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Research Article

EFFECTIVENESS OF NURSE LED INTERVENTION ON RESPIRATORY PARAMETERS, AND CHOLINESTERASE AMONG ORGANOPHOSPHORUS COMPOUND POISONING PATIENTS ADMITTED INDHANVANTRI CRITICAL CARE CENTRE AT ERODE – A HISTORICAL COMPARISON

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ABSTRACT

Context: Nurses play a vital role in the management of poisoning, as it demands close observation, timely administration of antidotes in adequate doses and skillful nursing interventions. **Methods:** Quasi-experimental design- A historical comparison was adopted. Total 30 organophosphorus compound poisoning patients, out of which 15 participants were in an experimental group and 15 participants were in control group. Purposive sampling technique was used to select the participants admitted in Dhanvantri Critical Care Centre at Erode. The level of respiratory parameters was assessed by adopting in vitro ABG (Arterial Blood Gas) analysis which constitutes pH (acidity), pCO2 (partial pressure of carbon dioxide), pO2 (partial pressure of oxygen) and HCO3 (bicarbonate). Serum cholinesterase estimation level was measured from the vein by adopting in vitro method. **Results:** The Paired t' test value of respiratory parameter (pH, pCO2, pO2, HCO3) scores showed statistical significance in the experimental group. Only pCO2 paired t' test scores showed statistical significance in control group. Unpaired t' test value of posttest respiratory parameter (pH, pCO2, pO2, HCO3) scores between experimental and control group was statistically significant. The Paired t' test value of cholinesterase scores showed statistical significance in the experimental group (t=4.00). Whereas control group showed statistical nonsignificance (t=0.71). Unpaired t' test value of posttest cholinesterase scores between experimental and control group was statistically significant (t=3.84). **Conclusion:** The study findings revealed that administration of Nurse-Led Intervention were highly significant to improve respiratory parameters and levels of cholinesterase among organophosphorus compound poisoning patients in the experimental group than control group.

Keywords: Nurse-Led Intervention, Respiratory Parameters, Cholinesterase, Organophosphorus Compound Poisoning.

INTRODUCTION

Globally, organophosphorus (OP) pesticide poisoning is a serious occupational hazard accounting for more than 80% of pesticide-related hospitalization. Pesticide self-poisoning is responsible for killing approximately 300,000 people worldwide every year and mostly from a rural background. In developing countries, the mortality can be as high as 70% (Eddleston M. 2000, Eddleston M, Phillips MR. 2004). High mortality could be probably due to lack of hospital services in the vicinity, inadequate transport facility, more patients with caregivers ratio and finally non availability of definite antidote (Buckley NA, 2004).

Recent data from National crime bureau of India shows suicide by consumption of pesticides account for 19.4% and 19.7% of all cases of suicidal poisoning in the year 2006 and 2007 respectively. WHO estimates that approximately 3 million pesticide poisoning occur worldwide and cause more than 2,20,000 deaths. Developing countries like India and Srilanka have reported increased rates of toxicity and death (Darren M 2007).

Respiratory complications of OP poisoning occur during, and as a consequence of, the acute cholinergic crisis, delayed neuromuscular dysfunction, and recurrent cholinergic toxicity. Patients who were intubated after 24 hours required a significantly longer period of ventilation. Bronchorrhea results from neuronal and nonneuronal cholinergic stimulation of the mucus glands, cilia, and cells producing periciliary fluid (Kummer W, Lips KS, Pfeil U 2008, Takemura Y, Helms MN, et al., 2013). Acute respiratory distress syndrome (ARDS) has been reported in several cases of OP insecticide poisoning (Akgur S, Veral A, Ege B, 2008). It may result directly from pulmonary complications of poisoning, such as aspiration or inhalation, or indirectly via hematogenous exposure to OP compounds.

It was observed that majority of the cases were showing respiratory alkalosis (65%) on ABG, followed by respiratory acidosis (15%) and metabolic alkalosis (5%). No cases showed metabolic acidosis in the study. 15% cases showed normal acid-base status in the study. The cases of respiratory acidosis and apodosis were further classified into acute, partly compensated and fully compensated. Out of the total 20 cases, 2 cases (10%) showed acute respiratory acidosis whereas 1 case (5%) showed partly compensated respiratory acidosis. 4 cases (20%) showed acute respiratory alkalosis. Whereas, partly and fully compensated respiratory alkalosis was observed in 6 (30%) and 3 (15%) cases respectively (DudekulaMoulali, D.V.H.S Sarma, et al., 2014).

Clinical manifestations following OP poisoning can be associated with the extent of decrease of PChE. OP pesticides inhibit carboxylic esterase enzymes including acetylcholinesterase (AChE) and plasma cholinesterase (PChE). AChE can be found in erythrocytes, nervous tissue and skeletal muscles, while PChE can be found in plasma, liver, heart, pancreas, and brain. Most of the clinical manifestations associated with exposure to OP compounds have been attributed to inhibition of these enzymes (Karalliedde L, 2002).

Organophosphate poisoning is a common cause of acute poisoning in India with high mortality. Prompt recognition and aggressive treatment of acute intoxication are essential to minimize the mortality and morbidity. Nurses play a vital role in the management of poisoning, as it demands close observation, timely administration of antidotes in adequate doses and skillful nursing interventions. Counselling to the poisoned patients will reduce the chances of a repeat attempt at poisoning. It also enables the healthcare personnel to improve the quality of treatment, minimize the cost of therapy and the period of hospitalization. Family counseling is mandated; this helps the family members to cope with the situation and accept the patient as he is.

Poisoning is a common cause of hospital admissions. Caring for patients with OP poisoning is a challenge for nurses. Assessment and prevention of complications are one of the vital roles of the nurse. Appropriate, evidenced-based practice will enhance quick

recovery, reduce morbidity and mortality. Nurses must ensure that both patients and family members receive counseling, to cope and live in the community(Amala Rajan, Ilavarasi Jesudoss, 2016).

Many kinds of literature show a paucity of research work in a nurse-led intervention on respiratory parameters and cholinesterase among organophosphorus compound poisoning patients. Still, research gap exists between nurse-led intervention for respiratory parameters and cholinesterase in organophosphorus compound poisoning patients. The novelty of this research work is based on the respiratory parameters and cholinesterase level and need for nurse-led intervention in which control group participants were selected from the previous case reported within six months.

MATERIALS AND METHODS

Before the collection of data, permission was obtained from the Chairman, Dhanvantri Critical Care Centre at Erode.This study was approved by Institutional Human Ethical Committee. After obtaining written informed consent, organophosphorus compound poisoning patients who fulfilled the inclusion criteria were recruited and enrolled in the study in June 2016. Quasi-experimental design- A historical comparison was adopted. Total 30 organophosphorus compound poisoning patients, out of which 15 participants were in an experimental group and 15 participants were in control group. Purposive sampling technique was used to select the participants admitted to Dhanvantri Critical Care Centre at Erode.

All participants were interviewed before intervention in experimental and control group by assessing demographic variables like age, gender, occupation, family monthly income, residential area, the intention of poison and type of poison. The level of respiratory parameters were assessed by adopting in vitro ABG (Arterial Blood Gas) analysis which constitutes pH (acidity), pCO2 (partial pressure of carbon dioxide), pO2 (partial pressure of oxygen) and HCO3 (bicarbonate). Serum cholinesterase estimation level was measured from the vein by adopting in vitro method. For both the test, a blood sample was collected during morning around 4-5 a.m. ABG (Arterial Blood Gas) analysis was done daily, whereas serum cholinesterase estimation was done once in 5 days. Two mL of arterial blood was collected from the femoral artery, and two mL of venous blood was collected from antecubital fossa and transferred to the EDTA vacutainer. It was labeled with patient's name, age, and serial number. Throughout the procedure, aseptic measures were taken. The collected blood was sent to Dhanvantri Critical Care laboratory by following standard operating procedure.

Immediately after pretest, the participants received Nurse-Led Intervention protocol by administering the high flow of oxygen (5-7 liters) based on oxygen saturation with subsequent frequent suctioning once in 2 hours and brief psychotherapy focusing to raise awareness of the problem and explores problem-solving techniques on primarily present concern and stressors once a day. The intervention was given on 1st day after weaning from the ventilator for three consecutive days. Control group participants were selected from the previous case reported within 6 months and compared with experimental subjects.

Subject's right to withdraw/withhold the information was ensured before data collection. Informed consent form was translated into the Tamil language. After clarifying the doubts, signature was obtained from organophosphorus compound poisoning patients. Written Informed consent was obtained from each participant related to the study purpose, type of data, nature of commitments, participations and procedure. Confidentiality of the data was ensured throughout the study. The risk-benefit ratio was calculated.

RESULTS

Descriptive, inferential and nonparametric statistical analytic method was used to analyze and interpret the data. A probability of 0.05 or less was taken as statistically significant. Statistical package for social science, PCT version 17 (SPSS Inc, Chicago) was used for analyzing the data.

Table 1: Frequency and Percentage Distribution of Pre and Posttest Scores on Respiratory Parameters in Experimental Group.

Respiratory Parameters	Levels of Respiratory Acidosis	Experimental group				Levels of Respiratory Alkalosis	Experimental group			
		Pretest		Posttest			Pretest		Posttest	
pH		F	%	F	%		F	%	F	%
pCO2										
pO2	Mild	4	27%	6	40%	Mild	6	40%	3	21%
HCO3	Moderate	2	13%	2	13%	Moderate	1	7%	2	13%
	Severe	1	7%	2	13%	Severe	2	13%	-	-
n=15										

Table 2: Frequency and Percentage Distribution of Pre and Posttest Scores on Respiratory Parameters in Control Group.

Respiratory Parameters	Levels of Respiratory Acidosis	Control group				Levels of Respiratory Alkalosis	Control group			
		Pretest		Posttest			Pretest		Posttest	
pH		F	%	F	%		F	%	F	%
pCO2										
pO2	Mild	5	33%	4	27%	Mild	2	13%	1	7%
HCO3	Moderate	4	27%	2	13%	Moderate	1	7%	6	40%
	Severe	2	13%	-	-	Severe	1	7%	2	13%
n = 15										

In the pretest, the experimental group showed 27% with mild respiratory acidosis, 13% with moderate respiratory acidosis and 7% with severe respiratory acidosis. In posttest, 40% had mild respiratory acidosis, 13% of participants showed moderate respiratory acidosis and 13% showed severe respiratory acidosis. Likewise in the pretest, the experimental group showed 40% with mild respiratory alkalosis, 7% with moderate respiratory alkalosis and 13% with severe respiratory alkalosis. In posttest, 21% had mild respiratory alkalosis, 13% of participants showed moderate respiratory alkalosis, and none showed severe respiratory alkalosis (Table-1).

In the pretest, the control group showed 33% with mild respiratory acidosis, 27% with moderate respiratory acidosis and 13% with severe respiratory acidosis. In posttest, 27% had mild respiratory acidosis, 13% of participants showed moderate respiratory acidosis, and none showed the severe level of respiratory acidosis. Likewise in the pretest, the control group showed 13% with mild respiratory alkalosis, 7% with moderate respiratory alkalosis and 7% with severe respiratory alkalosis. In posttest, 7% had mild respiratory alkalosis, 40% of participants showed moderate respiratory alkalosis and 13% showed the severe level of respiratory alkalosis(Table-2).

Table 3: Frequency and Percentage Distribution of Pre and Posttest Scores on Cholinesterase Level among Organophosphorus Compound Poisoning Patients in Experimental Group and Control Group.

Level of Cholinesterase	Experimental group				Control group			
	Pretest		Posttest		Pretest		Posttest	
	F	%	F	%	F	%	F	%
Low	8	53%	3	20%	9	60%	6	40%
Average	4	27%	3	20%	3	20%	2	13%
High	3	20%	9	60%	3	20%	7	47%
N =30 (n1=15, n2=15)								

In the experimental group, the measured cholinesterase level in pretest showed low elevation (53%), 27% participants reported with average elevation and 20% revealed high elevation of cholinesterase. In posttest 20% had a low elevation of cholinesterase, 20% showed average elevation and 60% showed the high elevation of cholinesterase. Control group in pretest showed 60% low elevation, 20% average elevation and 20% high elevation of cholinesterase. In posttest 40% had low elevation of cholinesterase, 13% showed average elevation and 47% showed high elevation of cholinesterase (Table-3).

Table 4: Comparison of Mean, Standard Error, Paired T' Test and Unpaired T' Test Value with Pre and Posttest Scores of Respiratory Parameters between Experimental and Control Group.

Variable		Group		Mean ± SE	Group		Mean ± SE	Significance Paired 't' test		Significance Unpaired 't' test	
								Experimental group	Control group	Experimental group	Control group
Respiratory parameters	pH	Experimental group	Pretest	2.87± 0.09	Control group	Pretest	2.27 ± 0.21	t = 3.50 P<0.003	t = 1.87 P >0.08	Mean 2.60 t = 2.37 P< 0.02	Mean 1.93
			Posttest	2.40 ± 0.16		Posttest	2.07 ± 0.23				
	pCO2		Pretest	1.80 ± 0.20		Pretest	1.80 ± 0.14	t = 6.50 P <0.001	t = 2.25 P <0.04	Mean 1.73 t = 2.29 P< 0.02	Mean 1.20
			Posttest	2.07 ± 0.25		Posttest	2.67 ± 0.13				
	pO2		Pretest	2.47 ± 0.19		Pretest	2.13 ± 0.19	t = 2.64 P <0.01	t = 1.46 P >0.16	Mean 2.13 t = 2.80 P< 0.009	Mean 1.33
			Posttest	2.13 ± 0.26		Posttest	2.00 ± 0.17				
	HCO3		Pretest	2.00 ± 0.22		Pretest	1.93 ± 0.21	t = 2.64 P <0.01	t = 1.46 P >0.16	Mean 2.33 t = 2.08 P< 0.04	Mean 1.80
			Posttest	2.33 ± 0.21		Posttest	2.07 ± 0.21				
N =30 (n1=15, n2=15)											

Comparison of mean, standard error of pretest pH scores in the experimental group showed 2.87±0.09 and posttest showed 2.40±0.16. Pretest pCO2 mean scores in the experimental group showed 1.80±0.20 and posttest showed 2.07±0.25. Pretest pO2 mean scores in the experimental group showed 2.47±0.19 and posttest showed 2.13±0.26. Pretest HCO3 mean scores in experimental group showed 2.00±0.22 and posttest showed 2.33±0.21 (Table-4)

Likewise, comparison of mean, standard error of pretest pH scores in control group showed 2.27±0.21 and posttest showed 2.07±0.23. Pretest pCO2 mean scores in control group showed 1.80±0.14 and posttest showed 2.67±0.13. Pretest pO2 mean scores in control group showed 2.13±0.19 and posttest showed 2.00±0.17. Pretest HCO3 mean scores in control group showed 1.93±0.21 and posttest showed 2.07±0.21 (Table-4)

The Paired t' test value of respiratory parameter (pH, pCO2, pO2, HCO3) scores presented in Table-4 showed statistical significance in the experimental group. Whereas, Paired t' test value of the respiratory parameter (pH, pO2, HCO3) scores showed statistical nonsignificance in control group. Only pCO2 paired t' test scores showed statistical significance in control group (Table-4)

Unpaired t' test value of posttest respiratory parameter (pH, pCO2, pO2, HCO3) scores between experimental and control group was statistically significant. It indicates that there was a significant difference between the groups. Based on posttest pH, pCO2, pO2, HCO3 mean scores, experimental group showed improvement in all respiratory parameters compared with control group(Table-4)

Table 5: Comparison of Mean, Standard Error, Paired T' Test and Unpaired T' Test Value with Pre and Posttest Scores Of Cholinesterase Level between Experimental and Control Group.

Variable	Group	Mean ± SE	Significance Paired 't' test		Significance Unpaired 't' test	
			Experimental group Pre – Posttest	Control Group Pre –Posttest	Experimental group Posttest	Control group Posttest
Cholinesterase	Experimental – Pretest	1.80 ± 0.22	t = 4.00 P < 0.001	t =0.71 P > 0.48	Mean= 2.13	Mean= 1.27
	Experimental – Posttest	1.27 ± 0.12			t =3.84 P < 0.001	
	Control- Pretest	1.80± 0.20				
	Control - Posttest	1.53± 0.19				
N =30 (n1=15, n2=15)						

Comparison of mean, standard error of pretest cholinesterase scores in the experimental group showed 1.80±0.22 and posttest showed 1.27±0.12. Likewise, comparison of mean, standard error of pretest cholinesterase scores in control group showed 1.80±0.20 and posttest showed 1.53±0.19 (Table-5).

The Paired t' test value of cholinesterase scores presented in (Table-5) showed statistical significance in the experimental group (t=4.00). Whereas control group showed statistical nonsignificance (t=0.71).

Unpaired t' test value of posttest cholinesterase scores between experimental and control group was statistically significant (t=3.84). It indicates that there was a significant difference between the groups. Based on posttest cholinesterase mean scores, experimental group (Mean=2.13) showed an increased level of cholinesterase compared with control group (Mean=1.27).

DISCUSSION

Distribution of demographic variable in the experimental group according to their age group depicts that highest percentage (67%) were in the age group of 31-40 years. In control group, according to their age group, the highest percentage (40%) were in the age group of 31-40 years. Gender depicts that highest percentage (53%) were female gender in the experimental group. In control group, highest percentages (73%) were male gender. This result is supported by a male to female ratio of 1:1.5. The mean age of the patients was 25.5 with a standard deviation of 9.45(Getnet Mequanint Adinew&Assefa Belay Asrie, 2017). Participants according to their residential area showed majority 60% were from a rural area in the experimental group and in control group majority 67% were from rural area. A Retrospective study showed that 56.7% of the cases lived in an urban environment compared to 43.3% who lived rurally (Getnet Mequanint Adinew&Assefa Belay Asrie, 2017).Type of poisoning depicts that highest 53% of participants had taken pesticide poisoning in the experimental group. Likewise highest 67% of participants had taken insecticide poisoning in control group. The significant result reported by Subhash Chandra Joshi & Chandra Prakash, (2013) revealed that the most common motive of poisoning was with suicidal intent, both in males (50.80%) and females (43.01%) and the highest number of patients consumed Dichlorvos (40.86%).

Nurses play a vital role in the management of poisoning, as it demands close observation, timely administration of antidotes in adequate doses and skillful nursing interventions. Poisoning is a common cause of hospital admissions. Caring for patients with OP poisoning is a challenge for nurses. Assessment and prevention of complications are one of the vital roles of the nurse. Appropriate, evidenced-based practice will enhance quick recovery, reduce morbidity and mortality. Nurses must ensure that both patients and family members receive counseling, to cope and live in the community (AmalaRajan, IlavarasiJesudoss, 2016). The Paired t' test value of respiratory parameter (pH, pCO2, pO2, HCO3) scores showed statistical significance in the experimental group. Whereas, Paired t' test value of the respiratory parameter (pH, pO2, HCO3) scores showed statistical nonsignificance in control group. Only pCO2 paired t' test scores showed statistical significance in control group. Unpaired t' test value of posttest respiratory parameter (pH, pCO2, pO2, HCO3) scores between experimental and control group was statistically significant. It indicates that there was a significant difference between the groups. Based on posttest pH, pCO2, pO2, HCO3 mean scores, the experimental group showed improvement in all respiratory parameters compared with control group.

The Paired t' test value of cholinesterase scores showed statistical significance in the experimental group (t=4.00). Whereas control group showed statistical nonsignificance (t=0.71).Unpaired t' test value of posttest cholinesterase scores between experimental and control group was statistically significant (t=3.84). It indicates that there was a significant difference between the groups. Based on posttest cholinesterase mean scores, experimental group (Mean=2.13) showed an increased level of cholinesterase compared with control group (Mean=1.27).

This finding was supported by Murat S, (2003), concluded that organophosphorus poisoning is a serious condition that needs rapid diagnosis and treatment. Since the respiratory failure is the major reason for mortality, careful monitoring, appropriate management and nursing care, early recognition of complication may decrease the mortality rate among organophosphorus poisoning patient. There was significant inhibition of plasma cholinesterase and elevation of serum amylase at admission with a return to normal values on the 5th day. Plasma cholinesterase inhibition <10% is associated with high degree of mortality. Hyperamylasemia>200 U/L has been associated with poor prognosis and proneness to respiratory failure SharanBadiger et al., (2016).

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