

Original article:

Determine the significance of proprioceptive neuro muscular facilitation technique with conventional chest physiotherapy in mechanically ventilated organophosphorus poisoning patients

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ABSTRACT:

Introduction: Organophosphates (OP) are commonly used as pesticides around the world. Exposures to OP cause a significant number of deaths each year. The purpose of this study was to find out significance of PNF with CPT in OP poisoning patients.

Methodology: This interventional study included 30 patients with history of OP poisoning & within 48 hours of ventilation. Values of pulmonary and hemodynamic parameters were compared on post conventional CPT and further after post PNF .

Results: Repeated measure ANOVA was used to statistically analyze the data. Values of Parameters obtained were not significant to consider PNF with CPT (P = 0.310).CPT improves values of pulmonary and hemodynamic parameters in OP poisoning patients while PNF didn't.

Conclusion: PNF did not significantly enhance values of post CPT pulmonary & haemodynamic parameters in mechanically ventilated OP poisoning patients during acute management period.

Keywords: OP poisoning , ventilated patients

INTRODUCTION

Organophosphorus (OP) compounds were first synthesized about one and half century back in France. Tetraethyl pyrophosphate (TEPP) was first to be manufactured in liquid form in 1950. Since then numerous compounds have been synthesized and used as agricultural insecticide.^[1]Consumption of OP compounds for suicidal attempts particularly high in agricultural families all over the world. An estimated 3 million cases of pesticide poisoning occur every year (World health OP insecticide 1990).^[2] Clinical presentation of OP exposure depends on the specific agent, the quantity and the route of entry. Initial symptoms may range from mild as flu like

syndrome, to immediately life threatening respiratory arrest.

Toxicity occurs, soon after exposure but may be delayed, depending on the agent and route of entry. The most rapid onset of symptoms occurs with inhalation, and the slowest with dermal exposure. Respiratory arrest can occur within 50 minutes of inhalation. OP toxicity generally occurs within 4-12 hrs, full-blown toxicity may not be manifested for 24 hrs. Cholinergic excess produces the signs and symptoms of acute OP exposure. Predominant clinical findings are usually muscuranic followed by CNS and then nicotinic manifestations.

GI symptoms and signs are usually seen after ingestion of organophosphates. Aerosol exposure typically presents with respiratory and ocular complaints. CNS effects generally include anxiety, restlessness, coma and seizures, but chorea psychosis, depression and chorea athetosis have been described. Muscle weakness and paralysis develops, in severe exposure un-treated patients die as a result of respiratory arrest. [3]

Immediate attention to due airway and adequate oxygenation is essential, atropine should be administered until secretions dry. Adequate ventilation is paramount in these patients because respiratory distress is common and is primary cause of mortality in critical cases. Continuous pulse oximetry, antidote administration, mechanical ventilation and admission to an intensive care unit are essential to proper management. Cardiac monitoring during atropine administration is indicated. Frequent suctioning of the airway along with chest physiotherapy is usually necessary until the patient is adequately atropinized. Endotracheal intubation is often necessary in severe poisoning because of secretions, decreased level of consciousness, or weakness of the respiratory muscles. [4]

Prolonged treatment with adequate respiratory care in ICU is necessary as patient goes from acute stage to intermediate syndrome. After one resolution of cholinergic effects in acute organophosphate poisoning, but before the onset of peripheral neuropathies a myasthenia like syndrome can occur, this process has been called as intermediate syndrome. [5]

Mortality percentage has been reduced due to good intensive care management (Usually these patients are mechanically ventilated with regular medical management). Routinely chest physiotherapy (CPT) is advocated to bring improvement in pulmonary and hemodynamic

parameters. Conventional CPT in the form of percussions, vibrations, postural drainage and suctioning are followed usually. The chest care of patients with OP poisoning is particularly challenging because of their inability to participate in the treatment approach. These patients will tolerate chest percussions, vibration, suctioning etc. but it may not be possible to put them in an optimum position for postural drainage.

Facilitator stimulus in the form of proprioceptive neuromuscular facilitation (PNF) respiration is adopted to produce reflex respiratory movement responses. It alters the rate and depth of breathing, improving the compliance and hemodynamic. PNF techniques are externally applied proprioceptive and tactile stimuli that produce reflex respiratory movement responses that appear to alter the rate and depth of breathing. Peri oral stimulation, vertebral pressure (upper and lower thoracic spines), co-contraction of abdomen are the few PNF techniques routinely used. PNF is usually given with CPT when the patient is unconscious and uncooperative in the active CPT procedure. Studies have revealed that patients with myotonic dystrophy improved their lung functions after PNF with staged basal expansion. SpO₂ levels showed significant improvement. [6] But there are no studies supporting OP poisoning and PNF. Hence

the need for the study is to determine the significance of PNF with conventional chest physiotherapy in patients with OP poisoning during the acute management period.

MATERIALS & METHOD

An interventional study on a convenience sample of 30 patients was done in this study. The source of data were the patients admitted with history of OP poisoning on ventilator in the Intensive Care Unit (ICU).

This study was commenced by January 2013 and completed by August 2013.

The sample size was 30. Both males and females, between 20-40 years of age, with the history of OP poisoning and within 48 hours of Endotracheal intubation and ventilation were selected for the study. Patients with fracture rib/vertebrae [in case of associated injuries] and Chronic obstructive pulmonary diseases were excluded from the study. The hospital ethical clearance committee granted the ethical approval for the study. The study design was Interventional study and, an informed consent was taken from the patient attenders after explaining them about the purpose of the study patients who met inclusion criteria.

At first values of compliance, minute ventilation, saturation of oxygen, heart rate, and blood pressure were recorded from ventilator monitors (i.e. values of pre CPT). After chest assessment patient was subjected to conventional CPT (Vibrations, percussions, postural drainage and suctioning if indicated) according to requirements, immediately post CPT values of Compliance, SpO₂, VE, HR, and BP were recorded from ventilator monitors. After recording the values 3 minutes rest was given. Then patient was administered PNF techniques of perioral stimulation, vertebral pressure (upper and lower thoracic spines) and co-contraction of abdomen. Each technique was repeated 5 times in supine lying position with 10 seconds of stimulus pressure and 10 seconds of rest. Post PNF values of Compliance, V_E, SpO₂, BP, and HR were recorded from ventilator monitors.

RESULTS

The repeated Measures ANOVA has been used to find the significance of Pulmonary and hemodynamic parameter values between pre CPT -Post CPT-Post PNF. Statistical software namely SPSS 11.0 were used for the analysis of

the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Table 1 & 2 shows that pulmonary and hemodynamic parameter values were significantly improved post CPT. several previous studies also have revealed the same. Compliance did improve from 84.80+ 10.64 to 85.53+10.85, but is not of clinical significance. P = 0.310 shows no statistical significance. Similarly minute ventilation, systolic and diastolic blood pressure variations are not clinically significant though statistically significant (P<0.001). SpO₂ did not alter through out the study

DISCUSSIONS

Significance of CPT was proven by many clinical trials in ventilated and non-ventilated patients. Percussions, Vibrations and postural drainage help in better mucociliary transport. Post CPT pulmonary and hemodynamic parameter values were significantly enhanced. Compliance, minute ventilation, saturation of oxygen, blood pressure and heart rate are valid and reliable tools in understanding the mechanics of lungs and heart. [8,9]

Drawing the inference from statistical analysis, according to Table 1 values of compliance were drastically enhanced from 62.70±10.34 to 84.80±10.64 post CPT. And after PNF techniques values were 85.53 + 10.85, increasing marginally. Post CPT values increased due to secretion clearance. Post PNF, values did not increase significantly as OP compounds are Acetyl cholinesterase inhibitors and block neuromuscular transmission and techniques of PNF act on intact peripheral neuromuscular pathways. Table 2 shows that there was no statistical significance between post CPT and post PNF values of compliance (p = 0.310 and t = 1.034)

According to Table 1 values of minute ventilation improved from 12 + 1.79 to 14.56 + 1.19 post

CPT and post PNF reduced to 13.94 ± 1.28 . Minute ventilation improved post CPT due to secretion clearance. Post PNF values did not increase as OP compounds block peripheral neuromuscular pathways only. Rate of respiration increases temporarily due to the effects of vibrations percussion etc. A value of minute ventilation depends on tidal volume and respiratory rate. As respiration rate increases minute ventilation increases. The moment these procedures are with drawn slowly respiration rate also reduces thus reducing minute ventilation marginally.

Table 2 shows high statistical significance when post CPT and post PNF values were compared ($t = 6.005$ and $p < 0.001$).

According to Table 1 SpO_2 did not alter after CPT or PNF. Recorded values remained at 100%.

The reason for this result could be due to high levels of supplied oxygen concentration, which was used, in acute OP poisoning management.

According to Table 1 & 2 SBP was increased from 132.03 ± 7.34 to 138.18 ± 6.59 Post CPT, Post PNF decreased to 134.73 ± 7.11 . Similarly DBP increased from 85.70 ± 6.74 to 88.37 ± 8.76 post CPT and decreased to 86.86 ± 7.49 post PNF. Post CPT values increased due to CPT maneuvers and secretion clearance. There was decrease in post PNF values. Values of SBP show high statistical significance ($t = 7.409$ & $p < 0.001$). Similarly values of DBP shows statistical significance ($t = 2.892$ & $p < 0.001$). According to the results variations of blood pressure are seen in patients and also in normal individuals, which is within normal limits.

According to Table 1 & 2 heart rate was increased from 123.05 ± 8.19 to 128.70 ± 8.79 post CPT and decreased to 124.93 ± 8.83 post PNF. $P < 0.001$ and $t (= 10.344)$ values show high statistical significance. Heart rates were at higher

limits due to atropinization. Post CPT values increased due to CPT maneuvers for a brief period of time. And post PNF values were decreased. Variation in heart rate was due to atropinization and CPT maneuvers, which was in considerable therapeutic limits.

Overall, when parameters were compared post CPT to post PNF there was no significant improvement in values.

OP compounds being Acetyl cholinesterase inhibitors block neuromuscular transmission. These compounds cause acute CNS toxicity, which results in respiratory failure. The intermediate area of the ventral surface of the medulla oblongata appears to be the most sensitive site for CNS depression. PNF acts on intact peripheral neuromuscular pathways. PNF did not contribute because of impaired peripheral and central neuromuscular pathways. This is the reason why PNF did not contribute its role in acute OP poisonings.

Values of Parameters did not alter significantly with PNF. From this study it was understood that PNF is not an adjunct to improve hemodynamic as well as pulmonary parameter values, in OP poisoning acute management period. Hence we concluded from our study that PNF techniques did not enhance significantly post CPT pulmonary and hemodynamic parameter values in mechanically ventilated OP poisoning patients during acute management period. The limitation of our study was that different brands of OP pesticides have variable concentrations and toxicities. Toxicity in humans depends on amount and duration of consumption. Eliciting it would have given better predictors in assessing patient. Future studies in the form of a specific acute management program in acute toxicity and a major long-term health rehabilitation program for organophosphate-induced delayed neurotoxicity could be focused.

Table 1 : Clinical values of Pre CPT, Post CPT and Post PNF.

Parameters	Pre CPT (Mean \pm SD)	Post-CPT (Mean \pm SD)	Post PNF (Mean \pm SD)
Compliance(C) (ml/cm H ₂ O)	62.70 \pm 10.34	84.80 \pm 10.64	85.53 \pm 10.85
Minute Ventilation (V _E) (lts/min)	12.00 \pm 1.79	14.56 \pm 1.19	13.94 \pm 1.28
Saturation of O ₂ (SpO ₂)(%)	100.00	100.00	100.00
Systolic Blood pressure (SBP) (mmHg)	132.03 \pm 7.34	138.13 \pm 6.59	134.73 \pm 7.11
Diastolic Blood Pressure (DBP) (mmHg)	85.70 \pm 6.74	88.37 \pm 8.76	86.80 \pm 7.49
Heart Rate (HR) (Beats/min)	123.03 \pm 8.19	128.70 \pm 8.79	124.93 \pm 8.83

TABLE 2 : Comparison of Post CPT and Post PNF parameters using student ‘t’ test

Parameters	Post CPT (Mean \pm SD)	Post PNF (Mean \pm SD)	Significance by Student t
C	84.80 \pm 10.64	85.53 \pm 10.85	t=1.034 P=0.310
V _E	14.56 \pm 1.18	13.94 \pm 1.28	t=6.005 P<0.001
SpO ₂	100.00	100.00	-
SBP	138.13 \pm 6.59	134.73 \pm 7.11	t=7.409 P<0.001
DBP	88.37 \pm 8.76	86.80 \pm 7.49	t=2.892 P<0.001
HR	128.70 \pm 8.79	124.93 \pm 8.83	t=10.344 P<0.001

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Date of submission: 29 December 2013

Date of Provisional acceptance: 08 January 2014

Date of Final acceptance: 12 February 2014

Date of Publication: 04 March 2014

Source of support: Nil; Conflict of Interest: Nil