A brief review on toxicity of Abrus precatorius in animals

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Abstract

Although ornamental for humans, Abrus precatorius is not so when it comes to livestock. Plant bears feather like leaves with active ingredient concentrate in the seed mostly. Poisoning in both humans and animals are common due to the attractive appearance of the seed, shiny red color with black eye at the top. Malicious poisoning in cattle is very frequently encountered; the effected animal shows local signs of poisoning as necrosed lesions on the stabbed site. Crushed seeds when consumed, exhibits series of digestive disturbances viz. diarrhea, vomition (in capable species) and severe dehydration to name a few. Nevertheless, the seed when taken orally also imparts to systemic toxicities with signs such as drowyness, staggering gait, coma, convulsion and death in severe cases. Line of treatment is based on the symptoms observed.

Keywords: Abrus precatorius, seeds, livestock, cattle, poisoning

1. Introduction

Abrus precatorius, commonly known as Rosary Pea, is an ornamental plant native to India. The plant inhabits in subtropical climate. When supported by external source these plants reach a height of 10–20 ft. It bears alternate, compound, feather-like leaves, with small oblong leaflets while the flowers are numerous and appear in the leaf axils along the stems [1]. The flowers are also small and occur in clusters 1–3 inches long, usually red to purple, or occasionally white. The fruit is a legume about 3 cm long containing hard ovoid seeds about 1 cm long [2] (Fig. 1). The plant contains a toxic ingredient, abrin which is composed of two chains. Chain A is responsible for halting protein synthesis by inhibiting the normal functioning of ribosome while chain B facilitates entry of chain A inside the target cell. The A-chain attacks the 60S subunit of the ribosome and by cutting out elongation factor EF2, stops protein synthesis. It has been reported that upto 1500 ribosomes are inactivated by a single molecule of abrin. The toxicity signs of abrin is quite similar to ricin (toxic ingredient in Ricinus communis) however the former being the more toxic (fatal dose of abrin is 1/75th of ricin) [3]. The toxic entity lies in the oval shaped seeds. Poisoning in humans is common as children get attracted to the bright red color seeds with a black eye at the top (hilus). Whole intact seeds when ingested it passes through the Gastrointestinal tract without absorption resulting in no toxicity. It is quite interesting to note that the seed in some pocket areas of India is used to make necklace by passing thread through the seeds (making a hole) and the necklace seeds are unintentionally swallowed by children while playing. Since the seed is not intact as it has been perforated, gut enzymes react with the seed resulting in toxicity. Moreover, Biting of seeds by infants when used by mothers as ornaments frequently leads to accidental poisoning. Toxicity is characterized by nausea, vomition and convulsion1. Death may occur in severe case when unattained. This review briefly describes the toxicity profile of Abrus precatorius with clinical signs and possible line of treatment.

2. Local use of Abrus precatorius in India

Dry leaves when made into hydro extract can be used to treat eye diseases [5]. Hot water extract of roots is used to stimulate menstrual flow. Seeds extract is used as an abortifacient [6] and counter conception. Vaginal poultice prepared from seeds in Ayurvedic and Unani medicine is used as an abortifacient [7]. Seeds are used as an aphrodisiac in Ayurvedic system of medicine [8]. Many reporters also claimed that the toxic entity in the seed can be destroyed by boiling. Reports claimed that one single seed when opsonised with jaggary (gur) is consumed during the menstrual cycle prevents conception for one year [9].
Libido is enhanced by consuming the hot water extract of dried seeds orally in Unani medicine. Leaves extract when administered intravaginally induce abortion [10].

Source: www.ecrater.com

Fig 1: Abrus precatorius leaves, flowers and seeds.

3. Toxicity
Among livestocks cattle are prone to become victims when left for grazing in open field dominated by Abrus precatorius. The poisoning of cattle with Abrus is of interest owing to the fact that it is one of the means employed for the malicious destruction of cattle; in India [11], Low caste people in the community who deal with skins of animals for their livelihood actively take part in such malicious poisoning practices [12].

The seeds are crushed and mixed with water to make a paste. The paste is then shaped into needles of about one inch in length and is dried under sunlight until it becomes hard enough to be injected [13]. Cattle grazing in neighbour’s field are made to suffer as a means of grievance. The needles once injected initiates a series of reaction leading to Black Quarter like lesions and ultimately making the animal worthless.

The substance so prepared are called Sui or Sitari hence poisoning is very often referred by layman as Sui/Sutari poisoning. However reports stated that spikes thus prepared are less active than fresh prepared powdered [14].

4. Clinical signs of toxicity
Intact seeds when ingested by animal do not show any signs and symptoms as it is expelled wholly in excreta (dung). However, when the seeds are masticated and swallowed, poisoning is displayed as local as well as systemic signs.

4.1 Local effects: Affected animal shows dermatitis and conjunctivitis as local effects. Oral consumption can produce severe gastroenteritis accompanied with severe pain, constant vomiting, watery diarrhea which later on changes to bloody, thirst, followed by circulatory collapse. Gastroenteritis when lasts for prolonged period may even cause death of the animal [15].

4.2 Systemic effects: When injected locally, animal exhibits peculiar signs resembling to viper snake bite hence create confusion while diagnosing in most of the cases. The injured animal shows a series of inflammatory changes, with the site of injection turning edematous and hemorrhagic. The victim (animal/human) becomes drowsy, unable to move, and goes into coma; this is followed by convulsions and death. Reports suggested that abrin can lead to the development of cardiac arrhythmias, convulsions, and cerebral edema [16].

5. Diagnosis
Diagnosis is made based on the history of the animal by the owner or animal attendant and clinical signs observed.

6. Pathological findings
The pathological changes following crushed (masticated) seed intake leads to hemorrhagic gastroenteritis apart from fatty changes and necrosis of hepatocytes and renal tubules, pulmonary hemorrhages, edema, emphysema and erosions of abomasal and intestinal epithelium [17]. Local lesions in the injected area include necrosed and edematous muscle and the presence of petechial hemorrhages in visceral organs as well as throughout the body.

The signs and symptoms simulate viper snake bite resembling an accidental cause.

At the site of injection edema, inflammation and necrosis with oozing of blood stained fluid occurs. The animal loses its power of movement and is even unable to stand, becomes drowsy and apathetic, does not like taking food and water, followed by tetanic convulsion. It becomes comatose and dies by 3 to 4 days [18].

7. Line of treatment in cattle
Due to the open field grazing of cattle in a country like ours, amongst all, poisoning of Abrus precatorius is commonly observed in cattle hence line of treatment is restricted to the said species only.

Remove the animal from the poisoning site to prevent further ingestion.

Saline purgative (viz. magnesium sulphate) at the rate of 100-200 g should be administered. Saline purgatives are poorly absorbed osmotic preparations that result in the secretion of water in the intestines to maintain isotonicity with plasma [19]. Magnesium sulfate exerts its purgative effect due to local action in the intestinal tract, it is also possible that released hormones such as cholecystokinin or activation of constitutive nitric oxide synthase [20] may contribute to this pharmacological effect.

Activated charcoal at the rate 250-500 g should be administered preferably as a suspension in water several minutes to 24 hrs after ingestion [21]. It can also be used as an important ingredient of Universal antidote in combination with kaolin, tannic acid and magnesium oxide. (Vegetable charcoal 10 g, Magnesium oxide 5 g, Kaolin 5 g and tannic acid 5 g) [22]

Alkalinity of urine is to be maintained to facilitate excretion of absorbed toxins by infusing sodium bicarbonate as 1.4% solution 3 ml per 24 hours intravenously. When suspended in water agents such as sodium bicarbonate and sodium citrate react to produce hydroxide ions, which are basic anions capable of accepting and neutralizing protons like hydrogen ions [23].

In case of sui injection, the local area is to be properly cleaned or fragments of the spike is dissected out as soon as possible. Anti-abrin serum should be used as an antidote. Calcium gluconate can be given to combat tetany. Circulation is to be maintained and symptomatic treatment as required.

8. Conclusion
Abras precatorius is an ornamental plant native to subtropical climatic zone. The ubiquitous nature of the plant is
responsible for poisoning in livestock (mainly cattle) owning to their open grazing habit. Toxicity may occur following topical injection in the muscles of the limbs as a means of grievance in rural India. The injected lesion shows a series of inflammatory response which resembles snake bite due to viperine species. The lesion overtime spreads further associated with edematous swelling and necrotizing myositis resembling black quarter like lesion. Masticated seeds on oral ingestion results in gastroenteritis and hemorrhagic gastritis. Prompt diagnosis and specific treatment (Ant- amin Serum) must be advocated whenever available to save the animal. Besides, line of treatment depends on the symptoms observed which includes purgatives to hasten elimination of toxin in the GIT, activated charcoal to prevent further absorption of toxicant from the GIT and keeping pH of the urine towards basic to abolish tubular reabsorption and to increase rate of toxin elimination. Delay in treatment and unattained cases may lead to loss of animal, partially or completely.

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10. References