



Angel's Trumpet: A Toxic Beauty!

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Abstract

This review provides a medically focused overview of the angel's trumpet and its associated uses and hazards. Under the guise of a decorative ornamental plant, the angel's trumpet is present in numerous gardens worldwide. Due to ignorance of the high content of the toxin's scopolamine, hyoscyamine and atropine (tropane alkaloids) contained, intoxications quickly occur. It is also increasingly gaining importance as a drug and intoxicant as well as a supposed therapeutic agent. Often misjudged in everyday clinical practice, a high degree of obsolete apparative diagnostics is carried out in the case of insufficient anamnesis. The reduction of information gaps and professional sensitisation should enable better handling of the plant and its toxidrome.

Keywords: Angel's Trumpet; Brugmansia; Datura; Intoxication**Abbreviations:** AT: Angel's Trumpet.

Introduction

The angel's trumpet AT (*Brugmansia* sp., originally: *Datura* sp.) is a widespread ornamental plant in Western Europe, the south-eastern USA, Australia and Asia, originating in South America [1]. It belongs to the nightshade family and is characterised by a bushy growth pattern with a height of up to 5 metres. The ovate leaves are alternate and have a wavy edge. Its eponymous large, calyx-like flowers are striking [2]. As its high content of tropane alkaloids - especially scopolamine, hyoscyamine and atropine - is largely unknown, it is mostly found as a decorative and supposedly harmless ornamental plant. The toxins are contained in all parts of the plant, especially in the roots and seeds. Some species are additionally covered with toxin-containing trichomes (=glandular hairs: fur-like hairiness) [3].

Due to the competitive antagonism at the acetylcholine receptor, it develops parasympatholytic symptoms up to anticholinergic syndrome. Toxidrome manifests itself in very different forms and depending on the toxin dose, whereby even small amounts can cause pronounced symptoms. There is a broad spectrum of symptoms ranging from general agitation, vomiting, constipation, hot-dry skin, facial flushing, mydriasis and urinary retention to

tachycardia, hypertension and seizures [4]. In addition, intensively paralysing and hallucinatory effects as well as strong aggressive behaviour may occur [1,5]. The same applies to the very related jimson weed (*Datura* sp.) [6]. Its use as a supposed remedy and intoxicant is becoming increasingly important. In the following, the various areas of use and danger will be considered, and attention will be drawn to the high risk of intoxication due to ignorance. Thereby, there is the possibility to reduce information gaps and to sensitise oneself for the dangers and possible occurring symptoms to be able to recognise intoxication faster and to treat it better in the future. Potential sources of danger can thus be addressed in a preventive manner and patients can be adequately advised.

Discussion

Types of use & poisoning

Most poisoning incidents are caused by improper handling when cutting and caring for the plant. Witten et al. were able to show that, due to the toxin-containing glandular hairs described above, mere skin contact can cause symptoms of poisoning [7]. Intoxication is particularly common in children and adolescents. Due to the high distribution area and the unrestricted access in

most gardens, there is an increased risk for these age groups to come into contact with the plant unsupervised and possibly even to ingest plant parts. Andreola et al. describe the presentation of an 11-year-old girl after contact with AT in the paediatric emergency department with visual impairment and unilateral mydriasis (8mm). Examination revealed no neurological abnormalities [3]. In another case a 5-year-old boy presented to the paediatric emergency department with fever, dysarthria and increasing clouding of consciousness. In addition to erythema on the body and face, there was nausea and vomiting followed by hallucinations & dizziness. Comprehensive laboratory examination and imaging were unremarkable, and the condition improved spontaneously after 48 hours under inpatient control. The boy had eaten seeds and flowers of AT in the neighbour's garden [8]. Witten and Di Rocco report a 14-year-old girl also with unilateral mydriasis, visual impairment and headache without other neurological symptoms. After extensive interdisciplinary diagnostics including MRI without findings, local intoxication by AT could also be proven after a new anamnesis [7]. In the case of a 53-year-old woman, unilateral mydriasis, tachycardia and palpitations presented after contact with AT during gardening. Extensive diagnostics were performed under suspicion of a neuro-ophthalmological disease [9]. Havelius and Asman observed domestic exposure to AT in 7 cases aged 36 to 83 years with mostly unilateral mydriasis and sometimes mild systemic symptoms. Neuro-ophthalmological examination and diagnosis were unremarkable in each case [10]. Numerous other cases describe the presentation of patients to the emergency department or ophthalmology with unilateral mydriasis and otherwise largely symptom-free. In each case, the extensive diagnostic work-up was unremarkable and not very conclusive [11-14]. In all cases, the mydriasis completely normalised in the course of 24 hours to one week. Lahdes et al. were able to demonstrate systemic absorption after ocular scopolamine intoxication in a placebo-controlled study. In this context, further physical symptoms may occur due to the very rapid systemic absorption at higher concentrations [15].

In one case, after self-instillation of plant sap for self-therapy due to ocular problems, the tropane alkaloids caused decreased vision, redness, lacrimation, photophobia and in the course conjunctival and circumcorneal congestion, corneal oedema, and folds in Descemet's membrane. With insufficient conservative therapy, keratoplasty was eventually required [16]. In addition, as described in the case of Kim et al, the flowers of the plant are used for decoration and as an ingredient in cooking. Here, especially the use as a garnish in gastronomy proves to be dangerous. Food contact sometimes leads to contamination by the toxins contained in the plant. As a result, a 64-year-old female patient was admitted to the emergency room with fluctuating degrees of confusion/delirium, disorientation, lack of attention and dysarthria. Physical symptoms were not found. She had used the flowers as decoration in the preparation of a traditional Korean dish. The symptoms improved spontaneously over the course of 10 hours [2].

Another increasingly growing area concerns substance abuse

as a drug due to hallucinogenic effects of the tropane alkaloids, primarily by scopolamine and hyoscyamine. Besides direct consumption and smoking of dried plant parts, preparation as tea is playing an increasingly important role. Göpel, Laufer & Marcus report three cases in adolescents. In two cases (16 & 17 years old), massive visual hallucinations, agitation, aggressiveness, and combativeness occurred after consumption of home-made tea from the flowers, so that treatment was only possible with difficulty and partly under fixation in the intensive care unit. Besides activated charcoal against further toxin absorption, haloperidol and diazepam were used for symptom control. The third patient (16 years) also showed visual hallucinations, extreme disorientation & agitation, but no aggression during treatment. The clinical and neurological examinations performed were unremarkable in each case. All patients had bilateral mydriasis for several days and retrograde amnesia from the time of ingestion. Most of the symptoms disappeared after 1-2 days. The motive for use was financial problems with the purchase of other drugs, and all of them had a history of drug use [1].

Furthermore, Nogue et al. describe in one case the unknowing consumption of scopolamine under the premise of cocaine consumption. In this case, the cocaine was adulterated with AT extracts [17]. Due to careless overdoses, serious intoxications with extensive side effects often occur. Here, in addition to the typical physical symptoms, very pronounced psychotic-hallucinatory symptoms (anxiety states, disorientation, hyperactivity, coordination disorders, coma) become apparent. In one case, the hallucinatory state led to self-induced genital and lingual mutilation with subsequent complete amnesia over this period [5]. Besides the preparation of teas, home-made 'moon flower' wine is also used. In the case of Smith et al., the patients were admitted to hospital after about 1.5 hours with symptoms of shortness of breath and weakness. Extreme concentrations of tropane alkaloids (especially scopolamine) could be detected in the secured wine samples, which illustrate the high levels within the plant and a possible potentiation during processing [18]. The detection of tropane alkaloids is possible by gas chromatography from urine or blood [6,18].

Particularly in the Asian region, a lively use of plant parts for therapy can be found in the context of traditional Chinese medicine due to the healing effects attributed to the ingredients. Doan et al. demonstrated with the evaluation of 203 cases of the Taiwan Poison Control Center how high the proportion (81%) of self-therapies without professional supervision is, sometimes with pronounced intoxications. Long-lasting mydriasis was accompanied by tachycardia, confusion, dry skin and mouth, and delirium. 36% of the cases were severe. If therapy with the antidote physostigmine is indicated, they were able to show a more rapid recovery of central nervous system toxicity in treated patients compared to non-treated patients [19].

Comparable anticholinergic symptoms have been demonstrated by self-induction of atropine to obtain a secondary gain of disease

in Munchausen's syndrome [20]. The same could be demonstrated by Wood et al. in the form of an induced mydriasis of a child in Munchausen's by proxy syndrome of the mother [21]. The possible use of plant components of AT as a natural source must be considered here. Detached from this, the tropane alkaloids have already been used therapeutically for a long time in the form of various therapeutic agents and areas of application in conventional medicine due to their anticholinergic effect and can also lead to comparable side effects there if used incorrectly. Examples include mydriatics in ophthalmology (Boro-Scopol®), antiemetics in the form of transdermal patches (Scopoderm TTS®) against motion sickness and spasmolytics in the form of N-butylscopolamine for spasmodic conditions of the gastrointestinal tract [22]. The tropane alkaloids have been used for a long time as therapeutic agents in various fields of application.

Conclusion

Under the guise of a decorative ornamental plant, angel's trumpet is found in many gardens around the world. People are often unaware of the high content of the toxin's scopolamine, hyoscyamine and atropine (tropane alkaloids). The possibilities of intoxication are manifold due to the high toxicity in all parts of the plant and the largely negligent handling of the plant. Children and young people are particularly at risk because of the unprotected access in many gardens. In addition, abused as a substitute drug and intoxicant and used as a supposed therapeutic agent, it is gaining in importance. Clinically, patients present with a variety of symptoms up to the full-blown anticholinergic syndrome due

to the muscarinic antagonistic effect. Most frequently, the first presentation is due to the presence of mostly unilateral mydriasis because of inoculation into the eye due to improper handling of the plant. Therefore, in view of acute neurological clinical pictures with unilateral mydriasis, intoxication with the angel's trumpet should be considered as a differential diagnosis. This shows that the patient's detailed anamnesis is essential and can save the sometimes comprehensive but obsolete diagnostic equipment.

The therapy of intoxication depends on the severity of the symptoms. In most cases, a purely symptomatic therapy regime is sufficient and the symptoms regress in the course of a week, depending on the dose. If acute oral intoxication is present, the use of activated charcoal can reduce further toxin absorption. In the case of pronounced systemic symptoms with a possible vital threat, intensive medical monitoring should be the priority in any case. The temporary use of antipsychotics such as haloperidol and benzodiazepines has been described for the control of possibly occurring strong aggression and delirium states. In severe cases, the use of the antidote physostigmine has been shown to have some effect in reducing neurological symptoms. First and foremost, education on the proper use of the plant should be provided. Adequate protective clothing for hands and eyes is particularly important to avoid accidental contamination. In view of the high-risk potential, especially for children, it is advisable to advise parents to ensure comprehensive access to AT in any case or better to refrain from cultivating this plant (Figure).

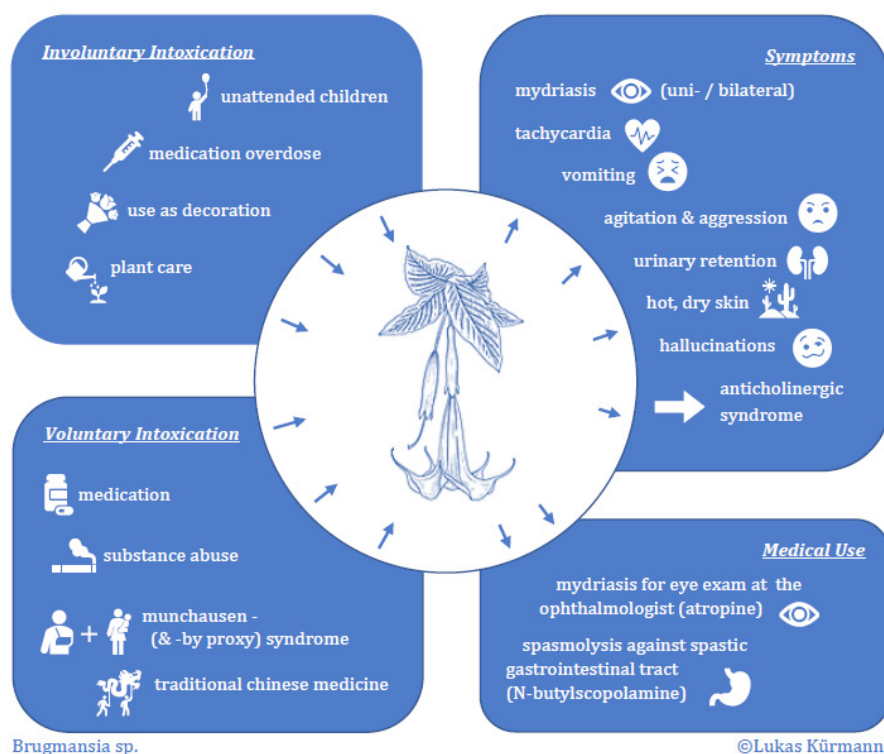


Figure:

This review shows the broad spectrum of different uses and dangers of AT and is intended to raise awareness in dealing with this plant. With a lack of knowledge and the numerous possibilities of intoxication as well as the abundance of presenting symptoms, recognition is difficult in everyday clinical practice. Nevertheless, it should be considered as a differential diagnosis, especially in the ophthalmological-neurological and emergency medical setting and can usually be established with the help of a detailed anamnesis, without the need for complex instrumental diagnostics. We hope that this review could close some information gaps and strengthen attentiveness in dealing with this plant.

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Conflict of interest

We certify that we have no financial affiliation/interest (eg, stock holdings, consultantships, honoraria) in the subject matter, materials, or products mentioned in this manuscript. None of the authors of this article have any conflict of interest to report, nor any interests represented with any products discussed or implied.

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