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A Study of Clinical Profiles and Prognosis of Patients with Paraquat Poisoning in Tertiary Health Care Centre

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Abstract
BACKGROUND :*Agriculture being the primary mode of occupation in Assam leads to the rampant and widespread use of chemical pesticides and and herbicides. Paraquat is a widely used herbicide. Ingestion of Paraquat irrespective of the quantity could be fatal with life threatening effects on the gastrointestinal tract ,kidney liver,lung and other organs. Suicides due to paraquat poisoning are an important cause of morbidity and mortality especially due to the absence of specific antidote. Metabolism of Paraquat generates free radicals that damage the cellular organelles and membranes,causing damage to many organs ,especially the pulmonary alveolar epithelium. Death is usually associated with respiratory insufficiency due to an oxidative insults to the Type II alveolar epithelium with subsequent fibrosis.Consumption of Paraquat > 40 mg/kg causes acute multiorgan failure with death within the first 2 days, while <20 mg/kg of Paraquat causes mild symptoms and most survive.Paraquat of 20–40 mg/kg causes severe mucosal damage followed by multiorgan failure. The few, who survive, die within 2–4 weeks due to lung fibrosis. The pulmonary alveolar cells selectively accumulate polyamines ,being structurally similar to polyamines. Paraquat gets accumulated in these cells, causing selective delayed lung injury. Although PQ is commonly used in India, except for one large study[Rao R et al Golden hours in severe paraquat poisoning-the role of early haemoperfusion therapy], dataon Paraquat poisoning are restricted to case reports and small case series.*
MATERIALS AND METHODS: *All the patients with paraquat poisoning admitted in Tertiary care centre from 1st September 2021 to 31st August 2022 were included in the study. Total 45 patients with history of ingestion of paraquat were evaluated after taking informed consent.. The patients were followed up for a period of 30 days to observe the outcomes. The obtained data was then statistically analysed to summarise the demographic characteristics, clinical features and outcomes of the cases.*
RESULTS*: Out of 45 patients, 28 were females (62.2%) and 17 were males ((37.77%).Female to Male ratio was 1.65:1. Mean of patient'sage and length of hospital stay was 26.17 years and 11.5 days respectively. The in-hospital fatality rate was 95.5% (n=43).All routes of paraquat poisoning were through ingestion and other routes of poisoning were not found. Ingestion of paraquat was for deliberate self harm or suicide in 93.3% (n=42), accidental in 4.44% (n=2) and homicidal in 2.22% (n=1).It was found that patients who ingested fewer than 5ml (n=2) survived whereas all patients who ingested more than 10ml (n=43) expired.The main signs and symptoms of patients included vomiting (88.8%), epigastric pain (66.5%), mucosal erosive lesions of oral cavity and pharynx (93.3%).Acute kidney failure ((71.1%) ,Acute Lung Injury (51.1%) Acute hepatitis was seen in (33.34%), and leucocytosis was seen in (71.1%) and anaemia was seen in 20% of the patients.*
DISCUSSION: *Paraquat is widely used for its efficacy and low environmental toxicity. The lack of specific specificantidote increases the fatality rate. The most common cause of death in our study is respiratory failure followed by multi organ failure.The main stay of treatment is supportive,though some studies shows benefit from immunosuppressant.*
CONCLUSION: *From our study, it was found that most of the patients were from age group of 20 to 35 years old. They belong mostly to the reproductive age group and majority of the poisoning were suicidal in nature. The severity and outcome of paraquat poisoning were determined primarily by the amount ingested. The most common cause of death was respiratory failure. Our study shows a very high in- hospital mortality rate of 95.5%.*

Keywords: *Paraquat, Paraquat poisoning, Acute lung injury, Acute kidney injury*

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I. Introduction

Agriculture is the primary occupation of the people of India with majority of the population involved in it. This leads to wide use of chemical pesticides and herbicides which are easily available in the market. Paraquat (1,1'-dimethyl -4,4'-bipyridinium dichloride) is one of the most widely used herbicides discovered in 1955. It is a fast acting, reasonably priced and easily accessible non selective contact herbicide. However, this product is highly toxic for humans .It's ingestion is mainly used for the purposes of suicide and can cause multiple organ failures including liver insufficiency, acute kidney injury, heart failure and lung fibrosis which is the life threatening. Paraquat is a pungent corrosive liquid available in the market as 'All Clear', 'Gramex', 'Gramo', 'Gramoxone' etc. in India. As little as a teaspoonful of concentrated paraquat can result in death. In adult human, estimated lethal dose is about 3-6 grams of paraquat ion which is equivalent to 10-20ml of 20% paraquat solution. Because of its high toxicity, European Union withdraw paraquat from its market in 2007.The paraquat inhibits the reduction of nicotinamide adenine dinucleotide phosphate (NADP) to nicotinamide adenine dinucleotide phosphate hydrogen (NADPH) resulting in the overproduction of reactive oxygens and nitrites that destroy the lipids of cell membranes. Death is usually associated with respiratory insufficiency due to an oxidative insult to the Type II alveolar epithelium with subsequent fibrosis .There is no specific antidote and none of the current treatment modalities have proved to be successful in acute fulminant paraquat poisoning.

II. Aims And Objectives

To study the clinical profiles and outcomes of patients with paraquat poisoning hospitalised in Department of Medicine, in a tertiary care centre in Assam

MATERIALS AND METHODS:

Type of study : Hospital Based Observational Study
Place of Study : Department of Medicine, in a tertiary care centre in Assam.
Duration : 1st August 2021 to 31st July 2022.
Number of cases : 45

INCLUSION CRITERIA:

All patients with paraquat poisoning aged 13 years or above hospitalised in Department of Medicine, in a tertiary care centre in Assam.

EXCLUSION CRITERIA:

1)Patients below 13 years of age
2)Poisons other than paraquat
3)Patients who did not give consent

ETHICAL REVIEW:

Ethical clearance was obtained from the institutional ethical committee of tertiary care hospital.

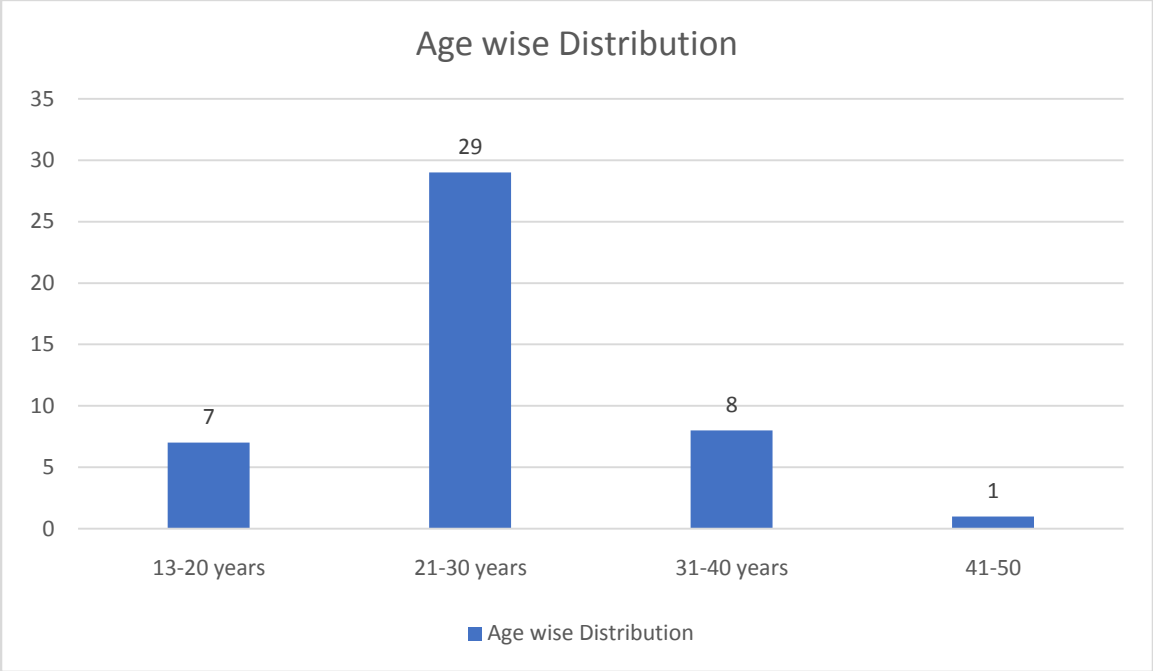
STATISTICAL ANALYSIS:

The statistical analysis of data was performed using the computer program, statistical package for Social Service (SPSS) for window version 20.0 Chicago Inc. and MicrosoftExcel 2010. Results are presented as mean ± standard deviation.

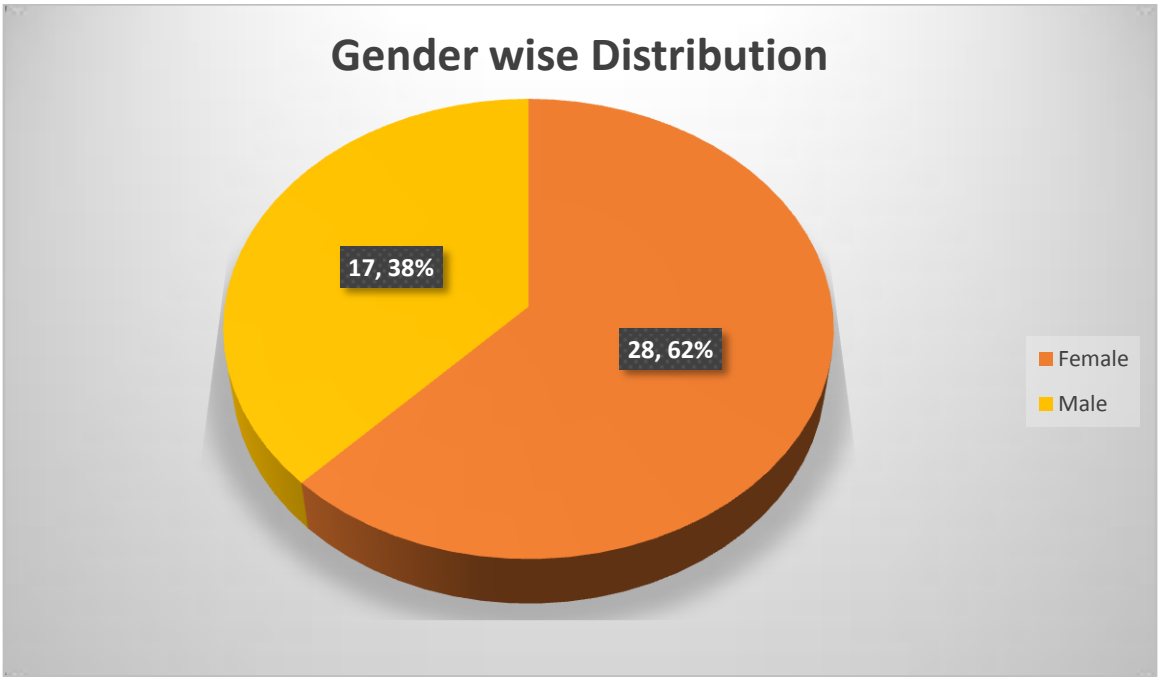
III. Results And Observation:

AGE WISE DISTRIBUTION:

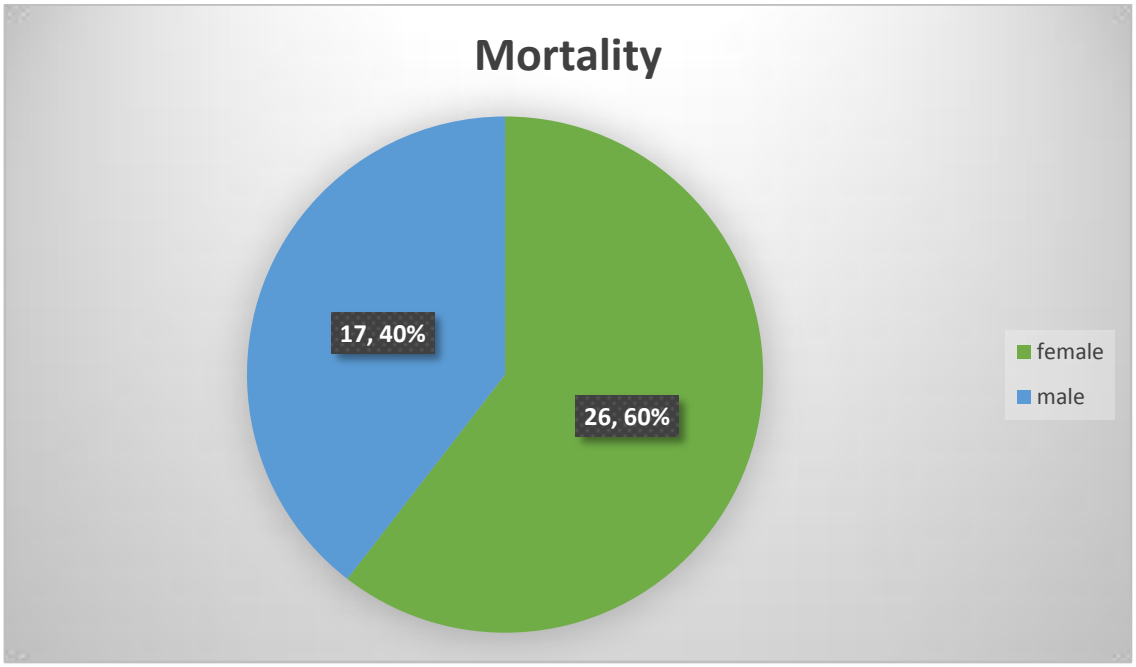
In our study, majority of the patients were in the age group of 21-30 years (64.45%), followed by 31-40 years (17.78%). The mean age was 26.17 years. The minimum age of the patient was 17 years and the maximum age of the patients was 45 years.



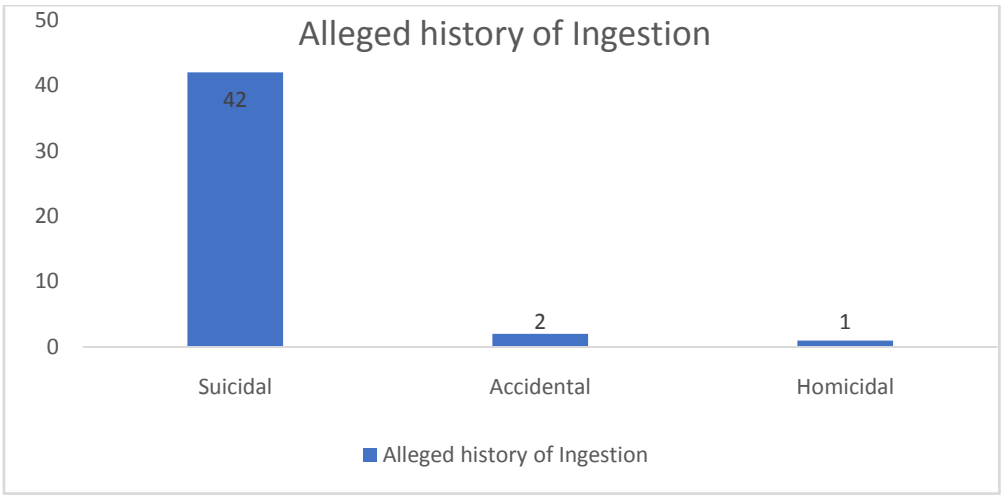
GENDER WISE DISTRIBUTION:
In our study, 28 (62%) patients were females and 17(38%) patients were males. Female to Male ratio was 1.65:1.



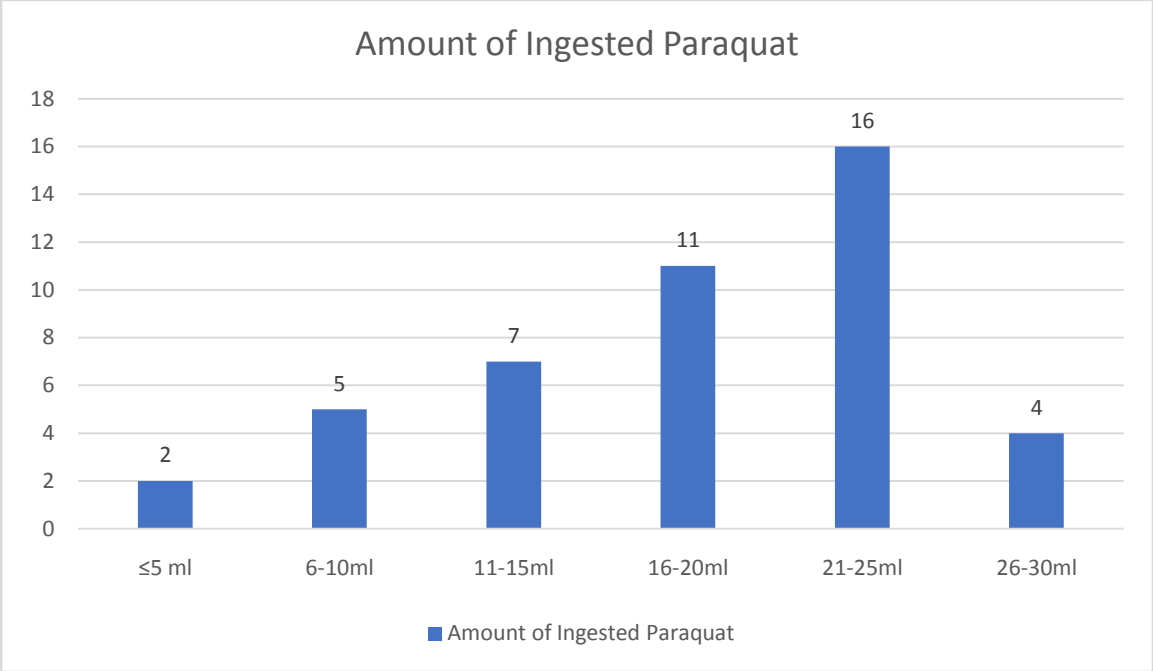
MORTALITY:
Out of 45 patients, 43 patients expired. Of the expired patients, 17 (39.53%) were males and 26 (60.47%) were females.



ALLEGED HISTORY OF INGESTION OF PARAQUAT:
In our study, all routes of paraquat poisoning were through ingestion, out of which 42 (93.33%) were suicidal, 2(4.44%) were accidental and 1 (2.22%) were homicidal respectively.

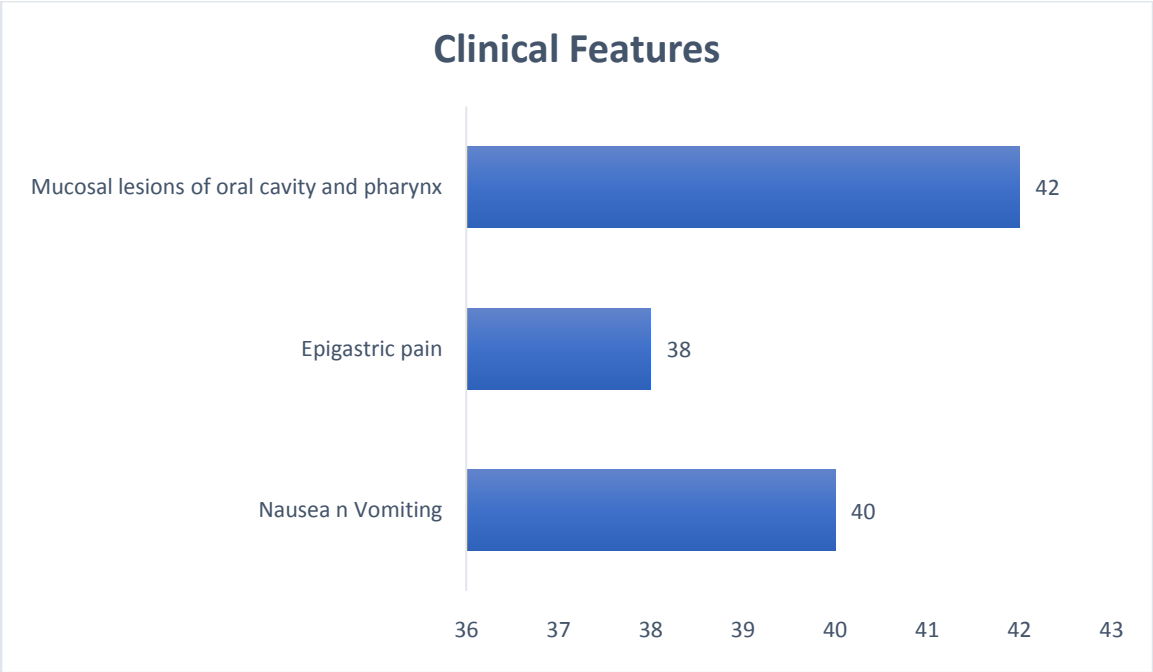


AMOUNT OF INGESTED PARAQUAT:
The amount of ingested paraquat was stated by patients in measures of cap of the poison container, mouthful or in terms of teaspoon. We considered the volume of the container cap to be 25ml, mouthful equal to 30ml and teaspoonful equal to 5ml respectively. It was found that maximum number of patients ingested around 25ml and the patients who ingested ≤5ml survived whereas all patients who ingested more than 10ml expired.



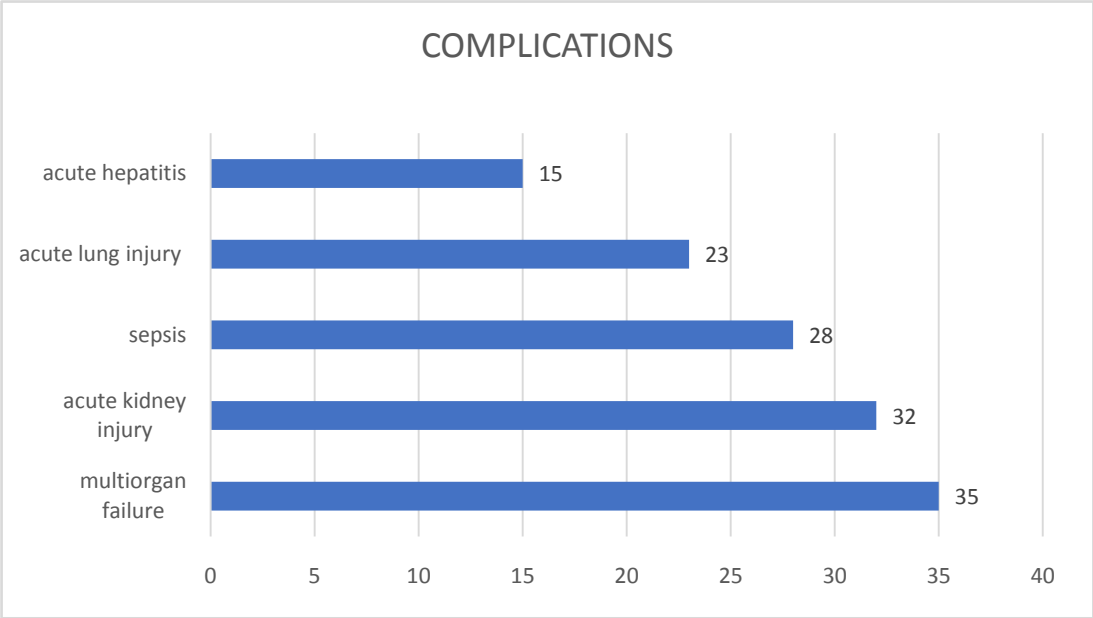
CLINICAL FEATURES:

In our study, it was found that out of 45 the patients, 40 (88.8%) patients had nausea and vomiting, 38(84.4%) patients had epigastric pain and 42(93.3%) patients had mucosal lesions of oral cavity and pharynx and some patients presenting with decrease urine output and respiratory difficulty.



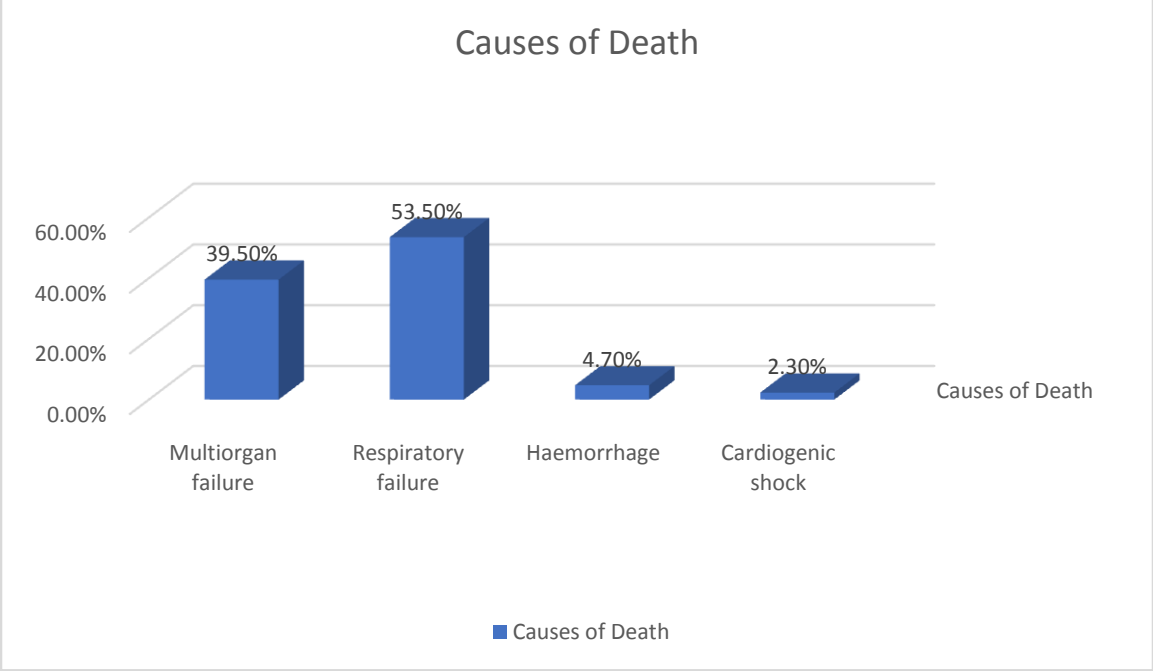
COMPLICATIONS:

In our study, most of the patients develop multiorgan failure 35 (77.8%) followed by acute kidney injury 32 (71.1%), sepsis28(62.2%),acute lung injury 23(51.1%) acute hepatitis 15 (33.34%).



CAUSES OF DEATH:

In our study, the most common cause of death was respiratory failure 23 (53.5%), followed by multi organ failure seen in17 (39.5 %), hemorrhage 2 (4.7%) and cardiogenic shock 1 (2.3%).



IV. Discussion :

In this retrospective study of 45 patients, most were females in the age-group of 21–30 years.,The most common cause of death was respiratory failure 23 (53.5%), followed by multi organ failure seen in17 (39.50%), hemorrhage 2 (4.7%) and cardiogenic shock 1 (2.3%).The use of immunosuppression did not affect theoutcome.

Out of 45 patients, 28 were females (62.2%) and 17 were males (37.77%). Female to Male ratio was 1.65:1. Mean of patients' age and length of hospital stay was 26.17 years and 11.5 days respectively. The in-hospital fatality rate was 95.5% (n=43).Of the expired patients 39.5% (n=17) were males and 60.4% (n=26) were females. Out of 45 patients, 4.44% (n=2) survived.

All routes of paraquat poisoning were through ingestion and other routes of poisoning were not found. Ingestion of paraquat was for deliberate self harm or suicide in 93.3% (n=42), accidental in 4.44% (n=2) and homicidal in 2.22% (n=1).

The amount of ingested paraquat was stated by patients in measures of cap of the poison container, mouthful or in terms of teaspoon. We considered the volume of the container cap to be 25ml, mouthful equal to 30ml, and teaspoonful equal to 5ml respectively. The mean of ingested was 20.5ml.

It was found that patients who ingested fewer than 5ml (n=2) survived whereas all patients who ingested more than 10ml (n=43) expired.

The main signs and symptoms of patients included vomiting (88.8%), epigastric pain (66.5%), mucosal lesions of oral cavity and pharynx (93.3%). Acute kidney failure (71.1%) , Acute lung injury (51.1%) Acute hepatitis was seen in (33.34%), and leucocytosis was seen in (71.1%) and anaemia was seen in 20% of the patients.

Hsiao-Hui Chen et al. (2013) reported that corrosive action PQ is greater than the Glyphosate weedicide and systemic toxicity occurred with rapid development of hypoxia, hepatitis, and renal failure in many cases. Hsieh YW et al. (2013) observed in six pediatric patients with 33.3% mortality. Ja-Liang Lin et al. (2006) in a randomized control trial observed the mortality rate of the study group (five of 16, 31.3%) was lower than that of the control group (six of seven, 85.7%) with repeated pulse dose of methylprednisolone and cyclophosphamide with continuous dexamethasone therapy for patients with severe PQ poisoning.Chen and colleagues successfully treated a case of severe PQ poisoning using repeated pulse therapy of methylprednisolone. The routes of poisoning are ingestion and direct contact with the skin .Direct contact of PQ with skin causes burns and dermatitis.Contact with the eye may irritate, burn, corneal damage, and scarring. Lethality of PQ depends on the quantity ingested. A patient who has ingested a large amount (>40 ml) of PQ, generally presents with multi-organ dysfunction syndrome, pulmonary edema, cardiac, renal, and hepatic failure along with central nervous system involvement with seizure and have a higher chance of death.The lethal dose in humans is approximately 35mg/kg body weight (10ml - 15ml of a 20% solution).Clinical features depend upon the amount of ingested poison. After ingestion, it causes a burning sensation in the mouth, throat, abdominal pain, nausea, vomiting, and diarrhea. Severe oral ulcers may develop within a few days. The tongue may be coated and inflamed with ulceration called 'Paraquat tongue'. Once absorbed, it rapidly distributes in the tissue such as the liver, kidney, and lungs. After ingestion, the greatest PQ concentration is found in the lungs, and the concentration peak in 5 to 7 hours. In lungs it causes pulmonary congestion, edema, hemorrhage, diffuse alveolitis, and extensive pulmonary fibrosis. Acute respiratory distress may occur after 24 to 48 hours after ingestion. PQ selectively accumulates in the capillary endothelial and epithelial cells of the lung and causes diffuse alveolitis followed by extensive pulmonary fibrosis in about 3-14 days. Lungs were usually affected in all the fatal cases with features of pulmonary edema and lung fibrosis. After absorption, its accumulation in the liver cause hepatic injury. PQ is eliminated mainly by the kidney and acute kidney failure is a recognized complication of its poisoning, with reports of oliguric and non-oliguric cases. PQ causes renal failure by causing hypovolemia, circulatory failure, septicemia, and direct toxicity. Multiple systems are involved but pulmonary features are predominant and are the usual cause of death. A very high case fatality of PQ is due to its inherent toxicity and lack of definitive treatment.

V. Conclusion:

From our study, it was found that most of the patients were from age group of 20 to 35 years old. They belong mostly to the reproductive age group and majority of the poisoning were suicidal in nature. The severity and outcome of paraquat poisoning were determined primarily by the amount ingested. The most common cause of death was Respiratory failure followed by multi organ failure .Our study showed a very high mortality rate of 95.5%.The amount of paraquat consume and presence of lung injury had a correlation with mortality and the use of steroid did not alter the mortality rate.In the absence of effective antidote and specific treatment paraquat continues to cause a very high mortality rate

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