12 h after primary PCI **(Huang, et al, 2020).**

Two recent systematic reviews and meta-analyses identified risk factors (i.e., older age, dementia, hypertension, pre-ICU emergency surgery or trauma,

Acute Physiology and Chronic Health Evaluation II (APACHE-II) score, mechanical ventilation, metabolic acidosis, delirium on the prior day and coma) and outcomes (i.e., increased mortality, cognitive impairment; longer durations of mechanical ventilation and longer lengths of stay in the ICU) .for delirium overall in the ICU. However, there is a growing number of studies suggesting that there may be important differences in risk factors and outcomes among delirium **(Krewulak, et al, 2020)**

Delirium during critical illness is a common and morbid condition, which is imperfectly understood. Its prevention and treatment have the potential to do meaningful good at both the patient and the public health levels, postoperative delirium and its associated effects can be decreased through prevention strategies and early recognition. Prevention strategies require an understanding of the risk factors that predict delirium. Some studies have discovered the risk factors of delirium in other populations, but for patients being diagnosed AMI and undergoing Primary Percutaneous Coronary Intervention, it still need to be further analyzed and summarized**. (Prendergast, et al, 2022).**

Treatment or intervention after the onset of delirium has little influence on the severity, duration, or recurrence of the condition. Primary preventive efforts are especially important since delirium may be avoided in 30–40% of cases. Risk factors may be reduced by measures including improved pain management, hearing or vision aids, improved sleeping conditions, physical activity instruction, and nutritional counseling. In an effort to modify the many components most likely to trigger a delirium, several preoperative, preoperative, and postoperative unimodal and multimodal, pharmacological and non pharmacological treatments have been attempted **(Mansou, et al, 2022).**

The American Geriatrics Society published the best practice statement for older adults with postoperative delirium which highlights 3 key non-pharmacologic components to prevent and treat postoperative delirium: (1) implementing multicomponent non-pharmacologic interventions to prevent postoperative delirium in high-risk patients which are overseen by an interdisciplinary team, (2) utilize interdisciplinary teams to deliver multicomponent interventions once a patient has been diagnosed with postoperative delirium, and (3) implementing formal education programs for healthcare systems and hospitals. **(Chen, et al, 2022).**

Nurses provide the frontline care for patients and need to take on a more active role in the prevention, early identification, and treatment of delirium. Measures, such as providing individualized care, preventing harm, managing medical issues, analyzing the cause, and modifying the environment promote effective patient care, while reducing hospital costs. However, nurses often experience stress and anxiety when assigned to patients with delirium and there is often a lack of resources to support these nurses who care for patients experiencing delirium **(Thomas,et al, 2021).**

Significance of the study

According to admission office in heart hospital at Assuit university hospitals there was 500 cases of primary percutaneous coronary intervention annually through year2021. There was about 100 cases delirium after primary percutaneous coronary intervention. Those patients need for special care.

Delirium is a preventable medical condition that is a symptom of acute brain dysfunction. It appears in 60% to 80% of critically ill patients who are on mechanical ventilation and in 20% to 50% of critically ill patients who are not on mechanical ventilation. These percentages mean that more than 40000 patients receiving mechanical ventilation in intensive care units (ICUs) in the United States experience delirium every day **(Swarbrick& Partridge, 2022).**

Aim of this study:

The present study aims to

To assess incidence and risk factors of delirium for the patients post primary percutaneous coronary intervention.

Operational definition

percutaneous coronary intervention(PCI)refers to the strategy of taking a patient who presents with ST segment elevation myocardial infarction (STEMI) directly to the catheterization laboratory to undergo mechanical revascularization using balloon angioplasty, coronary stents, or aspiration thrombectomy **(soomro, et al, 2022).**

Research question

What is the incidence of delirium for the patients post primary percutaneous coronary intervention?

Patient and methods

Research design:

In this study, a descriptive research design was adopted.

Study variables:

- The independent variable was incidence and risk factor related to delirium.
- The dependent variable was delirium aged patients.

Setting:

The study was done at coronary care unit in the Assiut University Heart Hospital.

Sampling

Study subjects

The prospective sampling of 60 adult male and female patients that presented to coronary care unit with delirium post Primary Percutaneous Coronary Intervention was constitute the study sample.

Inclusion criteria:

Age between 18-65 years, Percutaneous primary intervention, STEMI, Both sex and Mechanical ventilated patients..

Study tools:

Tool I: Patient assessment questioner: It will be developed by the researcher review of current literatures it includes:

Part (I): Demographic data for patient such as patient code, age, sex, marital status and level of education.

Part (II): Hemodynamic assessment sheet: which include (Temperature, Respiration rate, Pulse, Blood pressure)

Part (III): Cardiovascular assessment sheet: it includes ECG monitoring, arrhythmia, chest pain, mode of oxygenation (O2, Fio2).

Part (IV): Laboratory investigation (Serum urea, creatinine, cardiac enzymes, troppin, liver function test lipogram, CBC).

Part (V): Neurological assessment by using: Glasgow Coma Scale which developed by **(prasad, 1996)** and adopted from **(Mehta & chinthapalli, 2019)** to assess level of consciousness of patient and categorized as **eye opening:** spontaneously take (4) points, to speech take (3)points, to pain (2)points and no response take (1) point, **verbal response:** oriented take(5) points, confused take (4) points, inappropriate words take (3) points, incomprehensible sounds take (2) points, no response take (1)points and **motor response:** obeys command take (6), localized pain take (5) points, withdrawal from pain (4) points, flexion (decorticate) take (3)points, extension (decerebrate) take (2)points and no response take (1) point. total is (15) points. Patients assesses and assumed all points and categorized as (13- 15) was mild, (9- 13) was mid and 3-8) was sever**.**

Tool (II): Assessment of delirium risk factor: smoking, pre-existing dementia, severe medical Illness, hearing impairment (measured as patient us hearing aids), depression, abnormal sodium, potassium, chest pain, chest infection and hypoxia etc.

Tool (III): Assessment of delirium scale**.** Adopted from (**Kutlubaev, et al, 2016)** it consist of altered level of conscious, inattention, disorientation, hallucination, delusion or psychosis, psychomotor agitation or retardation, inappropriate speech or mood, sleep wake cycle disturbance, and symptoms fluctuation and it categorized as **normal** take (0 point, **Subsyndromal** delirium take(1-3) points and **delirium** take(4-8).

Methods

The study was conducted throughout two main phases, which were preparatory phase, Data collection.

Preparatory phase:

- Permission to conduct the study was obtained from hospital responsible authorities after explanation of the aim of the study.
- The tools collection was developed by the researcher based on the relevant literature reviewing.
- The developed tools (I, V) were tested for content related validity by 7 experts in the field of critical care and emergency nursing and cardiology department at Assuit University and necessary modifications will be done.
- The Reliability was done on tools by Cronbach's Alpha to assess the consistency and stability of the tools.
- A pilot study was conducted in (10%) 6patients of sample to test the feasibility, applicability of the tool.
- Protection of human right (ethical consideration).
- Research proposal was approved from ethical committee in the faculty of nursing, there was no risk for study subject during application of research, the study followed common ethical principles in clinical research, written informed consent was obtained from responsible person after explaining the nature and the purpose of the study, Patients were assured that the data of this research will not be reused without second permission, Confidentiality and anonymity were assured and Each patient had the right to refuse participation or withdraw from the study without any rational at any time.

Data collection:

- Patients were assessed for demographic data and medical data post cardiac catheterization using **(tool I)** since admission to third day. It took about 30 minutes. .
- The researcher assessed every patient for laboratory investigation on admission and at discharge by using **tool (I)** and every patient was assessed neurologically daily by using **tool(I).**It took about 30 minutes.
- The researcher assessed patients after primary percutaneous coronary intervention and record all of risk factors assessment sheet by using(**tool II).** It took about 30minutes.
- The researcher assessed patients daily since admission until discharge by using delirium assessment scale (**tool III).** It took about 30 minutes**.**
- Data were collected in the morning shift.
- Data were collected in six month.
- Data were collected from coronary care unit and catheterization unit at Assuit university heart hospital from May 2023 to October 2023.

Statistical analysis:

The data were tested for normality using the Anderson-Darling test and for homogeneity variances prior to further statistical analysis. Categorical variables were described by number and percent (N, %), where continuous variables described by mean and standard deviation (Mean, SD). All analyses were performed with the IBM SPSS 20.0software

Table (1): Mean±SD (range) distribution of the studied sample according to their demographic characteristics (N=60)

Items	No ( )	%
Age /year		
From 30 - 40 years	9	15.0
From 41 - 50 years	19	31.7
<50 years	32	53.3
Mean±SD(range)	**50.88±8.22(30-64)**	
Gender		
Male	46	76.7
Female	14	23.3
Marital status		
Single	16	26.7
Married	38	63.3
Divorced	2	3.3
Widowed	4	6.7
Education		
Illiterate	22	36.7
Read and write	6	10.0
Preparatory school	3	5.0
Secondary school	20	33.3
University	9	15.0
Smoking		
Yes	34	56.7
No	26	43.3
Diagnosis		
Myocardial infarction , PPCI	60	100
Mean±SD(range)	**2.12±0.74(1-3)**	

Table (2A): Mean±SD (range) description of Laboratory investingation For Study sample (N=60)

Items	Mean±SD(range)
Cardiac enzymes	
CK	
On admission	417.18±571.18
3rd day	183.38±160.06
CK-MB	
On admission	123.09±137.37
3rd day	27.31±14.36
Troponin	
On admission	1.9±7.01
3rd day	37±0
Kidney function test:	
Creatinine	
On admission	179.52±146.3
3rd day	200.06±173.23
Urea	
On admission	15.67±10.05
3rd day	16.72±9.54
Electrolytes	
Na	
On admission	134.96±8.14
3rd day	137.19±5.83
K	
On admission	3.85±0.87
3rd day	3.84±0.67
Mg	
On admission	1.96±0.5
3rd day	1.89±0.19

Table (2 B): Mean±SD (range) description of Laboratory investingation For Study sample (N=60)

Items	Mean±SD(range)
Lipogram	
Cholesterol	
On admission	188±0
LDL	
On admission	598±0
HDL	
On admission	479.5±281.17
Prothrombin time	
On admission	13.88±4.16
3rd day	12.73±2.37
Prothrombin concentration	
On admission	87.31±26.74
3rd day	89.63±25.32
INR	
On admission	1.63±1.65
3rd day	1.37±0.55
Blood glucose level	
On admission	246.4±121.43
3rd day	208.15±100

Table (3): Mean±SD (range) distribution of Neurological assessment by using Glasgow Coma Scale (GCS) For Study sample (N=60)

Items	No ( )	%
Glasgow Coma Scale(GCS)		
On admission		
Mild	25	41.7
Moderate	35	58.3
Severe	0	
Mean ±SD(Range)	**9.28±1.09(7-11)**	
2nd day		
Mild	25	53.2
Moderate	17	36.2
Severe	5	10.6
Mean ±SD(Range)	**8.02±2.16(4-11)**	
3rd day		
Mild	6	30.0
Moderate	11	55.0
Severe	3	15.0
Mean ±SD(Range)	**7.65±1.13(5-10)**	

Table (4): Percent distribution of the studied sample related to risk factors (N=60)

Items	Yes		No	
	No ( )	%	No ( )	%
Smoking	34	56.7	26	43.3
Dementia	0	0.0	60	100.0
Respiratory acidosis	46	76.7	14	23.3
Anemia	4	6.7	56	93.3
hearing impairment	8	13.3	52	86.7
Metabolic acidosis	8	13.3	52	86.7
Hyperkalemia	48	80.0	12	20.0
Depression	2	3.3	58	96.7
Chest pain	60	100.0	0	0.0
Lidocaine	4	6.7	56	93.3
Hypoxia	28	46.7	32	53.3
Respiratory infection (Pneumonia)	25	15	35	58.3

Table (5): Mean±SD (range) distribution of the studied sample related delirium assessment scale (N=60)

Items	No ( )	%
Delirium Scale		
On admission		
Normal	34	56.7
Subsyndromal delirium	2	3.3
Delirium	24	40.0
Mean ±SD(Range)	**1.78±2.08(0-5)**	
2nd day		
Normal	0	0.0
Subsyndromal delirium	8	17.0
Delirium	39	83.0
Mean ±SD(Range)	**4.34±0.96(3-6)**	
3rd day		
Normal	0	0.0
Subsyndromal delirium	6	30.0
Delirium	14	70.0
Mean ±SD(Range)	**3.95±1.09(2-6)**	

Table (6): Correlation between Delirium assessment scale and risk factors for study sample (N=60)

Items		On admission	2nd day	3rd day
Smoking (bad habits)	r	-.275-	0.396	1.000**
	P	0.034	0.084	
Dementia	r	0.187		
	P	0.151		
	P	0.496	0.025	
Respiratory acidosis	r	.375**	-0.397	-1.000-**
	P	0.003	0.083	
Anemia	r	-0.070		
	P	0.597		
Hearing impairment	r	-0.150	0.031	
	P	0.252	0.898	
Metabolic acidosis	R	-0.150	0.023	1.000**
	P	0.252	0.924	
Hyperkalemia	R	-.358-**	-0.412	
	P	0.005	0.071	
Lidocaine	R	-0.226		
	P	0.082		
Hypoxia	R	.259*	0.168	1.000**
	P	0.046	0.479	
Respiratory infection (Pneumonia)	R	-0.182	-0.359	
	P	0.163	0.120	

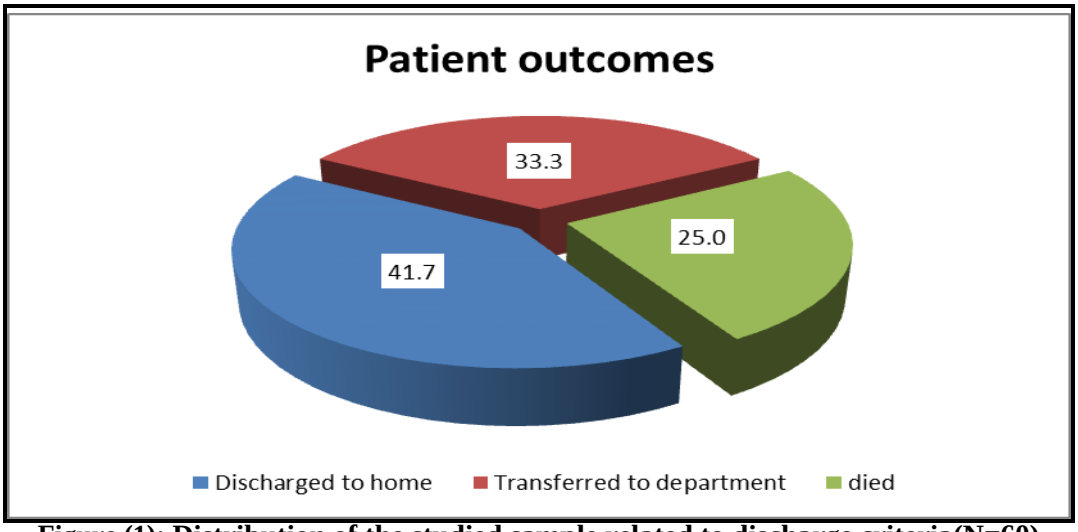

Figure (1): Distribution of the studied sample related to discharge criteria(N=60)

Table (1): Illustrates thedistribution of patientsaccording to their socio demographic characteristics; (53.3%) of patients were agedabove 50 years and (15.0%) of patients were aged between (30 – 40) years. Among the total sample (76.7%) of the patients were male and (23.3%) were females. Moreover, (63.3%) were marriedand (26.7%) were single and (3.3%) were divorced. As regarding educational levelit was found that (36.7%) were Illiterate, (33.3%) were secondary school and (5.0%) were preparatory school, (56.7%) were smoked.

Table (2A): Shows distribution of laboratory investigations regarding (cardiac enzymes, electrolytes and kidney function) that there is no statistical significance difference at all days.

Table (2B): Shows distribution of laboratory investigations regarding (lipogram, prothrombin time, concentration and INR) and blood glucose level that there is no statistical significance difference at all days.

Table(3): Show distribution of Glasgow Coma Scale on admission 41.7% of patients were mild, 58.3% were moderate, at 2rd day 53.2% were mild, 36.2% were moderate and 10.6% were sever and at 3rd day 30.0% were mild, 55.0% were moderate and 15.0% were sever

Table (4): Show that 56% of patient was smoking, 88% have past health history, 76.7% have medical illness, 6.7 % have previous delirium, 13.3% have hearing impairment, 13.3% were hypoglycemic, 80.0% were abnormal sodium and potassium 3.3% were depressed, 100.0% have chest pain, 6.7% taken lidocaine drugs, 46.7% were hypoxic and 15% were pneumonia.

Table (5): Show distribution of the studied sample related to delirium assessment as at admission 50.0% was delirium and 50% was Subsyndromal delirium, at 2nd day 70.0% was delirium, 30.0 % was Subsyndromal delirium and at 3rd day 56% was normal,3.3% was Subsyndromal delirium and 40 % was delirium.

Table (6): The current study showed that there was a highly statistical significant relationship between delirium risk factors and delirium assessment scale as Smoking, respiratory acidosis, metabolic acidosis, hyperkalemia and hypoxia.

.**Figure (1):** Show distribution of the studied sample related to discharge criteria as (41.7%) were discharged to home, (33.3%) transferred to department and (25%) died.

Discussion:

Post-operative delirium is an acute neuropsychiatric clinical syndrome characterized by disturbances in memory, thought, behavior, perception, consciousness and orientation. This syndrome is a common and unrecognized condition after surgery in aged individuals. Delirium is not only a manifestation of clinical syndromes, but also increased mortality, longer hospital stay, as well as decreasing physical performance and social functioning **(Morandi, et al, 2022).**

Depending on where and what kinds of research have been done, there is a huge variation in the reported incidence of delirium increased in post-operative. According to reports, delirium happens in patients undergoing major surgery of patients in Intensive Care Units **(Mansou, et al, 2022)** and patients undergoing cardiovascular surgery. **(Detroyer, et al, 2018)**

The main findings of this thesis showed that delirium is a common post-operative complication after cardiac surgery. It also showed that age of the patient developed delirium were aged above fifty years the outcome in alignment with **(Li, et al, 2019)** who mentioned that the incidence of delirium increasing with increasing the age above fifty years old also.

For the sex of the studied population, it was noticed that delirium is most common among males than the female and this study is supported by studies done by **(Li, et al, 2019) & (Jackal, et al, 2021)** who found that the males were more affected by delirium.

According to the current analysis, more than half of the patients suffered from delirium were married and smokers, these outcomes were conflicted with the research done by **(Li, et al, 2019)** who mentioned that most of the delirious patients were living alone and **(Oliveira, et al, 2018)** who mentioned that more than half of the patient on his study were nonsmokers.

In relation to the degree of education, the present research found that most of the studied population were illiterate or secondary school and this results agreed with the results obtained from **(Grotti & Falsini, 2022)** who said that the about one third of the studied sample were illiterate.

(Tubaro, et al, 2021) demonstrated that there were none any specific variations associated between delirium and the primary cardiac condition for the PCI and these results disagree with the outcomes of the present research which clarified that more than two thirds of patients underwent PCI had STEMI.

The study of **(Pagad, et al, 2020)** mentioned that NSTEMI was independent risk factor to increase the risk of developing delirium after PCI with more than two thirds of the studied people who developed delirium after PCI were diagnosed as NSTEMI and these result is in conflict with the outcomes of the present research which showed that about more than two thirds of the research sample were diagnosed with STEMI.

We identify dementia as an independent risk factor for delirium in MI patients, despite the fact that

several distinct predictors of delirium in hospitalized patients have been identified. Dementia is the most consistently reported risk factor in various contexts.

The results of the research conducted by **(Falsini, et al, 2018)** indicates that there was highly statistically significant distinction between the studied population regarding to hypokalemia, hypernatremia, and hypoglycemia with p value less than 0.001and these results were in the same line with the results of this study which reflect normal level of hemoglobin, sodium, potassium and glucose level.

The outcomes of the research done by **(Tilouche, et al 2018)** indicate that thereno statistical significant difference between the studied population regarding to hyperkalemia and these result was in conflict with this study.

Regarding to the cardiac enzymes (CK, CK-MB and troponin)for the patients who developed delirium, the current study represented that there were no statistically significant differences regarding these results are supported by the results of the study done by **(Jäckel, et al, 2021)** showed that there were no statistically significant differences between the delirium development among the studied groups. But **(Rengel, et al, 2018)** mentioned that there was significant difference regarding to troponin only.

In relation to the blood sugar level, the current study revealed that there was no significant difference and the study done by **(Jäckel, et al, 2021)** showed that the glucose level of the studied patients shown no significant difference between the both groups who develop and who did not develop delirium.

For the renal function tests, the available study revealed that the creatinine level of the studied population is little bit higher than the normal level but there is a lot of studies which compared the renal insufficiency between two groups (with and without) delirium andbetween the two groups, there was no statistically significant difference. (**(Li, et al, 2019) & (Jackal, et al, 2021)**. On the other hand, study done by **(Ma, et al, 2020)** showed that After PCI, delirium among ACS patients with renal impairment had a 15.97% incidence rate.

Regarding to the coagulation factors particularly the INR as it is the most important factor reflect the coagulation status of the patient and based on it the dose of anticoagulant is adjusted, the present study showed that there was no discernible difference among patients and this result agreed with the findings of the study done by **(Rahimi, et al, 2021)** who mentioned that there was no discernible difference among both group and the higher level of INR may be because of the underlying medical condition.

According to the current study's findings the prognosis of the patient after having delirium as post-operative complication, it was noticed that more than one quadrant of the total sample died in the hospital and less than half discharged home and these results are supported with the results of study done by **(Lee, et al, 2022)** who mentioned that less than quadrant of the studied population died with delirium before discharged from the hospital.

Conclusion

The present study concluded that incidence of delirium among patients under study was 83% .and the most associated risk factors for development among patients were advanced age, smoking, respiratory acidosis, electrolyte imbalance, chest pain, hypoxia and respiratory infection.

Recommendations

The following suggestions were made in light of the current study's findings:

- It recommended to continuously assess patients for delirium risk factors in order to develop delirium preventive measures, which influence patients outcomes.
- Patient with delirium after primary percutaneous coronary intervention should have a great attention from nurses staff to prevent risks as pulmonary edema, bleeding and hematoma injury Based on the findings of the current study.
- Creating plans to raise the standard of care following PPCI surgery.

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