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Original Research Article

CLINICAL PROFILE, ECG CHANGES, AND OUTCOMES IN PATIENTS WITH OLEANDER SEED POISONING AT A TERTIARY CARE HOSPITAL

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Abstract

Background: Oleander plant is grown for its ornamental value across various parts of India. The components of Oleander seed are predominantly cardiac glycosides (thevetin A and B and neriifolin), which are toxic to cardiac muscle on ingestion of its seeds. Its toxicity is similar to that of digoxin overdose. This study aimed to study ECG changes and dys-electrolytemia, clinical profiles, outcomes, and sex differences in patients who ingested oleander seeds. **Materials and Methods:** This retrospective observational study included 214 patients with oleander seed poisoning treated at the Government Namakkal Medical College and Hospital between May and November 2023. Patient history, including seed consumption, arrival time, baseline ECG, and potassium level, was recorded after admission. Serial ECG monitoring was performed for 48 hours. **Result:** A significant difference was observed in the timing of heart block development between males (41.7% within 24h) and females (24.1%) ($p=0.029$). The occurrence of heart block was strongly associated with the number of seeds consumed ($p<0.0001$), with 100% of patients consuming > 11 seeds developing complete heart block. Consumption method significantly impacted outcomes ($p<0.0001$); swallowing seeds resulted in a 97.9% recovery rate, while crushed and juiced seeds had higher mortality rates (75%). Symptomatic management was more favourable in females (90.8%) than males (81.9%), though not statistically significant ($p=0.155$). **Conclusion:** The number and mode of consumption of oleander seeds significantly affected cardiotoxicity and outcomes, particularly those in the younger age group. Early recognition and continuous follow-up are crucial for better outcomes in patients ingesting oleander seeds.

INTRODUCTION

Worldwide, approximately 800,000 people commit suicide every year. Out of which around 1 lakh Indians commit suicide every year.[1] The most common age group involved as per 2012 national statistics is 15-44 with the southern states leading the list, males commit suicide twice as their female counterparts.[2] Common methods adopted for suicide: poisoning (33%), hanging (31%), and self-immolation (9%), according to 2012 statistics.[2] Oleander is an ornamental plant grown across the tropics and subtropics. The components of oleander seeds are predominantly cardiac glycosides (thevetin A and B and neriifolin), which are toxic to the cardiac muscle upon ingestion, and their toxicity is comparable to that of digoxin overdose.[3-5] More than 200 naturally occurring cardiac glycosides have been identified. The seed contains thevetin, which has one-eighth the potency of ouabain and mimics digitalis in action, thevetoxin is less toxic than thevetin; nerifolin is more potent than thevetin, peruvoside, and ruvoside; cerberin acts on the CNS; and produces tetanoid convulsions.[6]

These reversibly bind to the sodium (Na+)-potassium (K+)-adenosine triphosphatase (ATPase) pump on the cell membrane, resulting in increased intracellular sodium and decreased intracellular potassium levels. This causes elevated intracellular calcium in myocytes via the Na+ -calcium (Ca++)-exchanger. This cascade of events results in the depolarization of the cell.[7] Bradycardia and heart blocks are due to the vagotonic effects of cardiac glycoside by prolonging the refractory period in the atrioventricular (AV) node, shortening refractory periods in atria and ventricles, and decreasing resting membrane

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potential (increased excitability). Dysrhythmia, characterized by increased automaticity and depressed conduction, is suggestive of cardiac glycoside toxicity. The symptoms start within 2-3 hours of ingestion of the seeds.[6]

Oleander may irritate mucosal membranes, resulting in a burning sensation around the mouth and increased salivation. The gastrointestinal effects of oleander seed poisoning range from nausea and vomiting to cramping and bloody diarrhoea.8 Bradycardia and heart block are among the most frequently reported cardiac abnormalities. Various types of ventricular dysrhythmias and tachyarrhythmias have been described in the literature.[3-5,9-11] Patients may have a prolonged sinus rhythm before developing serious arrhythmias; therefore, all individuals should be monitored for at least 48 hours after ingesting seeds before being deemed fit for discharge.

Suicidal activity primarily affects the most economically productive population, taking a significant toll on families and country growth. Oleander toxicity resembles that of digoxin, and digoxin toxicity has been well studied and documented; therefore, early recognition and prompt treatment of oleander seed poisoning with our extensive knowledge of digoxin toxicity can prove to be a game changer. Namakkal consists of 8 taluks with 15 panchayat unions, 19 town panchayats, 322 village panchayats, and 5 municipalities. Namakkal is a semi-rural district with agricultural and agro-product production being the major source of income. However, extensive studies on oleander seed poisoning and its outcomes are lacking in this region. Such studies will help to reduce mortality rates through early recognition and prompt treatment.

Aim

This study aimed to study ECG changes and dyselectrolytemia, clinical profiles, outcomes, and sex differences in patients who ingested oleander seeds.

MATERIALS AND METHODS

This retrospective observational study included 214 patients with oleander seed poisoning admitted to the emergency department of the Government Namakkal Medical College and Hospital for 6 months from May 2023 and November 2023. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Patients aged ≥ 8 years with isolated oleander seed poisoning were included in the study.

Exclusion Criteria

Patients with a history of cardiac or renal problems were excluded from the study.

Methods

After admission, a detailed history was obtained regarding the time of consumption, number of seeds consumed, time of arrival to our hospital, baseline ECG, and serum potassium level. ECG was interpreted at presentation for changes, and if no changes were present, patients were followed for 48 hours with serial ECG monitoring. The time of consumption of the oleander seed and the time of first significant ECG change were noted. The serum potassium levels were measured at regular intervals. The patient was treated immediately at presentation according to the condition.

Statistical analysis

Data were collected, entered, and double-checked using a Microsoft Excel spreadsheet and was analysed using SPSS Statistics 19 for Windows (IBM Corp., Armonk, NY, USA). The results are presented as frequencies and percentages. Categorical data were compared using the chi-squared test. Statistical significance was set at p value <0.05.

RESULTS

Poisoning with oleander seed was more common in the age group of 21-30 (43.5%) and least common among those aged < 10 years and > 60 years (0.5%) and (2.3%) respectively. Of these patients, 59.3% were male and 40.7% were female. The consumption modes were as follows: direct swallowing of seeds (65.9%), eating crushed seeds (29.0%), juicing (2.8%), crushing and juicing (1.9%), and brewing (0.5%). Of the patients, 59.3 not had no ECG changes, 13.6% had only bradycardia, 9.3% had complete heart block, 7.9% had 1st-degree heart block, 7.9% had 2nd-degree heart block (including both Mobitz types 1 and 2), and 2% had non-specific ECG changes.

Among patients who experienced ECG changes after oleander seed poisoning, 64.4% were successfully cured with symptomatic management, while 23% required pacing for recovery. However, despite treatment efforts, 12.6% of patients did not survive. The serum potassium level was normal in 89.3% of patients, 7.5% had hyperkalemia, and 3.3% had hypokalemia. Most patients arrived at the ED within 6 h of oleander seed consumption (93.5%). ECG changes in 56 patients (64.4%) were cured with symptomatic treatment, 20 patients (23%) required temporary pacemakers, and 11 patients died (12.6%) despite treatment [Table 1].

Most female (68.8%) and male patients (53.5%) did not show any changes in ECG after oleander seed consumption, with no significant difference in the development of specific types of heart block or bradycardia between the sexes (p=0.302). A significant difference was observed between the time of heart block development and heart block in males within 24 h (41.7%) compared to females (24.1%) (p=0.029). There was no significant difference between male and female patients of potassium levels (p=0.726), with most patients maintaining normal potassium levels. The outcome of symptomatic management was slightly more favourable in females

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(90.8%) than in males (81.9%), however, this difference was not significant (p=0.155) [Table 2].

Patients who consumed < 5 seeds had a high rate of no ECG changes (62.9%). Among the patients who consumed 6-10 seeds, 36.8% developed a complete heart block, and 100% of those who consumed > 11 seeds developed a complete heart block. The occurrence of heart block was significantly associated with the number of seeds consumed (p<0.0001). The timing of ECG changes also correlated with seed consumption; all patients consuming > 11 seeds exhibited ECG changes within 24 h, whereas 63.4% of those consuming < 5 seeds showed no statistically significant changes (p=0.053).

Potassium levels remained within the normal range (3.5-5) for most patients, regardless of seed consumption, with no significant difference (p=0.90). However, hyperkalemia was observed in all patients who consumed more than 11 seeds. Patients who consumed < 5 seeds had a higher cure rate with symptomatic management (88.7%) than those consuming 10-11 seeds (57.9%). Mortality rates increased sharply with seed consumption, reaching 100% in those consuming > 11 seeds (p<0.0001) [Table 3].

Swallowing seeds directly resulted in the highest rate of no ECG changes (80.1%), whereas consuming crushed or juiced seeds led to higher incidences of complete heart block (21% and 83.3%, respectively). All patients who consumed brewed seeds experienced statistically significant ECG changes in their intake methods and modes of consumption (p<0.0001). The timing of ECG changes also varied significantly by consumption mode, with most patients who swallowed seeds not developing ECG changes (80.9%) and those consuming crushed or juiced seeds showing changes within 24 h (71% and 100%, respectively).

Potassium levels did not differ significantly based on consumption mode (p=0.856), with most patients having normal levels (3.5-5 mEq/L), although hyperkalemia (> 5 mEq/L) was observed, particularly in those consuming crushed seeds or a combination of crushing and juicing. The consumption mode significantly affected patient outcomes (p<0.0001), with swallowed seeds having the highest recovery rate with symptomatic management (97.9%), whereas crushed and juiced seeds resulted in significantly higher mortality rates (75%) despite treatment. Patients who consumed brewed seeds either fully recovered or died, and none of the patients required pacing for recovery [Table 4].

Table 1: Demographic details and clinical characteristics outcomes of patients.

		Frequency (%)
Age group (years)	< 10	1 (0.5%)
	21-30	93 (43.5%)
	> 60	5 (2.3%)
Gender	Male	127 (59.3%)
	Female	87 (40.7%)
Mode of consumption	Directly swallowing seed	141 (65.9%)
	Eating crushed seed	62 (29%)
	Juiced	6 (2.8%)
	Crushed and juiced	4 (1.9%)
	Brewed	1 (0.5%)
ECG findings	No ECG changes	127 (59.3%)
	Bradycardia	29 (13.6%)
	Complete heart block	20 (9.3%)
	1st-degree heart block	17 (7.9%)
	2nd-degree heart block	17 (7.9%)
	Non-specific ECG changes	4 (2%)
Serum potassium level	Normal	191 (89.3%)
	Hyperkalemia	16 (7.5%)
	Hypokalemia	7 (3.3%)
Time of arrival at ED	Within 6 hours	200 (93.5%)
	> 6 hours	14 (6.5%)
Outcomes for patients with ECG changes	Cured with symptomatic treatment	56 (64.4%)
	Needed temporary pacemakers	20 (23%)
	Died despite treatment	11 (12.6%)

Table 2: Comparison of type, development of heart block, potassium level and outcomes by sex in patients

		Sex		P-value
		Female	Male	
Type of heart block	No change	59 (68.80%)	68 (53.50%)	0.302
	1st degree AV block	7 (8.00%)	10 (7.90%)	
	2nd degree AV block	4 (4.60%)	13 (10.20%)	
	Complete heart block	6 (6.90%)	14 (11.00%)	
	Bradycardia	9 (10.30%)	20 (15.70%)	
	Non-specific ischemic changes	2 (2.30%)	2 (1.60%)	
Day of development of ECG changes	No changes	61 (70.10%)	68 (53.50%)	0.029
	Death within 24 h	21 (24.10%)	53 (41.70%)	
	Death after 24 h	5 (5.70%)	6 (4.70%)	

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Potassium (mEq/L)	< 3.5	3 (3.40%)	4 (3.10%)	0.726
	3.5-5	79 (90.80%)	112 (88.20%)	
	> 5	5 (5.70%)	11 (8.70%)	
Outcome	Cured with symptomatic management	79 (90.80%)	104 (81.90%)	0.155
	Need pacing for recovery	6 (6.9%)	14 (11%)	
	Death	2 (2.3%)	9 (7.1%)	

Table 3: Effects of number of seed consumption on type, development of heart block, potassium level and outcomes

		Number of seeds consumed			P-value
		< 5	6-10	> 11	
Type of heart block	No change	122 (62.90%)	5 (26.30%)	0	<0.0001
	1st degree AV block	15 (7.70%)	2 (10.50%)	0	
	2nd degree AV block	14 (7.20%)	3 (15.80%)	0	
	Complete heart block	12 (6.20%)	7 (36.80%)	1 (100%)	
	Bradycardia	27 (13.90%)	2 (10.50%)	0	
	Non-specific ischemic changes	4 (2.10%)	0	0	
Day of development of ECG changes	No changes in ECG	123 (63.40%)	6 (31.60%)	0	0.053
	ECG changes in 24 h	62 (32.00%)	11 (57.90%)	1 (100%)	
	ECG changes after 24 h	9 (4.60%)	2 (10.50%)	0	
Potassium (mEq/L)	< 3.5	7 (3.60%)	0	0	0.009
	3.5-5	174 (89.70%)	17 (89.50%)	0	
	> 5	13 (6.70%)	2 (10.50%)	1 (100%)	
Outcome	Cured with symptomatic management	172 (88.70%)	11 (57.90%)	0	<0.0001
	Need pacing for recovery	16 (8.20%)	4 (21.10%)	0	
	Death	6 (3.10%)	4 (21.10%)	1 (100%)	

Table 4: Effects of mode of seed consumption on type, development of heart block, potassium level and outcomes

		Mode of consumption					P-value
		Swallowed	Crushed	Juiced	Crushed and juiced	Brewed	
Type of heart block	No change	113 (80.10%)	14 (22.60%)	0	0	0	<0.0001
	1st degree AV block	7 (5.00%)	8 (12.90%)	0	1 (25.005%)	1 (100.00%)	
	2nd degree AV block	4 (2.80%)	11 (17.70%)	1 (16.70%)	1 (25.00%)	0	
	Complete heart block	0	13 (21.00%)	5 (83.30%)	2 (25.00%)	0	
	Bradycardia	15 (10.60%)	14 (22.60%)	0	0	0	
	Non-specific ischemic changes	2 (1.40%)	2 (3.20%)	0	0	0	
Day of development of ECG changes	No changes in ECG	114 (80.90%)	15 (24.20%)	0	0	0	<0.0001
	ECG changes within 24 hours	21 (14.90%)	44 (71.00%)	6 (100%)	3 (75.00%)	0	
	ECG changes after 24 hours	6 (4.30%)	3 (4.80%)	0	1 (25.00%)	1 (100.00%)	
Potassium (mEq/L)	< 3.5	4 (2.80%)	3 (4.80%)	0	0	0	0.856
	3.5-5	128 (90.80%)	53 (85.50%)	6 (100%)	3 (75.00%)	1 (100.00%)	
	> 5	9 (6.40%)	6 (9.70%)	0	1 (25.00%)	0	
Outcome	Cured with symptomatic management	138 (97.90%)	43 (69.40%)	0	1 (25.00%)	1 (1000%)	<0.0001
	Need pacing for recovery	3 (2.10%)	13 (21.00%)	4 (66.70%)	0	0	
	Death	0	6 (9.70%)	2 (33.30%)	3 (75.00%)	0	

DISCUSSION

In our study, oleander seed poisoning was more common in the age group of 21-30 (43.5%) and the least common among those aged < 10 years and > 60 years was 0.5% and 2.3%, respectively. Iyadurai et al. study comprised 30 patients aged 30.77±12.31 who presented at 12.29±8.48 hours after consumption of yellow oleander.12 Giridharan et al. the mean age of the patients was 29.2±9.88 years, ranging between 19 and 58 years. Most patients were between 18 and 30 years of age (65.0%), with a preponderance of females across all age groups.[13]

In our study, we found that the number of seeds consumed and the development of ECG changes were positively correlated (p<0.0001). The findings of Giridharan et al. showed a nonlinear correlation, contrary to Eddleston et al., where the incidence of cardiotoxicity did not increase proportionally with the number of consumed seeds.13,11 A similar correlation was reported by Anandhi et al. and Lokesh and Arunkumar in their studies.[14,15]

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The mortality rate in our study was 12.6%, when only patients with ECG changes were considered. Patient outcomes were not significantly correlated with sex (p=0.115). The overall mortality rate was 5.6%, which was higher than the 2.0% reported by Giridharan et al., and cardiotoxicity was the cause of death.[13]

In our study, 40.7% of the patients had cardiotoxicity comparable to that reported by Giridharan et al. and Anandhi et al. who had 48.0% and 42%, respectively.[13,14]

In our study, the mode of consumption had a positive correlation with the outcome of the patient's p>0.0001 which was like the outcome observed by Aparna et al. and Giridharan et al. with crushed, juiced, and brewed having worse outcomes when compared to other methods emphasising the intact seed swallowing having less severe outcomes.[13,16] Anandhi et al. had no significant correlation with the mode of consumption and cardiotoxicity.[14]

In our study, there was no positive correlation between time of arrival after consumption of seed and outcome (p=0.147), whereas Anandhi et al. found that the time delay between arrival and admission to the ED had a positive correlation with the development of serious arrhythmia, which might be because the mode of consumption is more important than the time of arrival after ingestion to the ED.[14]

CONCLUSION

Patients were in the younger age group, and nearly half of the patients had ECG changes and mortality, even with a treatment rate of 5.6%. As per the available literature, there have been studies that showed both linear and nonlinear correlations between the number of seeds consumed and the mode of consumption to the outcome among patients and cardiotoxicity. With a larger sample size, our study established that the number of seeds consumed and the mode of consumption play a crucial role in the development of cardiotoxicity and outcomes in patients with oleander seed ingestion. Early recognition and continuous follow-up are required for patients who ingest oleander seed for better outcomes.

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