Epidemiology and Clinical Profile of Gloriosa Superba Poisoning in Sri Lanka

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Abstract

Introduction: Gloriosa superba is a common plant poisoning in Sri Lanka which has fatal outcomes. Except few case reports, there are no systematic studies regarding its poisoning in the country. The objective of this study was to describe epidemiological and clinical manifestations following Gloriosa superba poisoning and its long term effects.

Methods: A descriptive observational study involving a series of 33 patients with Gloriosa superba poisoning was conducted for one year duration commencing from July 2015.

Results: Twenty-nine (87.87%) cases were deliberate self-poisonings and 4 (12.12%) were accidental poisonings. Females were 21 (63.63%) and males were 12 (36.36%). Their age ranged from 13 years to 72. Thirty (90.9%) ingested Gloriosa tubers. Five patients (15.15%) died due to Gloriosa poisoning. Thirty one patients (93.93%) developed acute gastrointestinal symptoms; 7 (21.21%) had cardiotoxic effects; 3 (9%) developed respiratory failure; 5 (15.15%) had neurological and bleeding manifestations; 2 (6%) had acute kidney injury. Hypokalaemia was observed in 16 (48.48%), leucopenia in 5 (15.15%) and anaemia in 4 (12.12%) patients. Alopecia was observed in 4 (12.12%) patients as the long term effect.

Conclusion: There is a multi-organ system involvement in Gloriosa superba poisoning such as gastrointestinal tract, heart, lungs, kidneys, brain, liver and haemopoietic system.

Keywords: plant poisoning; Gloriosa superba; Niyagala; colchicine; alopecia; Sri Lanka

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Consent: We confirm that the patients have given the informed consents for the case reports to be published.

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1. Introduction

_Gloriosa superba_ is a semi-woody, herbaceous, branching plant in the family Colchicaceae. It is called in English ‘flame lily’, ‘glory lily’, ‘superb lily’, ‘climbing lily’ or ‘creeping lily’ which refer to its exotic flower (figure 1). In Sri Lanka, it is known as ‘Niyagala’ in Sinhala whereas in Tamil it is called ‘Karthigaipoo’.

![Figure 1: Gloriosa superba (A) plant with flowers (B) tubers and (C) seeds](image)

The active poisonous constituents of the plant include highly active alkaloids such as colchicine, gloriosine, superbrine (a glycoside), chelidonic acid and salicylic acid (Subbaratnam 1954) among which colchicine (C\textsubscript{22}H\textsubscript{25}NO\textsubscript{6}) is the chief alkaloid (Dunuwille et al. 1968). _Gloriosa_ is cultivated in Tamil Nadu, India in order to yield a medicinal alkaloid whereas it grows wild in every region of Sri Lanka. All parts of the plant (figure 1) are poisonous. The colchicine content is higher in cultivated plants than in naturally grown plants and the seed contains more colchicine than the tubers (Basak et al. 2012). The lethal dose of colchicine in human is about 0.8 mg/kg (Labib et al. 2014). _Gloriosa superba_ poisoning may be accidental due to the resemblance of these tubers to the edible yams of _Ipomea batatas_ (sweet potato) or suicidal (Fernando R. and Fernando D. 1990; Prabhu et al. 2016) and rarely homicidal (Vidanalage et al. 2016). The poisoning may also occur when the plant is used as an herbal therapy (George 2011; Babu et al. 2012). In the western Sri Lanka _Gloriosa_ is responsible for 44% of plant poisonings with a 15% case fatality rate (Fernando R. and Fernando D. 1990). Even though the poisoning of _Gloriosa_ is higher in some parts of the country, there are no systematic studies in Sri Lanka regarding ‘Niyagala’ poisoning except for few individual case reports (Gooneratne 1966; Angunawela and Fernando.1971; Mendis 1989; Gooneratne et al. 2013; Namal Rathnayaka et al.2016). The objective of this study was to describe epidemiological and clinical manifestations following _Gloriosa superba_ poisoning and its long term effects.

2. Materials and methods

This was a descriptive observational hospital based study performed in medical wards Provincial General Hospital, Ratnapura-Sri Lanka for one year duration commencing from July 2015. All patients with the history of ‘Niyagala’ poisoning were recruited to the study. On admission and during hospital stay, each patient was examined by the principal investigator (RMMKNR) and data were collected using an interviewer-administered questionnaire. Laboratory findings such as complete blood count, blood urea,
serum creatinine, clotting profile (PT/INR, APTT), serum electrolytes, SGOT, SGPT, bilirubin were recorded from bed head tickets. Cardiotoxicity was assessed using serial ECGs. Ethical approval was obtained from the faculty of Medicine, University of Colombo, Sri Lanka (protocol No: EC/15/085).

3. Results

Data were collected from 33 patients of which twenty nine (87.87%) cases were deliberate self poisonings and four (12.12%) were accidental poisonings. Females were outnumbered males; females-21 (63.63%), males-12 (36.36%). Age ranged from 13 years to 72 in which female age range was 15-60 and male age range was 13-72. Thirty (90.9%) had ingested Gloriosa tubers; one each (3%) ingested leaves, flowers and ‘Niyagala’ seeds (about 50 seeds) who died 42 hrs after the ingestion (Namal Rathnayaka et al.2016). The number of ingested tubers ranged from 1 to 5; ten had ingested one tuber; 9 ingested 2 tubers; 7 ingested 3 tubers; 3 ingested 4 tubers and 5 tubers were ingested by one patient. The plant was found by patients in various places. Most of them (22: 66.6%) found it in tea estates; 8 (24.24%) in home gardens and one each (3%) found it near a footpath, jungle and temple garden. Twenty four persons (72.72%) were married and 6 (18.18%) were unmarried. Three of poisoned persons were students. Eleven persons (33.33%) were housewives and nine (27.27%) were unemployed. The occupations were 3 (9%) - garment workers; 4 (12.12%) working in tea estates and one each (3%) was a labourer, barber and three wheel mechanic. Thirteen persons (39.39%) had educated up to ordinary level examination and 15 (45.45%) were in grade 5-11 level; 4 (12.12%) were involved less than grade 5 level. There was one person (3%) who had educated up to the advanced level. Twenty eight persons (84.84%) have ingested the plant at their house; one ingested at the temple; one at the tea estate; one at the home garden and another one at his saloon. Two patients co-ingested paracetamol along with ‘Niyagala’. One patient had a previous suicidal attempt with drug overdose. The time gap between the ingestion and hospital admission was 30 min - 25 hrs. Most patients (10: 30.3%) were admitted to the hospital within 3 hrs of the ingestion; 6 (18.18%) within 2hrs of the ingestion.

<table>
<thead>
<tr>
<th>Investigation finding</th>
<th>No.of cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaemia</td>
<td>4 (12.12%)</td>
</tr>
<tr>
<td>Reduced red cell count</td>
<td>3 (9%)</td>
</tr>
<tr>
<td>Leucopenia</td>
<td>5 (15.15%)</td>
</tr>
<tr>
<td>Leucocytosis</td>
<td>4 (12.12%)</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>6 (18.18%)</td>
</tr>
<tr>
<td>Bicytopenia</td>
<td>2 (6%)</td>
</tr>
<tr>
<td>Pancytopenia</td>
<td>3 (9%)</td>
</tr>
<tr>
<td>Elevated PT/INR</td>
<td>5 (15.15%)</td>
</tr>
<tr>
<td>Hypokalaemia</td>
<td>16 (48.48%)</td>
</tr>
<tr>
<td>Mild elevation of SGOT/SGPT</td>
<td>10 (30.3%)</td>
</tr>
<tr>
<td>Moderate elevation of SGOT/SGPT</td>
<td>4 (12.12%)</td>
</tr>
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</table>

Five patients (15.15%) died due to Gloriosa superba poisoning. Two patients did not develop any features of the poisoning. They ingested only one piece of a tuber. Thirty one patients (93.93%) developed acute gastrointestinal symptoms (nausea, vomiting, abdominal pain or watery diarrhoea) of which 23 (69.69%) had nausea and vomiting. Seventeen patients (51.51%) complained of abdominal pain.
from which 2 had colicky type pain who needed morphine for the pain relief. Watery diarrhoea was a one of main complaints, which was present in 22 patients (66.66%) whereas bloody diarrhoea was not observed. Five persons (15.15%) had shortness of breath and of them 3 (9%) developed respiratory failure and died. Confusion and convulsions were found as neurological manifestations which presented as 5 (15.15%) and 2 (6%) respectively. One patient with convulsions had co-ingested 36 tablets of paracetamol. Polyneuropathy or weakness of limbs was not observed as neurological manifestations. Bleeding manifestations were found as malena in 2 patients (6%), hematemesis in one (3%), haematuria in 2 patients (6%) and bleeding per vagina in one (3%) patient. Cardiotoxic effects were found in 7 patients (21.21%) of which 2 had chest pain; one each had palpitations and heart failure; 7 had electrocardiographic (ECG) changes. Oliguria developed in 3 patients (9%) of which 2 (6%) had acute kidney injury (AKI). Alopecia was observed in 4 (12.12%) patients. Haematological manifestations and other laboratory findings were described in table 1.

Five patients (15.15%) were managed in the intensive care unit (ICU) of which 3 (9%) were intubated and given mechanical ventilation (figure 2). Three died while having treatments in ICU.

Figure 2: A patient with C-PAP ventilation at ICU on day 3 of Gloriosa superba poisoning

4. Discussion

In our study the main clinical feature of Gloriosa poisoning was the gastrointestinal disturbances like nausea, vomiting, abdominal pain and watery diarrhoea which were present as 93.3%. We did not encounter patients with bloody loose stools. When the patient’s history is not clear if these symptoms present with fever, Gloriosa poisoning may mimic acute infection involving gastrointestinal tract, lungs, liver and kidneys (Premaratna et al. 2015). Hypokalaemia and cardiotoxic features were the prominent manifestations. ST-T wave abnormalities (ST elevation) have been described following ‘Niyagala’ poisoning (Mendis, 1989) and colchicine intoxication complicated with complete heart block was also documented (Ertuğrul et al. 2015). Bradycardia, arrhythmias and ischaemic changes were found as ECG changes in our study. There was a patient who developed heart failure with acute ischaemic changes following ingestion of ‘Niyagala’ tubers. Ischaemic changes and heart failure have not previously been
reported following *Gloriosa superba* poisoning. Colchicine binds to tubulin - a structural protein of microtubules preventing its polymerization into microtubules. This anti-mitotic property disrupts the spindle apparatus that separates chromosomes during metaphase. Cells with high metabolic rates such as intestinal epithelium, hair follicles and bone marrow are the most involved by the arrest of mitosis (Fernando and Widyaratna, 1989). Therefore, acute gastroenteritis, alopecia and pancytopenia may be observed in *Gloriosa* poisoning. Alopecia was reported 7-14 days following *Gloriosa superba* ingestion (Gooneratne, 1966; Angunawela and Fernando, 1971; Premaratna et al. 2015). In our study the loss of hair was begun on day 5-16 of the ingestion; massive hair loss was observed on day 25-35 and regrowth of scalp hair occurred after around 3 months of the ingestion (figure 3).

**Figure 3:** Alopecia (A) on admission (B) 23rd day of poisoning (C) massive hair loss following one month of poisoning

Colchicine, therapeutically used in acute gout, decreases the formation of uric acid crystals in joints. Colchicine overdose by accidental (Maxwell et al. 2002), therapeutic misadventure or suicide was well documented (Ellwood and Robb 1971; Stapczynski et al. 1981; Folpini and Furfori 1995;). Accidental *Gloriosa* poisoning is rare which commonly occurs with food poisoning (Nada Brnèie et al. 2001). We found four cases (12.12%) of accidental ‘Niyagala’ poisoning of which 13 year old male student ingested a ‘*Gloriosa*’ flower in the school. He developed headache, vomiting and watery diarrhoea for one day duration 4 hrs after the ingestion. He was discharged on day 3 of the hospital admission without any complications. Non-fatal case of self ingestion of *Colchicum autumnale* flowers was also previously reported (Danel et al. 2001). Colchicine causes suppression of bone marrow due to its anti-mitotic activity and as a result there is a reduction of division of cell lines-red cells, white blood cells and platelets. We observed patients with reduction of one cell line, two cell lines (bicytopenia) and all cell lines (pancytopenia). *Gloriosa superba* was traditionally used as an herbal therapy for the treatment of urinary and reproductive systems, respiratory, skin diseases, cardiovascular troubles and many other disorders (Maroyi and Van der Maesen, 2011). The use of these tubers and seeds in traditional medicine has caused numerous human deaths in tropical Africa, India (George, 2011; Aleem, 1992; Samanta and Kumar, 2005) and Sri Lanka (Fernando R. and Fernando D. 1990). Colchicine affects both central and peripheral nervous system. Confusion and delirium may develop either secondary to poor cerebral perfusion or as a result of direct cerebral toxicity (Fernando and Widyaratna. 1989). It may also cause convulsions, restlessness and coma. Angunawela and Fernando (1971) reported that a non fatal case of an 18 year old...
A girl who had eaten raw tubers of *Gloriosa superba* developed absence of tendon and plantar reflexes and anaesthesia to pain and touch over both lower limbs after 6 hrs of the ingestion, compatible with acute ascending polyneuropathy. Delayed encephalopathy after ingestion of *Gloriosa* tubers was also documented (Gooneratne et al. 2013). We encountered 5 patients with confusion and 2 patients with convulsions in our study. A 23 year old girl developed generalized tonic-clonic convulsions on day 7 of ingestion of 2 tubers of ‘Niyagala’ with 36 tablets of paracetamol. She had 2 episodes of fits which responded to IV diazepam and IV phenytoin sodium. Other patient was a 19 year old boy who developed generalized tonic-clonic fits on day 5 of four tubers of ‘Niyagala’ ingestion. Both patients had alopecia and got completely recovered. There were 3 patients (9%) with respiratory failure who all died due to *Gloriosa* poisoning. Respiratory failure is due to the paralysis of intercostal muscles rather than the direct depression of the respiratory centre by colchicines (Angunawela and Fernando, 1971). Colchicine induced AKI found in 2 (6%) in the study, is probably secondary to excess fluid loss or hypovolaemia and was preceded by oliguria and haematuria. Colchicine may exert direct hepatic toxicity with moderate cytolysis and this may reduce the production of clotting factors. Thus bleeding tendencies may occur associated with high prothrombin time (PT) /international normalized ratio (INR). There were patients presented with malena, hematemesis, per rectal bleeding and haematuria following *Gloriosa* poisoning. Bleeding per vagina has previously been reported (Angunawela and Fernando, 1971).

5. Conclusion

The commonest clinical manifestation of ‘Niyagala’ poisoning is the acute gastroenteritis. Poisoning affects gastrointestinal tract, heart, lungs, kidneys, brain, liver and haemopoietic system. Ischaemic changes and heart failure may occur in addition to cardiac arrhythmias following *Gloriosa superba* poisoning.

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