Ain Shams Journal of Forensic Medicine and Clinical Toxicology
January 2022, 38: 57-67

A Triage for Disposition of Poisoned Patients with Cardiovascular Therapeutic Agents Presented to Poison Control Center of Ain Shams University Hospitals

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Abstract

Background: According to the 2016 annual report of the Poison Control Center of Ain Shams University Hospitals (PCC-ASUH), toxicity of cardiovascular drugs represented 7.8% of all intoxicated cases. There is a great variability in the disposition of the poisoned patients with cardiovascular therapeutic agents between poison control centers depending on triage guidelines, compliance to these guidelines and the current practice. **Objective:** To compare the triage for disposition of intoxicated patients with cardiovascular therapeutic agents in PCC-ASUH with the American Association of Poison Control Centers (AAPCC). **Methods:** This study was a comparative cross-sectional study. Patients were divided into; retrospective group in which disposition was based on PSS and local PCC protocols, and a prospective observational group using the AAPCC guidelines. **Results:** Eight hundreds and six patients were included. Retrospectively, (37.2%) of the studied patients were observed in ER then discharged, (36.7%) were admitted to ICU, (8.37%) were admitted to inpatient unit, and (17.73%) were referred to another toxicology center. Prospectively, most of poisoned cases (57.39%) observed in ER then discharged, (11.78%) of patients were admitted to ICU, (27.82%) were admitted to inpatient unit, and (3.01%) were referred to another toxicology center, with no apparent adverse effects during follow up. **Conclusion:** Application of the AAPCC triage method can reduce the unnecessary admissions of poisoned patients with cardiovascular therapeutic agents through increasing the percent of observed patients in ER and reducing ICU admissions and the need for referral to other health care facility.

Received in original form: 25 September 2021 Accepted in a final form: 30 November 2021

Key words Disposition, cardiovascular therapeutic agents, poison control center

Introduction

Intoxication with cardiovascular therapeutic agents is the second most common cause of death due to poisoning, accounting for more than 10% of all poisoning fatalities *(Cole., 2017).* The common cardiovascular drugs involved in acute intoxication are beta blockers (BBs), digitalis and calcium channel blockers (CCBs) *(Zeinvand et al., 2017).* According to the 2019 annual report of the PCC-ASUH, toxicity of cardiovascular drugs represented 6.7% of all poisoned cases *(Abdelhamid, 2021).*

Most of the cardiovascular therapeutic agents have narrow therapeutic indices so overdoses of these agents represent a challenge to physicians regarding patients' disposition, and the duration of observation. So, there is variability in the disposition of the poisoned patients between poison control centers *(Olson et al., 2005).* Deciding the observation period after suspected ingestion of cardiovascular therapeutic agents can be perplexing because most of these drugs are formulated as modified release products, so many poison control centers recommend a 24-hour admission for observation *(Wax et al., 2005).*

Disposition is the ultimate end point for all emergency departments visits (admission vs. discharge) *(Lee et al., 2020).* There is a great variability in the disposition of poisoned patients with cardiovascular therapeutic agents between poison control centers depending on the presence of triage guidelines, the compliance to these guidelines and the current poison control center practice *(Forrester, 2010).*

Aim of the Study

This study aimed at comparison of the triage method for disposition of the poisoned patients with cardiovascular therapeutic agents in the PCC-ASUH with the American Association of Poison Control Centres guidelines to improve the health care outcome

Patients and Methods

The current study was a comparative cross-sectional study. The study involved all patients presented to the PCC-ASUH with a history of acute intoxication after ingestion of cardiovascular therapeutic agents, in the period from January till December 2019. Exclusion

criteria included chronic poisoning and co-ingestion of multi cardio-depressant drugs.

The study involved two groups:

1. *Group A* (retrospective group) in which the data of 406 patient acutely poisoned with cardiovascular therapeutic agents had been collected from electronic database and medical records of PCC-ASUH in a 7-month period from 1/1/2019 to 31/7/2019. The study variables included demographic and clinical data (age, gender, underlying cardiovascular disease, and currently on cardio-depressant drug); drug ingestion data (type of the ingested drug, the ingested dose, experiencing manifestations); management and outcome data (delay time, disposition place, abnormal investigations, requirement of treatment, and outcome). Poisoning Severity Score was used to grade the severity of poisoning as regards the patient's manifestations (Persson et al., 1998).
   The decision regarding patients' disposition was based on PSS and local management protocols that recommended admission of all symptomatic patients poisoned by cardiovascular therapeutic agents to the ICU for close monitoring *(El Masry & Azab, 2013).*
2. *Group B* (prospective observational group) in which the data of 399 acutely poisoned patient with cardiovascular therapeutic agents had been collected in a 5-month period, from 1/8/2019 to 31/12/2019. Assessment of patients was done using The American Association of Poison Control Centres Guidelines.

Factors determining triage according to AAPCC *(Wax et al., 2005; Olson et al., 2005)*

1) Is suicidal intention suspected?
2) Is the patient symptomatic?
3) Delay time: Has more than
   - BBs: more than 6 h (IR), 8 h (SR), 12 h (sotalol) passed since ingestion?
   - CCBs: more than 6 h (IR), 18 h (MR other than verapamil), 24 h (MR verapamil) passed since ingestion?
   - ACEI & ARBS & Diuretics& Nitrates: more than 6 h passed since ingestion?
4) Does the Patient have cardiovascular disease? (e.g., ischemic heart disease, arrhythmia, HOCM)

or Patient taking another cardio-depressant drug? (e.g., BBs, CCBs, Digoxin, anti-arrhythmic drugs).

5) Is the home situation of concern? (e.g., patient lives alone, available reliable caregiver).
6) Unable to estimate the maximum ingested amount?
7) Maximum total ingested dose exceeds the threshold dose proposed by AAPCC.

- IR: immediate release; SR: slow release; MR: modified release: HOCM: hypertrophic obstructive cardiomyopathy
- If all answers are "NO": patients are considered in the low-risk group
- If any one of answers are "YES": patients are considered in high-risk group

Toxic doses as proposed by AAPCC

1. Beta Blockers (BB) toxic dose *(Wax et al., 2005).*

Drug	Threshold dose	
	Adult	Child
Acebutolol	>600 mg	>12 mg/kg
Atenolol	>200 mg	>2 mg/kg
Bisoprolol	>20 mg	No safe dose
Carvedilol	>50 mg	>0.5 mg/kg
Labetalol	>400 mg	>20 mg/kg
Metoprolol	>450 mg (IR)	>2.5 mg/kg (IR)
	>400 mg (SR)	>5 mg/kg (SR)
Nadolol	>320 mg	>2.5 mg/kg
Propranolol	>240 mg	>4 mg/kg (IR)
	>5 mg/kg (SR)	
Sotalol	>160 mg	>4 mg/kg
Timolol	>30 mg tabs	No safe dose

2. Calcium Channel Blockers (CCB) toxic doses *(Olson et al., 2005)*

Drug	Threshold dose	
	Adult	Child
Amlodipine	>10mg	>0.3mg/kg
Bepridil	>300mg	Any amount
Diltiazem	>120 mg (IR)	>1 mg/kg
	>360 mg (SR)	
Felodipine	>10 mg	>0.3 mg/kg
Isradipine	>20 mg	>0.1 mg/kg
Nicardipine	>40 mg (IR)	Any amount
	>60mg (SR)	
Nifedipine	>30 mg (IR)	Any amount
	>120 mg (SR)	
Nimodipine	>60 mg	Any amount
Verapamil	>120 mg (IR)	>2.5 mg/kg
	>480 mg SR	

3. Digoxin: 1 mg in a child or 3 mg of digoxin in an adult can result in serum concentrations well above the therapeutic range *(Olson et al., 2017)* [a]
4. Anti-hypertensive drugs include: diuretics, vasodilators, ACEI (angiotensin converting enzyme inhibitors), ARBs (angiotensin II receptor blockers)

- Diuretics toxic doses *(Liang et al., 2017).*

Drug	Threshold dose(mg)
Acetazolamide	>1000
Dichlorphenamide	>200
Methazolamide	>300
Bumetanide	>2
Ethacrynic acid	>200
Furosemide	>600
Torsemide	>200
Amiloride	>20
Spironolactone	>400
Triamterene	>300
Eplerenone	>100
Trichlormethiazide	>4
Bendroflumethiazide	>20
Chlorothiazide	>2000
Chlorthalidone	>200
Cyclothiazide	>6
Flumethiazide	>2000
Hydrochlorothiazide	>200
Hydroflumethiazide	>200
Indapamide	>10
Methyclothiazide	>10
Metolazone	>20
Polythiazide	>4
Quinethazone	>200

- Nitrates: the estimated adult lethal oral dose of nitroglycerin is 200-1200 mg. Hypotension occurs at low doses, but massive doses are required to produce methemoglobinemia *(Olson et al., 2017)*[b].

According to the AAPCC guidelines group B patients were further divided into two groups: low-risk and high-risk groups. For the high-risk group, admissions either to ICU or inpatient unit were recommended according to the ICU admission criteria (e.g., second- or third-degree heart block, cardiogenic shock, increasing metabolic acidosis, respiratory depression, emergency intubation, seizures, disturbed consciousness, Glasgow Coma Scale score <12, need for ECMO, hypokalemia secondary to digitalis overdose, and need for digoxin immune antibody Fab fragments) *(Schwarz, 2017).*

The low-risk groups were discharged. However, those patients were advised to visit PCC-ASUH Clinic as soon as possible, if they showed any symptoms *(Watts et al., 2004).*

Sample size calculation: The group sample sizes of at least 393 cases per group achieve 80% power to reject the null hypothesis of zero effect size when the population effect size is 0.20 and the significance level (alpha) is 0.050 using a two-sided z test.

Ethical considerations

The study was carried out after approval of Faculty of Medicine Ain Shams University Research Ethics Committee (FMASU- REC), as well as the director of the PCC-ASUH. Confidentiality of data was maintained through anonymous collection of data from electronic database and medical records and used only for the purpose of demographic analysis.

Results

The current study was conducted on 808 patients out of a total of 1405 patients admitted to the PCC-ASUH in 2019. The retrospective and prospective groups included 406 and 399 patients respectively.

The mean age of all patients was (20.6 ± 13.8) years old, with the majority of presented patients (82%) as females, and about (1.2%) were already on various cardiac disease treatment.

In group A about 52.22% of patients have ingested toxic dose, but only (11.33%) experienced clinical manifestations. While in group B (44.11%) of patients have ingested toxic dose, but only (5.51%) experienced manifestations.

Beta Blockers was the most common drugs presented by intoxication, followed by anti-hypertensives, digoxin and CCBs with a significant difference between each group in relation to the total number of studied patients (table 1).

Based on PSS application, group (A) patients presented with no clinically significant symptoms. Antihypertensive toxic doses showed no clinically significant effect in all cases, and mild symptoms were mostly related to BB ingestion (62.5%). Moderate severity presentation was mainly due to ingestions of digoxin (72.92%). Severity and fatality were observed among patients who ingested CCBs (8.7%). All grades of severity showed significant difference between each grade in relation to the total number of patients (table 2).

As regards the PSS system and its effect on patients' triaging and outcome it showed a highly significant difference between each grade and the disposition of patient in relation to the total number of studied cases (table 3).

As regards the differentiating value of each of the fore mentioned triage systems and their effect on patients' outcome; ROC curve analysis was done for both tools to test their ability for the prediction of cardiotoxicity. PSS for BB, CCB, and antihypertensive drugs showed non-significant predictive values in discrimination of patients with cardiotoxicity from those patients without ($p > 0.05$). PSS for Digoxin predicted patients with cardiotoxicity, with good (85%) accuracy, 72% sensitivity and 97.5% specificity ($p < 0.01$) (figure 1).

On the other hand, ROC-curve analysis of AAPCCs Guidelines showed excellent (93%) predictive ability of cardiotoxicity, with 99.4% sensitivity and 87.6% specificity ($p < 0.01$). The value of sensitivity, specificity, positive predictive value, and negative predictive value were calculated as 99.4%, 87.6%, 86%, 99.5% respectively (figure2).

In group A, (37.20%) of patients were observed in the ER then discharged to home, (36.70%) of patients admitted to ICU, (17.73%) referred to another toxicology center, and (8.37%) admitted to inpatient unit, and (0.49%) mortality (table 4).

While in group B, (57.39% of patients were observed in the ER then discharged to home, (27.82%) admitted to inpatient unit, (11.78%) of patients admitted to ICU, and (3.01%) referred to another toxicology center, with (1.5%) of patients had

abnormal investigations, (1.75%) required treatment and no mortality was noticed.

Comparing the results of both groups (A &B) to determine the effect on patient disposition and outcome for each drug ingested. Tables 4&5 revealed a highly significant decrease in ICU admission in patients who ingested BB, CCBs and digoxin, with a high significant increase in ER observation and inpatient admission especially in patients who ingested BB and a highly significant increase in inpatient admission in patients who ingested CCBs (P value <0.0001).

Table (1): Chi square statistical analysis comparing group A (retrospective) & group B (prospective) as regards cardiovascular drug ingestion data

Variables		Total (n=805)		Group A (n=406)		P value	Group B (n=399)		P value
		N	%	N	%		N	%	
Toxic dose		404	50.19	212	52.22	<0.001**	176	44.11	<0.001**
Clinical manifestations of toxicity		66	8.45	46	11.33	<0.001**	22	5.51	<0.001**
Type of drug	antihypertensive drugs	227	28.2	95	23.4	<0.001**	132	33.08	<0.001**
	β-blockers	441	54.8	240	59.11	0.001**	201	50.38	<0.001**
	calcium channel blockers	68	8.4	23	5.67	0.015*	45	11.28	<0.001**
	Digoxin	69	8.6	48	11.82	<0.001**	21	5.26	<0.001**

*N: number of patients; *P ≤0.05 =statistically significant, **P≤0.001 =highly significant*

Table 2: Chi square statistical analysis showing grading of the severity of clinical manifestations in group A (retrospective) using PSS in relation to the type of ingested drug:

Type of drug ingested	Grading of severity of clinical manifestations										Total	P value
	None		Mild		Moderate		Severe		Fatal			
	0		1		2		3		4			
	N	%	N	%	N	%	N	%	N	%		
β-blockers	150	62.5	84	35	5	2.08	1	0.42	0		240	<0.001**
Calcium channel blockers	3	13.04	6	26.08	10	43.48	2	8.7	2	8.75	23	
Digoxin	3	6.25	9	18.75	35	72.92	1	2.08	0		48	
Antihypertensive drugs	95	100	0		0		0		0		95	

**P ≤0.05 =statistically significant, **P≤0.001 =highly significant*

Table 3: Chi square statistical analysis showing the use of PSS as a method of patient disposition in group A (retrospective):

Grading of severity of clinical manifestations	Disposition place				
	Observation	Inpatient	ICU	Total	P Value
None	151	12	88	251	<0.001**
Mild	4	18	77	99	<0.001**
Moderate	0	0	50	50	<0.001**
Severe	0	0	4	4	<0.001**
Fatal	0	0	2	2	<0.001**

**P ≤0.05 =statistically significant, **P≤0.001 =highly significant*

Table 4: Chi Square statistical analysis comparing between group A (retrospective) and group B (prospective) as regards; delay time, patients' disposition place and mortality rate:

Variables		Total (n=805)		GroupA (n=406)		Group B (n=399)		P Value
		N	%	N	%	N	%	
Delay time (In hours)		2(2-4)		2(2-4)		2(2-4)		<0.001**
Disposition place	ICU admission	196	24.35	149	36.7	47	11.78	<0.001**
	Inpatient admission	145	18	34	8.37	111	27.82	
	Observation and discharge	380	47.21	151	37.20	229	57.39	
	Referral	84	10.44	72	17.73	12	3.01	
Mortality rate		2	0.25	2	0.49	0	0.00	0.019*

*N: number of patients; *P ≤0.05 =statistically significant, **P≤0.001 =highly significant*

Table 5: Chi Square statistical analysis comparing patients' disposition place in relation to the type of drug ingested in both group A (retrospective) & group B (prospective):

Type of drug ingested	Disposition place	Group A (n=240)		Group B (n=201)		P value
		N	%	N	%	
β-blockers	ICU	99	41.25	24	11.94	<0.0001**
	Inpatient	34	14.16	82	40.79	
	Observation & discharge	50	20.8	92	45.77	
	Referral	57	23.75	3	1.49	
Calcium channel blockers	ICU	14	60.86	8	17.77	<0.0001**
	Inpatient	0	0	29	64.44	
	Observation & discharge	3	13.04	2	4.44	
	Referral	6	26.08	6	13.33	
Digoxin	ICU	36	75	15	71.42	0.001**
	Inpatient	0		0		
	Observation & discharge	3	6.25	3	14.28	
	Referral	9	18.75	3	14.28	
Anti hypertensive drugs	ICU	0		0		<0.0001**
	Inpatient	0		0		
	Observation & discharge	95	100	132		
	Referral	0		0		

*N: number of patients; *P ≤0.05 =statistically significant, **P≤0.001 =highly significant*

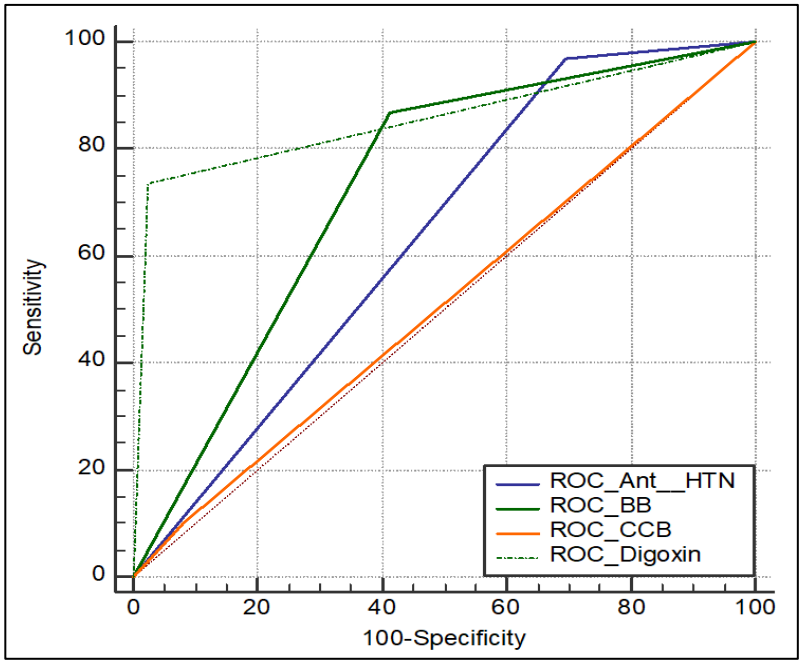

Figure (1): ROC curve analysis of PSS to predict cardiotoxicity of ingested drugs

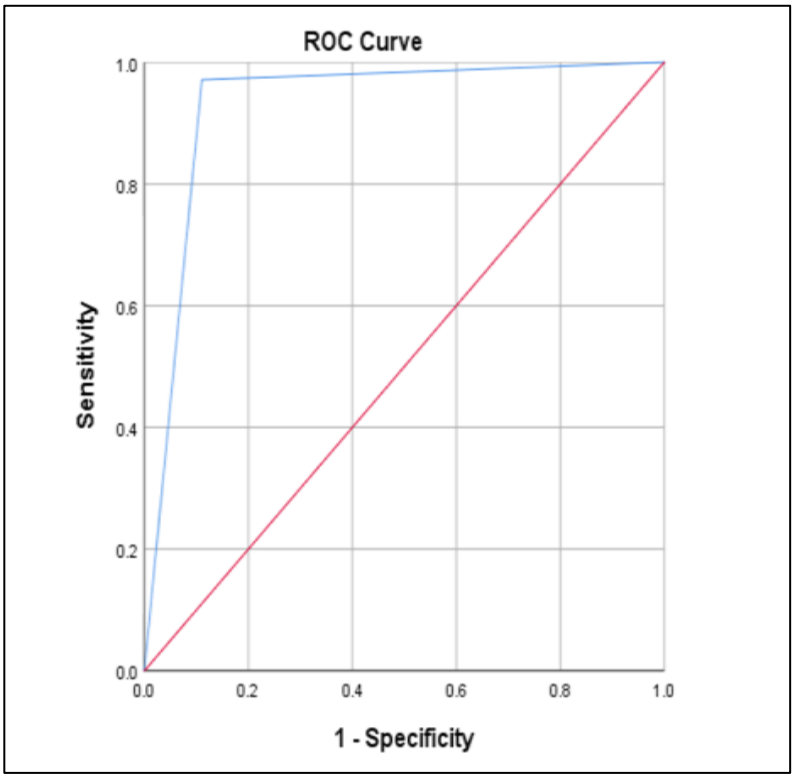

Figure (2): ROC curve analysis of AAPCC guidelines to predict cardiotoxicity of ingested drugs

Discussion

The whole purpose was to throw light on the implementation of different triage systems on poisoned patients with cardiovascular therapeutic agents to assess their effect on outcome and disposition especially as regards ICU admission. Local protocol of PCC-ASUH and the PSS were applied on group A while AAPCC protocols were applied on group B. This might tickle the fact of rarity of ICU beds and could help solve such an economic burden.

The triage system was first implemented in hospitals in 1964 when Weinerman published a systematic interpretation of civilian emergency departments using triage *(Robertson-Steel, 2006).* Triage systems acquired their importance by identifying patients needing immediate resuscitation; thereby prioritizing their care and initiating diagnostic & therapeutic measures as appropriate *(Brouns et al., 2019).*

Poison Severity Score gained its importance for being a standardized scale for severity grading of poisoning, allowing qualitative evaluation of morbidity and risks due to poisoning**.** It is used for classification of acute poisonings regardless of the type and number of agents involved both in adults and children. The PSS has several subjective criteria, is time consuming to score, and is likely to be of little use with some types of poisonings, limiting its clinical utility *(Schwarz et al., 2017).*

According to AAPCC, patients with moderate or major clinical effects are more likely to require ICU admissions. Moderate effect is defined as signs or symptoms following exposure that are more pronounced, more prolonged, or more systemic in nature than minor symptoms. Examples include disorientation, hypotension responsive to treatment, isolated brief seizures, and acid base disturbances. While the major effect is defined as signs or symptoms that are life-threatening or resulted in significant residual disability or disfigurement. Examples include repeated seizures or status epilepticus, respiratory compromise requiring intubation, ventricular tachycardia, hypotension, cardiac or respiratory arrest *(Schwarz, 2017).*

The current study showed that most of poisoned patients were females in the age group 20.6±13.8 yrs. This agrees with Vijayakumar (2015) who explained this by the high prevalence of depressive disorders in females in this age group. Also, Zeinvand et al. (2017) attributed this to various causes such as lack of social support, unemployment, and economic instability. This was in contrast to Ramesha (2009) and Anthony and Kulkarni (2012) who stated that males outnumbered females in India. While according to studies in Saudi Arabia, males and females were both affected similarly *(Al-Barraq & Farahat, 2011; Jalali A et al., 2012).*

Suicidal attempts occurred in 60% of the studied patients. Similar results were noted by Arıkan et al. (2014) in Turkey, Adinew et al. (2017) in Ethiopia, and Bamathy et al. (2017) in India. These results are in contrast to the 2019 annual report of AAPCC which noted suicidal poisoning in 18.9% of cases only, because the majority of intoxicated patients were children ***(Gummin et al., 2020).***

The current study revealed that beta blockers toxicity was the commonest cardiovascular drug toxicity (54.8%) followed by antihypertensive drugs (28.2%), digoxin (8.6%) and calcium channel blockers (8.4%), This study was in accordance with Hussien et al. (2018), and previous PCC-ASUHs annual reports *(El Masry & Tawfik, 2013; Tawfik & ElHelaly, 2015; Tawfik & Khalifa 2017).* This could be explained by the wide spread of BB among Egyptian population as it is used in the treatment of hypertension, tachyarrhythmia, heart failure, angina pectoris, migraine headache, anxiety, glaucoma, tremors, hyperthyroidism, and other various disorders.

In contrast to our study, Ayhana et al. (2015) in a study conducted in Turkey reported that digitalis toxicity is the most common cardiovascular drug toxicity. While Brusin et al. (2016) found that calcium channel blockers toxicity was the commonest cardiovascular drug toxicity among the studied patients in Russia reflecting the widespread use of these drugs in his country for treatment of hypertension.

This study showed that the delay time of presentation 2-4 hours. Early presentation could be attributed to easy access to PCC-ASUH and its good reputation in successful management of cases.

In the current study, mortality from toxicity of cardiovascular therapeutic agents was (0.25%). Two cases had died from cardiogenic shock due to calcium channel blockers toxicity, which agreed with previous PCC-ASUHs annual reports Halawa et al., (2013); Tawfik and Khalifa (2017). This could be attributed to the fact that primary features of CCBs overdose are hypotension and bradycardia, which occur as a result of peripheral vasodilatation, reduced cardiac contractility, and decrease heart rate. The condition may be life threatening causing cardiogenic shock, AV conduction abnormalities and even complete heart block *(Pavasini et al., 2019).*

Beta Blockers overdose caused no apparent clinical effect in most of cases 62.5%, mild effect in 35%, moderate effect in 2.08%, severe effect in 0.42% with no fatality, with a high significant difference between each subgroup in comparison to the total number of patients in the retrospective group. This was in accordance with a large survey in US poison centers in 2003 where most of patients exhibited moderate effect *(Wax et al., 2005).*

Calcium Channel Blockers overdose caused moderate effect in most of cases 43.48%, mild effect in 26.8%, no effect in 13.04%, severe effect in 8.7%, and fatal effect in 8.7%., with a high significant difference between each subgroup in comparison to the total number of patients in the retrospective group. This agreed with Christensen et al. (2018) who conducted a retrospective study from January 2009 to January 2015 in Denmark which revealed that the majority of CCBs exposures (81%) led to hospital admission while mortality was 2%.

Digoxin overdose caused moderate effect in most cases 72.92%, mild effect in 18.75%, no effect in 6.25%, and severe effect in 2.08%, with no fatality, with a high significant difference between each subgroup in comparison to the total number of patients in the retrospective group. This was in accordance with 2011 annual report in United States poison control centers, where the majority of cases were classified as being moderate to severe in nature *(Vyas et al., 2016).* But on the contrary Limon et al. (2016) conducted a cross sectional study on acutely intoxicated patient by digoxin and reveled that most of patients exhibited mild effect.

Anti-hypertensive group showed no clinically significant effect and no fatality, with a high significant difference between each subgroup in comparison to the total number of patients in the retrospective group. This was in accordance with Sorodoc et al. (2010) who analyzed all patients with acute ACEI overdose and revealed that no sequelae or death in his study. This can be explained by the fact that ACEI overdose is well tolerated as hypotension that might occur is not life

threatening and also renal dysfunction is almost always reversible.

By using ROC-curve analysis, Poisoning Severity Score for BB, CCB, and Antihypertensive drugs showed non-significant predictive values in discrimination of patients with cardiotoxicity from asymptomatic patients. But PSS for Digoxin predicted patients with cardiotoxicity, with good (85%) accuracy, 72% sensitivity and 97.5% specificity.

These findings were in accordance with Zaaqoq et al. (2012), who found that PSS is useful in predicting cardiotoxicity for digoxin. But in contrast with those published by Casey et al. (1998), who found that PSS is helpful in assessing the clinical severity, the likelihood of further deterioration, the selection of cases warranting follow up, and the need for referral to a clinical toxicologist.

Prospectively all seven factors of AAPCC showed significant values in differentiating toxicity positive from toxicity negative patients. This was in accordance with study done by Kwon et al. (2007) in Seoul emergency center, who found significant values for factors included e.g., intention, manifestations, and individual circumstances.

By using ROC-curve analysis, AAPCC guidelines predicted patients with cardiotoxicity, with excellent (93%) accuracy, 99.4%, sensitivity and 87.6% specificity ($p < 0.01$), 86% positive predictive value and 99.5% negative predictive value.

Retrospectively with application of PSS, (37.20%) of studied patients were observed in ER then discharged, (36.70%) of patients were admitted to ICU, (8.37%) were admitted to inpatient unit, and (17.73%) were referred to another toxicology center due to unavailability of ICU beds. Prospectively after application of AAPCC guidelines (57.39%) observed in ER then discharged to home, (11.78%) of patients admitted to ICU, (27.82%) admitted to inpatient unit, and (3.01%) referred to another toxicology center, with no apparent adverse effects during follow up of intoxicated patients at PCC clinic, with a high significant difference between both retrospective and prospective groups as regards patient disposition after application of AAPCC guidelines.

Retrospective application of both PCC and local admission protocol of management, showed patient disposition and distribution that agreed with a study done in Turkey where approximately 37% of patients were admitted to ICU but most of patients who undergone that study 63% were observed in the inpatient unit *(Canakci et al., 2018).* This was in contrast with a study done in Paris emergency department where 6% of the cases were hospitalized in the intensive care unit, 55% were followed up in emergency department for less than 24 hours *(Beaune et al., 2016).* Also, Gummin et al. (2020) showed that 66.3% of cardiovascular drugs exposure could be observed at home without medical intervention or emergency department visit.

Prospective application of AAPCC guidelines showed patient disposition that coincides with a study in US poison control center where 82% of patients were observed in ER,10% were admitted to inpatient unit and only 7% were ICU admitted. These results highlights the major role of efficient application of AAPCC guidelines as a proper method for patient disposition especially those who have ingested toxic dose of cardiovascular therapeutic agents *(Truitt et al., 2012; Gummin et al., 2020).*

Conclusion

The current study showed that by application of the AAPCCs guidelines in the prospective group, ICU admission decreased from (36.70%) to (11.78%), with sensitivity (99.4%), negative predictive value (99.5%), specificity (87.6%), positive predictive value (86%). All the forementioned data was compared with prospective group where application of PSS and local management protocol did not show that apparent decrease in the percentage of usage of ICU beds.

It can be concluded that AAPCC triage method is able to reduce the unnecessary admissions of poisoned patients with cardiovascular therapeutic agents through increasing the percent of observed patients in ER and reducing the cost of ICU admission together with decreasing the need for referral to other health care facilities which might pose a risk on the patient.

Recommendations

- Patients with suspected self-harm or suicidal intention by administration of a cardiovascular therapeutic agent should be referred to an emergency department immediately, this should occur regardless of the reported dose.
- Asymptomatic patients are unlikely to develop symptoms if the interval between the ingestion and ER presentation is greater than 6 hours for immediate release products, 8 hours for slow-release BBs, 12 hours for sotalol, 18 hours for modified release products CCBs, and 24 hours for modified release verapamil. So, these patients do not need observation
- Strict governmental policies are needed for the control of medicinal marketing.
- Collaboration between all poison centres is needed to provide a wide surveillance for accurate mapping of poisoning in Egypt.
- Application of AAPCCs guidelines is recommended in triaging patients with cardiovascular therapeutic agents' toxicity to reduce the economic burden of rarity of ICU beds.

Limitation

- Data about the ingested amount of drug are often inaccurate. As the history is frequently obtained from an intoxicated patient or a stressed caregiver. Parents might underestimate or overestimate the ingested dose because of denial or anxiety. Poison center personnel often use the largest reported dose to estimate an ingested dose in order to provide a wide margin of safety.

- Poor correlation between the reported dose and laboratory levels, due to unavailability of multiple drug levels.
- The exact time of ingestion was not known, so the observation time was prolonged

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فرز المرضى المصابين بالتسمم بالعقاقير العلاجية للقلب المترددين علي مركز علاج التسمم بمستشفيات جامعة عين شمس من اجل التوزيع الأمثل لهم

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الملخص العربي

المقدمة: يمثل التسمم بالعقاقير العلاجية للقلب ٧,٨٪ من جميع حالات التسمم وفقاً للتقرير السنوي لعام ٢٠١٦ لمركز علاج التسمم بمستشفيات جامعة عين شمس وهناك تباين كبير في فرز المرضى المصابين بالتسمم بالعقاقير العلاجية للقلب بين مراكز مكافحة السموم ناتج عن إرشادات الفرز والامتثال لهذه الإرشادات والممارسات الحالية

الهدف من الدراسة :مقارنة طريقة فرز المرضي المصابين بالتسمم من العقاقير العلاجية للقلب المترددين علي مركز علاج التسمم مركز علاج التسمم بمستشفيات جامعة عين شمس بالإرشادات المقترحة بواسطة الرابطة الأمريكية لمراكز علاج التسمم

طريقة البحث: هذه الدراسة عبارة عن دراسة مقطعية مقارنة حيث تم تقسيم المرضى إلى ؛ مجموعة دراسة مرجعية استند فيها على مقياس شدة التسمم والبروتوكول المحلي الخاص بمركز علاج التسمم ، ومجموعة دراسة رصدية مستقبلية باستخدام إرشادات الرابطة الأمريكية لمراكز علاج التسمم

النتائج: اشتملت الدراسة علي ٨٠٦ مريض .فى الجزء المرجعي من الدراسة ، لوحظ أن (٣٧,٢٪) من المرضى الخاضعين للدراسة تمت ملاحظتهم في الاستقبال ، (٣٦,٧٪) تم إدخالهم إلى وحدة العناية المركزة ، و(٨,٣٧٪) تم حجزهم بالقسم الداخلي ، و (١٧,٧٣٪) تم تحويلهم إلى مركز علاج تسمم آخر. فى مجموعة الدراسة المستقبلية تم إدخال معظم حالات التسمم (٥٧,٣٩٪) في غرفة الطوارئ ثم خروجها من المستشفى ، وتم قبول (١١,٧٨٪) من المرضى في وحدة العناية المركزة ، وتم حجز (٢٧,٨٢٪) في القسم الداخلي ، وتم تحويل (٣,٠١٪) إلى مركز علم السموم الآخر ، مع عدم وجود آثار سلبية واضحة أثناء المتابعة.

الخلاصة:يمكن أن يؤدي تطبيق طريقة الفرز المقترحة بواسطة الرابطة الأمريكية لمراكز علاج التسمم إلى تقليل حالات الإدخال غير الضرورية للمرضى المصابين بالتسمم بالعقاقير العلاجية للقلب من خلال زيادة نسبة اللمرضى الذين تتم ملاحظتهم في قسم الطوارئ وتقليل حالات الدخول في وحدة العناية المركزة والحاجة إلى الإحالة إلى مرافق الرعاية الصحية الأخرى.

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