Original Research Article

A study on glasgow coma scale score and QTC interval in predicting prognosis and outcome of organophosphate and carbamate poisoning

Raman Prabhakaran[1*], Marannan Navinkumar[2], Ponnusamy Kumar[3], Vijayakumari Vrinda[3]

[1]Professor, [2]Senior Resident, [3]Junior Resident
Department of Internal Medicine, Madurai Medical College, Tamil Nadu, India
[*]Corresponding author email: **drprabhakaran1960@gmail.com**

International Archives of Integrated Medicine, Vol. 4, Issue 6, June, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 19-04-2017 **Accepted on:** 02-05-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Prabhakaran R, Marannan N, Ponnusamy Kumar, Vijayakumari Vrinda. A study on glasgow coma scale score and QTC interval in predicting prognosis and outcome of organophosphate and carbamate poisoning. IAIM, 2017; 4(6): 1-7.

Abstract

Background: Poisoning with organophosphorous substances is the commonest cause of inpatient mortality among all poisonings in developing countries like India. This study is undertaken with an aim of assessing simple parameters like GCS and QTc (marker of ventricular arrythmias) in predicting the outcome and complications of organophosphate compound poisoning considering the mortality and sufferings of Organophosphorous poisoning patients.

Aim: To assess the utility of GCS score and QTc interval in predicting prognosis in patients who had consumed organophosphate and carbamate poisoning and to assess whether the above parameters helps to identify the high risk groups requiring mechanical ventilation.

Materials and methods: This study was conducted among 200 organophosphate and carbamate poisoning patients who were admitted at Government Rajaji Hospital, Madurai from February 2014 to September 2014. After taking detailed history and physical examination and investigations the Glasgow coma scale score and QTc interval at the time of admission was calculated. Patients with GCS score $\leq$ 13 and QTc interval > 0.44s in males and 0.46s in females as poor outcome.

Results: There was a linear relation with QTc interval and severity of Organophosphorous poisoning i.e. as the QTc interval increases the severity of poisoning increases. There was an inverse relationship

between the GCS score and severity of Poisoning, .i.e. as the GCS decreases the severity of poisoning increases.

Conclusion: Our study showed that respiratory failure in patients with OP compound poisoning can be predicted at admission by simple parameters like lower GCS and prolonged QTc interval in ECG.

Key words

Organophosphorous poisoning, QTC interval, Glasgow Coma Scale.

Introduction

Organophosphorus compounds have assumed considerable importance in most parts of the world. According to statistics, nearly 50% of the admissions with acute poisoning in emergency department are due to organophosphate compounds [1].

Their easy accessibility along with socio-cultural factors play a considerable role in the selection of organophosphates as a main suicidal agent and is most often preferred by young economically productive age group with a case fatality ratio of around 20 percent [2]. The organophosphate poisoning is associated with cardiac complications and most of them occur in the first few hours after exposure. Hypoxemia and electrolyte derangements are major predisposing factors for the development of these complications.

Materials and methods

Study Population

This study was conducted among 200 patients who are admitted in Govt. Rajaji hospital, Madurai with history and features of organophosphate and carbamate poisoning from February 2014 to September 2014.

Inclusion Criteria

- All Age > 12 years, both sex
- History of exposure to organophosphate or carbamate compounds within previous 24 hours presenting with characteristic clinical manifestations of organophosphate and carbamate poisoning.

Exclusion Criteria

- Patients who received treatment before admission
- Patients with doubtful diagnosis
- Mixed poisoning with other substances
- Known case of cardiac illness and chronic lung disease
- Patients known to be taking drugs that are likely to prolong QT interval within the past month
- Patients with dyselectrolytemia at admission.

Ethical Committee Approval: Obtained.

Study Protocol

GCS score and QTc interval will be calculated on admission for all patients. They will be compared with the severity of poisoning as suggested by dosage of atropine and pralidoxime used, development of complications like respiratory failure and outcome. The outcome would be classified into survival with or without ventilator assistance and death.

Statistical analysis

The data collected in the study was formulated into a master chart in Microsoft Office excel and statistical analysis was done with help of computer using statistical software package SPSS V.17 for Windows. Using this software, frequencies, range, mean, standard deviation and percentages were calculated.

Results

The mean age (± S.D): 30.18 (±10.82) years, minimum: 14 years, maximum: 70 years. About 86% of the study subjects were in the age group of less than 40 years while the remaining 14%

were aged above 40 years. In the study, males were predominant and constituted 52%. Male to female ratio was 1.8:1. Nine different OP compounds were consumed in the study. The most preferred one was Methyl parathion. Lice killer, Quinolphos and Dimethoate were the ones preferred next. The mean time (± S.D) of hospitalization in the study was 3.39 (±1.69) hours and in those who developed respiratory failure was 4.75 (±1.18) hours. There was a linear increase in the incidence of complications when the time of admission was delayed and this observation was statistically significant. The mean GCS (± S.D) in the study population at admission was12.88 (± 2.83) whereas the mean GCS was 10.70 in those admitted with respiratory failure and was 6.83 in those who eventually died. This inverse relationship of GCS with adverse events was significant statistically. The mean QTc interval in males included in the study was 412.38 ms. There was a statistically significant prolongation in the QTc interval in those developing complications due to OP poisoning. The mean QTc interval in females included in the study was 411.36 ms. The QTc interval was prolonged in those developing complications due to OP poisoning. This observation was statistically significant. Except for a few, all patients had features of acute cholinergic crisis and 60 of them developed respiratory failure. 7 patients developed intermediate syndrome and all of them needed respiratory assistance. Delayed polyneuropathy was not observed in any patient. Nearly 95% of the patients survived from toxic effects of OP poisoning. A good number of them needed respiratory assistance to survive. 12 patients eventually succumbed to the poisoning. 10 of 67 patients who required ventilator developed ventilator associated pneumonia. The incidence of pneumonia increased steadily with duration of ventilator support (**Table – 1 to 4**).

Table – 1: Distribution of GCS in the study population, Respiratory Failure and outcome (n=200).

GCS at admission	No. of patients	No. of patients developing respiratory failure	No. of deaths
> 13	125	28	2
8 – 13	61	25	2
< 8	14	14	8

(P value < 0.001; Student's t test)

Table – 2: Distribution of QTc in males, respiratory failure and death (n=104).

QTc	No. of patients	No. of patients developing respiratory failure	No. of deaths
< 400 ms	38	2	1
400-440 ms	37	13	3
> 440 ms	29	29	6

(P value < 0.001; Student's t test)

Table – 3: Distribution of QTc in females, respiratory failure and death (n=96).

QTc	No. of patients	No. of patients developing respiratory failure	No. of deaths
< 400 ms	42	2	1
400-460 ms	38	5	0
> 460 ms	16	16	1

(P value = 0.004; Student's t test)

Discussion

Mean age (± S.D.) of the study population was 30.18 (± 10.82) with a minimum of 14 years and maximum of 70 years. The demographics of my study corroborates well with the previous studies.

The mean age in a study conducted by one study [3] was 27.35±8.63 years and was 32±16.3 years in another study [4]. In other studies [5-9], majority of the patients were from the age group between 21-30 years.

Table – 4: Correlation between GCS, QTc with severity of poisoning.

	Pearson's Correlation coefficient (R)	**P value**
GCS vs dose of atropine	-0.600	<0.001
QTc vs dose of atropine	0.765	<0.001

Majority of the study population were males in our study. Males constituted 52% with a male to female ratio of 1.08:1. This observation corroborates with the other studies done in the past.

Shahin Shadnia, et al. included 47.6% males and 52.4% females in her study [22]. 69% males and 31% females constituted the study population in one study [10]. In one study [11], males constituted 76% and the rest were females. Even in other studies [12-21, 23], there was male predominance.

More than two thirds of the patients (70.5%) were brought to the hospital with a delay of 2 hours and more while the remaining 59 (29.5%) patients were brought within 2 hours of consumption of poisoning substance. 63 (31.5%) patients were brought after 4 hours of consumption while majority (39%) were hospitalized between 2 – 4 hours.

It was also observed that nearly all patients who developed respiratory failure were brought after 2 hours. The mean time (± S.D.) of hospitalization among those who developed respiratory failure was 4.75 ± 0.98 hours. Also, there was a statistically significant increase in the incidence of respiratory failure as well as mortality in patients admitted beyond 4 hours of consumption of organophosphorus compounds. ($p < 0.001$).

Deshpande, et al. [10] in her study involving 140 patients also observed that there is a statistically significant increase in incidence of respiratory failure and mortality in those presenting late to hospital. ($p < 0.026$)

The mean (±S.D.) GCS at admission in our study was 12.88 ± 2.83 with the minimum of 3 and maximum being 15. Majority of the patients (62.5%) were admitted with GCS > 13 while patients admitted with GCS between 8 -13 and less than 8 were 30.5% and 7% respectively.

Among those who developed respiratory failure, 41.8% had GCS > 13 while 26.9% had GCS between 8-13 and 31.3% had GCS < 8.

Davies, et al. [25] in his study involving 1365 patients concluded that GCS ≤ 13 needs intensive monitoring and treatment as it was associated with clinically severe poisoning. Deshpande, et al. [10] in her study observed that lower GCS score on admission was associated with more incidences of respiratory failure and mortality. Results from the study by Grmec, et al. [24] showed that a higher number of intubations and worse outcome was observed in those with GCS < 6 at admission.

There was an inverse relationship between GCS at admission and severity of poisoning as assessed by dosage of atropine used and duration of respiratory failure. This was statistically significant. (Pearson's Correlation coefficient was – 0.60; $p < 0.001$).

The mean QTc interval (± S.D.) in the present study was 411.89 ± 33.35 ms. QTc interval was considered to be prolonged if it is more than 440 ms in males and 460 ms in females. The mean QTc interval in males and females were 412.38 ms and 411.36 ms respectively.

Among 104 males included in the present study, 75 patients (72.12%) had GCS within normal limits and in spite of it, 15 of them (20%) developed respiratory failure. 29 males (27.88%) had prolonged QTc interval and all of them developed respiratory failure.

In the study, 96 females were included and 80 of them (83.33%) had a normal QTc interval. Yet 7 of them developed respiratory failure. Among the remaining 16 females (16.67%) who had prolonged QTc interval, all of them developed respiratory failure.

Among 200 patients enrolled in the current study, 193 patients (96.5%) had features of acute cholinergic crisis. 7 patients had features of intermediate syndrome and none of the study population had delayed polyneuropathy.

The incidence of respiratory failure was 100% in those who developed intermediate syndrome and was 31.01% in those with acute cholinergic crisis.

There were 7 cases (3.5%) of intermediate syndrome in the present study. The male: female ratio was 2.5: 1. All of them went to respiratory failure after a mean of 3.29 days. At admission, all of them had GCS score > 13 and a normal QTc interval. 2 of them died eventually.

There were 12 deaths in the current study. 10 of them were males and the rest were females. 2 of them developed intermediate syndrome. 1 developed ventilator associated pneumonia.

The mean GCS at admission in those who died was 6.83 ± 3.95 where as it was 13.26 ± 2.26 in those who survived. This observation was statistically significant. (p=0.001)

The mean QTc interval among those who died was 438.33 ± 30.66 ms when compared to 410.25 ± 32.88 ms in those who survived. This was too statistically significant. (p=0.004)

Similar results were obtained in the study conducted by Deshpande, et al. [10]. She observed a mean (± S.D.) GCS score of 5.81 ± 1.95 and QTc interval of 500 ± 70 ms in those who died. Both the observations were statistically significant. (p = 0.0092; 0.002 respectively)

Conclusion

Organophosphorus compounds are commonly used agents for suicidal purpose because of their easy availability. The main determining factors for mortality are the type of poisonous agent used, the severity of the poisoning, the stage at which treatment is started and the presence or absence of intensive care facilities.

The organophosphate poisoning is associated with cardiac complications and most of them occur during the first few hours of poisoning. Hence early and adequate atropinization will reduce the mortality to a great extent.

Respiratory failure is the commonest cause of death in OP poisoning. Though ventilators are boon to patients with respiratory failure, early identification and intensive management are vital in reducing the mortality.

Our study shows that respiratory failure in patients with OP compound poisoning can be predicted at admission by simple parameters like lower GCS and prolonged QTc interval in ECG. Glasgow Coma Scale may be more useful as it is simple, purely clinical, less time consuming and can easily be calculated by all primary care physicians.

These prognostic parameters can help doctors at peripheral health centres in successfully predicting outcomes and thereby high risk cases are referred to higher centres without any delay. In this way, the incidence of complications and mortality in OP poisoning can be reduced.

Acknowledgements

We express our sincere thanks and gratitude to the Dean, Government Rajaji Hospital and Madurai Medical College for permitting us to conduct this study.

We are extremely grateful to all our Assistant Professors and PG Residents of Department of Medicine for their constant source of cheer and encouragement throughout the study. We thank

all our patients who have formed the backbone of my study, without them this work would not have been possible. We are also thankful to paramedical staff of all departments for their concern.

References

1. Eddleston M. Patterns and problems of deliberate self-poisoning in the developing world. QJM, 2000; 93: 715–31.
2. Du Toit PW, Muller FO, van Tonder WM, Ungerer MJ. Experience with the intensive care management of organophosphate insecticide poisoning. S Afr Med J., 1981; 60: 227–9.
3. Senanayake N, de Silva HJ, Karalliedde L. A scale to assess severity in organophosphorus intoxication: POP scale. Hum Exp Toxicol., 1993; 12: 297–9.
4. Levy DE, Bates D, Caronna JJ, et al. Prognosis in nontraumatic coma. Ann Internal Med., 1981; 94: 293–301.
5. Chan B, Gaudary P, Grattan-Smith TM, McNell R. The use of Glasgow Coma Scale in poisoning. J Emerg Med., 1993; 11: 579–82.
6. Forsberg S, Hojer J, Ludwigs U. Prognosis in patients presenting with non- traumatic coma. Crit Care, 2010; 14: 333.
7. Bilgin TE, Camdeviren H, Yapici D, et al. The comparison of the efficacy of scoring systems in organophosphate poisoning. Toxicol Ind Health, 2005; 21: 141-6.
8. O' Brien BP, Murphy D, Conrick-Martin I, Marsh B. The functional outcome and recovery of patients admitted to an intensive care unit following drug overdose: a follow up study. Anaesth Intensive Care, 2009; 37: 802–6.
9. Heard K, Bebarta VS. Reliability of the Glasgow Coma scale for the emergency department evaluation of poisoned patients. Hum Exp Toxicol., 2004; 23: 197–200.
10. Archana Deshpande, Nitin Gaikwad and Sanjay Deshpande, et al. Study of Glasgow Coma Scale Score and QTc Interval in Prognosis of Organophosphate Compound Poisoning. Indian J. Clin. Med., 2012; 3: 25-31.
11. Budhathoki S, Poudel P, Shah D, et al. Clinical profile and outcome of children presenting with poisoning or intoxication: a hospital based study. Nepal Med Coll J., 2009; 11: 170–5.
12. Ku HL, Yang KC, Lee YC, Lee MB, Chou YH. Predictors of carbon monoxide poisoning induced delayed neuropsychological sequelae. Gen Hosp Psychiatry, 2010; 32(3): 310–4.
13. Bonow RO, Mann DL. Braunwald's Heart disease: A Textbook of Cardio-vascular Medicine, 9th edition, Philadelphia: Saunders, 2011.
14. Chuang FR, Jang SW, Lin JL, Chern MS, Chen JB, Hsu KT. QTc prolongation indicates poor prognosis in patients with OP poisoning. J Emerg Med., 1996; 14: 451–3.
15. Shadnia S, Okazi A, Akhlaghi N, Sasanian G, Abdollahi M. Prognostic value of long QT interval in acute and severe organophosphate poisoning. J Med Toxicol., 2009; 5: 196–9.
16. Shannon MW, Borron SW, Burns MJ. Shannon: Haddad and Winchester's Clinical Management of Poisoning and Drug Overdose, 4th edition, St. Louis: W.B. Saunders, 2007.
17. World Health Organization: The WHO recommended classification of pesticides by hazard. 2004; Geneva: Who Publications.
18. Temple WA, Smith NA. Organophosphorous pesticides. 2012; IPCS INTOX Databank. Available at: http://www.inchem.org/documents/pims/chemical/ pimg001.htm. Accessed Oct 13, 2012.

19. Karalliedde L, Henry JA. Effects of organophosphates on skeletal muscle. Hum Exp Toxicol., 1993; 12: 289–96.
20. Eddleston M, Mohamed F, Davies JO. Respiratory failure in organophosphorous self-poisoning. QJ Med., 2006; 99: 513–22.
21. Chuang FR, Jang SW, Lin JL, et al. QTC prolongation indicates a poor prognosis in patients with organophosphate poisoning. Am J Emerg Med., 1996; 14: 451–453.
22. Shadnia S, Darabi D, Pajoumand A, et al. A simplified acute physiology score in the prediction of acute organophosphate poisoning outcome in an intensive care unit. Hum Exp Toxicol., 2007; 26: 623–627.
23. Dart RC, ed. Medical Toxicology. 3rd edition, Philadelphia, Pa: Lippincott Williams & Wilkins; 2004.
24. Grmec S, Mally S, Klemen P. Glasgow coma scale score and QTc interval in the prognosis of organophosphate poisoning. Acad Emerg Med., 2004; 11: 925–30.
25. Davies JO, Eddleston M, Buckley NA. Predicting outcome in Acute Organophosphorous poisoning with a poison severity score or the Glasgow coma scale. QJM, 2008; 101: 371–9.