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Management of Acute Copper Sulphate Poisoning

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Patients can present with a known history of copper sulphate poisoning, if they complaint or if there is an eye witness. However this may not be apparent always, as if the patient is unconscious or unable to give a history. Sometimes they may purposefully be mute after deliberate self-harm. In any case of poisoning or suspected case of poisoning, clinician should put their every possible effort to find details of the poison such as substance(s), amount taken and the time of the incidence. It is not unusual to have mixed types of poisoning, especially with Alcohol or elicit substances. Involvement in shops selling chemicals, leather industry, agriculture, glue making and some religious activities may be an indirect clue to the accessibility to copper-sulphate, when the history is unapparent.

Management includes, initial emergency care and stabilization at the presentation, care during subsequent stay in the hospital (could include ICU care also), organization of psychosocial support during ward stay and follow-up care with continuation of care in the community.

Initial management is always as per any emergency targeting to attend and solve the most life-threatening parameter first. Circulation, Airway and Breathing assessed. Synchronized with it resuscitate the victim to achieve the stable goals in each. Shock can be hypovolemic due to dehydration, vomiting and poor intake, haemorrhagic due to gastric bleeding, cardiogenic due to arrhythmia by cardiac toxicity, and even distributive in case of pancreatitis. However always suspect mixed causes for shock, which is more common. Chest compressions, correction of arrhythmias, fluid or blood resuscitation and inotropic support may be needed to correct it. Always give intravenous fluid thinking it is hypovolemic shock unless proved otherwise. Aspiration is common in poisoning and need clearance of airway and sometimes respiratory support may be needed to achieve a good ventilation and oxygenation. Target oxygen saturation should be at least 94% in an emergency except for those of elderly, those with COPD (Chronic Obstructive Airway Disease) and Obesity where the target of >=88% is adequate. Quick assessment of disability and complete exposure are mandatory as in any case of poisoning. Changes of clothes washing out of further contact of the poison are essential.

Absorption of already ingested substance may be reduced by giving plenty of water and milk to drink although this lacks proven scientific evidence. Emesis is dangerous due to risk of further mucosal damage. Activated charcoal can be given, even though the supportive evidence is inadequate.

Check random blood sugar and correct derangements to achieve a target that avoids hypoglycaemia and hyperglycaemia (non stringent target of <180 mg/dl is adequate). Blood gas analysis is done with the initial blood drawing. Correct any derangement in electrolytes and acid base disturbances. Lactate level is assessed, which is high when there is tissue hypoxia. Repeat these investigations to assess the progress of management or development of complications.

Following the initial resuscitation and stabilization, usually at the emergency department, further care of the patient will depend on his or her clinical status. In severe cases of copper sulphate poisoning patient might need intensive care support.

Main stems of Management of copper sulphate poisoning, are reduction of absorption, supportive care, copper chelation therapy and management of complications.

1. *Reduction of absorption* – as described above.
2. *Supportive care* – initial resuscitation, then maintenance of hydration and nutrition and supportive care for organs involved.
3. *Chelation therapy*

1-1.5 g/day of oral **Penicllamine** in 2-4 divided doses can be given [1].

Dimercaprol (400 mg every 8 hourly), can also be given orally or by naso-gastric tube [2].

If the patient is unable to take orally, Intramuscular Dimercaprol, or **BAL** (British anti-lewisite – 3-5 mg/kg/dose four hourly in first two days and tailed off in the next 7-11 days) can be given.

Edetate Calcium Disodium can also use as a chelating agent.

There is no agreement on what chelating agent is better or how long it should be carried for due to lack of research in the subject [2]. If copper level can be done, chelation can be carried out until normal serum copper level is achieved. Copper cannot be removed by haemodialysis.

4. *Management of complications*

a. Management of Acute Kidney Injury (AKI)

Good hydration by oral or intravenous fluid therapy needed to prevent or treat AKI. Monitor fluid intake and urine out-put. Regular renal function monitoring is essential.

Renal replacement therapy – Haemodialysis (HD) may be needed to be given for weeks. Peritoneal dialysis is an option when HD not available but cannot continue for longer durations.

b. Management of Intravascular haemolysis (IVH)

Daily full blood count, reticulocyte count and blood picture will be done to monitor for haemolysis. Haemolysis can begin even in the early hours after ingestion. Blood transfusion may be needed as haemolysis can be severe. In addition gastric bleeding can contribute to anaemia and haemodynamic instability.

c. Management of Methaemoglobinaemgia

IV injection of **Methylene blue**, 1-2 mg/kg/dose. Cyanosis may be settled with one dose. If cyanosis persists beyond one hour repeat injections can be given. Methylene blue contraindicated in G6PD deficiency, due to risk of severe haemolysis. **Ascorbic acid** or **Hyperbaric oxygen** can be used in such cases.

d. Management of Hepatitis

Supportive care and avoid hepatotoxic medications.

e. Gastro-oesophageal erosions and bleeding

Blood transfusion needed if bleeding is severe or if haemodynamically affected. Proton pump inhibitors (like omeprazole or pantoprazole) can be used intravenously as injections or infusions. Endoscopy may be indicated if bleeding ulcer is suspected with continued bleeding in view of arresting it with adrenaline injections. However endoscopy carries the risk of iatrogenic mucosal tears due to erosions and weakened mucosa. Interval endoscopy can be done to investigate for erosions if symptoms persist or to demonstrate healing of any ulcers or erosions.

f. Aspiration pneumonia

Aspiration can lead to chemical pneumonitis, which is managed with supportive care. Oxygen *via* face mask or nasal prongs given if hypoxic. Intubation and ventilation may be necessary in severe cases. Infectious pneumonia can follow the chemical pneumonitis and antibiotics may be necessary, with broad spectrum including anaerobic cover [3-5].

ICU and ward based care can be days to weeks depending on the severity and complications. Psychosocial assessment and support should be provided in case of deliberate self-harm. Patient and family education is vital in both self-poisoning and accidental ingestion, which is common amongst children. Follow-up will be needed in cases like, severe renal impairment, needing weeks of HD, patients with gastric erosions and/ or ulcers needing follow-up endoscopies and those with hepatitis. Resolution of pneumonia could be demonstrated with follow-up chest x-ray to show the resolution of consolidation in 4-6 weeks.

It is important to highlight the fact that initial care (especially by minimising the absorption) and resuscitation of a patient received at community and emergency department has a larger impact on development of organ failure and survival later on. Chelation therapy is the key to minimize the risk subsequently [6-8].

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