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NURSES'KNOWLEDGE AND PRACTICE TOWARDS HIGH FREQUENCY OSCILLATORY VENTILATION IN PEDIATRIC INTENSIVE CARE UNIT

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Abstract

High frequency oscillatory ventilation is considered one of the advanced modes of mechanical ventilation which is used for lung recruitment, avoids over distention, and does not rely on bulk flow for oxygenation and ventilation. **This study Aimed** to evaluate nurse's knowledge and practice about high frequency oscillatory ventilation in pediatric intensive care unit . **Design:** quasi experimental design was conducted on a sample of 54 nurse working in pediatric intensive care unit at Mansoura University Children Hospital. **Data collection Tools :**Two tools were used for data collection including questionnaire to evaluate nurse's knowledge about mechanical ventilation and high frequency oscillatory ventilation pre and post intervention, the second tool was an observational checklist to evaluate nurse's practice with high frequency oscillatory ventilation pre and post intervention. **Results:** more than half of the studied nurses had poor knowledge & the majority of them had poor practice about high frequency oscillatory ventilation pre intervention while post intervention both knowledge and practice was improved .Also, the studied nurses ' knowledge was affected by their experience and educational level. .**Conclusion** : all nurses had poor knowledge and practice pre intervention about high frequency oscillatory ventilation but improved after taking the course about high frequency oscillatory ventilation to be fifty four percent for knowledge &ninty eight percent for practice)**Recommendations:** it is recommended that continuous health educational program for all nurses about high frequency oscillatory ventilation and any new machines to improve their knowledge , practices and facilitate their dealing with the pediatric patient patients .

Key Words: Pediatric Intensive Care Unit , High frequency Oscillatory Ventilation, Knowledge, Practice

Introduction:

Many modes used in mechanical ventilation according child status as Pressure-cycled ventilation (PCV), pressure support ventilation (PSV), and several noninvasive modalities which used by a tight-fitting face mask. In these modes the ventilator delivers a set inspiratory pressure , tidal volume varies based on the responding and resistance of the respiratory system. Respiratory system mechanism changes can results in changes in minute ventilation, because it controls the distending pressure of the lungs, this mode can useful in patients with acute respiratory distress syndrome (ARDS**)(Chatburn , Volsko , Hazy , Harris , and Sanders ,2011) .**

High-frequency oscillatory ventilation (HFOV) may be used in ventilation to reduce ventilator-associated lung injury, prevent inspiratory pressures of high peak , then avoid over distension at the end of expiration, avoids occurrence of recruitment and de-recruitment of alveoli for un healthy lung. Also, HFOV may be used in pediatric as in diffuse alveolar disease cases (DAD) Optimal using of high frequency oscillatory ventilation needs good assessment between the patient's pathophysiology status and machine factors to maintain the lung healthy .The appropriate using of HFOV will be illustrated when many trials are done that both early intervention and lung recruitment help lung that lung on the deflation limb of its pressure volume relationship , these trials compare of pressure volume relationship, and comparing HFOV with other ventilation that help as lung-protective**(Pinzon,,Rocha, Ricachinevsky , Piva, et al ,2013)**.

The nurse should be knowledgeable of the possible complications, predict and prevents problems, identify early signs of complications and initiates proper intervention. The nursing role begin when connect pediatric patient with an oscillator, the sight of child patient who connected with HFOV can be disturbing for the family of him so, the nurse should provide adequate information to the patient' s family after a patient has been connected to the oscillator machine, monitoring of the patient for equal and continuous chest vibrations should be performed, which known as the chest wiggle **Şebnem , İsmet , Elem , Leyla, 2011).** The child should be take sedation or muscles paralyzed before starting HFOV to get a baseline and then to follow the patient condition which connected with HFOV . Gastric feeding should be continued by inserting small bowel feeding tube **.**Chest x ray should be taken one hour after HFOV initiation, then every 12hours then every 24 hours and as doctor order. Blood gases should be taken after one hour of connecting with HFOV , then every two hours then every eight hours for the next sixteen hours and with parameters change or change in patient status. Child need an adequate preload, so the blood pressure should be maintained when starting HFOV by trying to keep CVP >12 (**Santschi, Jouvet, Leclerc, Gauvin, Newth, Carroll et al ,2010).**

Proper management of ARDS wanted a good plan to maintain opening of the lungs, HFOV may help in reducing of inflammatory mediators in broncho alveolar samples. When need to maintain adequate alveolar ventilation, should use low MAP and pressure amplitude at low levels to avoid pulmonary over distension or atelectasia ARDS patients **(Faqih, Qbba'h, and,Rihani,2012).** the use of HFOV is attractive for ARDS**..** It can be used in Pneumothorax, mediastinal emphysema and pulmonary interstitial air, HFOV may be used in children especially with asthma and bronchiolitis, it may be effective with Pulmonary edema and postoperative heart patients **(Ghonimat, Yamani, Sultan, 2012).**

Aim of the study:

Evaluate nurses' Knowledge and Practice towards pediatric patients on High Frequency Oscillatory Ventilation (HFOV) in Pediatric Intensive Care Unit (PICU).

Research Hypotheses:

Pediatric nurses will have better knowledge about High Frequency Oscillatory Ventilation after the intervention than before.

Pediatric will have satisfactory practice regarding care of pediatric patients on high frequency oscillatory ventilation after the intervention than before.

Subjects and Method:

Design:

Quasi experimental design(pre and post test)was used in carrying out this study.

Setting: This study was carried out at Pediatric Medical Intensive Care Unit at Mansoura University Children's Hospital (MUCH).

Subjects: A convenience sample of nurses (54) working at the bove mentioned setting who were providing care for children receiving mechanical ventilation regardless of their age and qualification or years of experience.

Tools of Data Collection:

Tool I- A structured interview questionnaire sheet :

It was developed by the researcher after reviewing the related literatures in English language it will included three parts:

Part I: Characteristics of the studied nurses such as: Nurse`s age, educational level, years of experience in Pediatric Intensive Care Unit , Job, training courses about high frequency oscillatory ventilation , have private work .

Part II: Nurse's knowledge about Mechanical Ventilation such as:
(Definition, Modes,Indications, Complicationsof mechanical Ventilation, and routine nursing care for pediatric patient on mechanical ventilation)

Part III: Nurse's knowledge about High Frequency Oscillatory Ventilation such as (Definition , Indications, Mechanism of HFOV Contraindications, Complications of HFOV , weaning , Nursing care towards patient on HFOV and how to deal with patient) .

Tool II: Observational Checklists to evaluate nurse's practice about care of pediatric patient on High Frequency Oscillatory Ventilation

a- Preparing and connecting child on HFOV(16 items).

b-Care provided during pediatric patient connection to HFOV(9 items).

c-weaning and care after disconnection from HFOV(5 items)..

1-Scoring system for nurse's knowledge about mechanical ventilation : For each question the total marks were 48 marks

2-Scoring system for nurse's knowledge about high frequency oscillatory ventilation total marks were 45 marks

3-Total nurses' knowledge about mechanical ventilation and high frequency oscillatory ventilation score(93 marks) were classified into:

Good knowledge score :≥ 75%

Average knowledge score: 50<75%

Poor knowledge score: < 50%

3-Scoring system for observational checklist for PICU nurses about high frequency oscillatory ventilation:

One score was given to done completely, zero was given to not done The total marks were 30 marks.

Total nurses' practice regarding high frequency oscillatory ventilation score was classified into:

Competent nurses' practices score ≥65%

Incomptent nurses' practices score < 65%

Methods:

- Official permission was obtained from the administrator of the Pediatric Intensive Care Unit in MUCH.
- Actual official permission; including an ethical committee of the Faculty of the Nursing Mansoura University to get an approval for conducting the study.
- The tools were tested for its content validity by five experts in the field of the study before its implementation , by a panel of 5 experts in the field of PICU medical and nursing for its clarity, content and sequence of items.
- Observational checklist was done with some modifications which it was standardized checklist for Care fusion 3100A. The internal consistency of the developed tool was tested by using Cronbach's alpha coefficient test r was 0.73 for tool I, and r was 0.78

for tool II.

- Informed oral consent was obtained from each nurse after explaining the aim of the study.
- Confidentiality of data and anonymity as well as nurses' right to withdraw from the study at any time was ascertained
- Withdraw at any stage freely without any responsibilities
- Each nurse was interviewed before applying the educational guidelines in order to collect nurse's data using the study tool (I) part (1).
- Assessmentof nurse's knowledge about mechanical ventilation and high frequency oscillatory ventilation tool (1) part (II,III).
- Assessment of nurse's practice about high frequency oscillatory ventilation.
- Every nurse was interviewed individually by the researcher to collect the necessary data. The researcher was available four days per week and the duration of each interview lasted from 20-25 minute.
- The guiding booklet was prepared by the researcher, it was specially designed in a simple arabic language to meet nurse's practical needs and In this phase, The educational sessions was performed through 4 sessions for theory and practice. Every session consumed one hour in a group of 10 nurses in Pediatric Intensive Care Unit using different teaching methods .
- knowledge deficits regarding high frequency oscillatory ventilation.

Statistical analysis: Data were collected, then entered, processed, and analyzed using SPSS software (version 17.0). **Data were presented in tables and graphs as frequencies and percentages.**Non-parametric Wilcoxon signed ranks test if not. One-sample t-test was used to compare a mean against a hypothetical value while its alternative nonparametric one-sample Wilcoxon signed ranks test was used to compare a median against a hypothetical**valuZWilcoxon.Quantative data for two groups were compared using independent samples t- test if normallydistributed.Linear relationship between variables was done using Sperman's correlation. A significant finding indicated when the P value <0.05 .**

Results

Characteristics of the studied nurses in PICU are clarified in table (1). It was observed from this table that, half of female studied nurses (50 %) were in the age group from 31- 36 years, while, the minority of them (18%)was in the age group from more than 36 years to 40 years. Regarding nurses' educational level, the current study revealed that, more than two thirds of nurses (70%) were Bachelor degree of nursing. While, (25%) of the other nurses had diploma certificate. Concerning the years of experience, the current study showed that, less than quarter (18.5%) had 10 years of experience while, the majority (81.5 %) had 10 years and more of experience. In addition, all of the studied of studied nurses didn't receive any training program about high frequency oscillatory ventilation as knowledge or practice .

The table(2) It was cleared that, about approximately three fourth of the nurses (74.07%) had poor knowledge score pre intervention and post intervention, the percentage become the majority of them as revealed by (81.48%). Statistical significant differences were found between nurses' knowledge pre and post the intervention.

It was revealed from this table(3) that, there was an extremely statistical significant difference between the level of total nurses practice pre / post the intervention . It was noted that, none of the nurses had "competent" practices score (0.0%) before course But, post the

intervention approximately all of them had competent practice score (98.14%) . Thistable (4)revealed that only experience has effect on nurses knowledge after the intervention and had statistical significant while the other characteristics haven't statistical significance This table (5)was clarified that, there was a positive correlation between nurses' knowledge and practice about HFOV post intervention.

Table (1) Characteristics of the studied nurses in percentage distribution

Nurse's characteristics		**No=54**	
		No.	**%**
Age in years	20 - 30ys	10	18.52
	31-36ys	27	50
	37-40ys	17	31.48
	Mean ± SD = 33.37 ± 5.04		
Educational level	Diploma	14	25.92
	BSc	40	74.07
Job	Head Nurse	2	3.70
	Bed side Nurse	52	96.30
Experience	Less than 10 years	10	18.5
	10 years and more	44	81.5

Table (2) Total nurse's knowledge about mechanical ventilation and high frequency oscillatory ventilation pre and post intervention.

	pre Intervention		**Post Intervention**		**Test of Significance**
	N0 (54)	**%**	**NO(54)**	**%**	**P**
Good	0	0	44	81.48	0.002**
Average	14	25.92	10	18.51	
Poor	40	74.07	0	0	

Table (3): Percentage distribution of total level of nurses' practice regarding care of pediatric patient on HFOV pre and post the intervention

Practice level	**Pre intervention**		**Post intervention**		**P**
	NO	**%**	**NO**	**%**	
Competent	0	0	53	98.14	≤**0.000 ****
Un competent	0	0	1	1.85	

Table (4) Relationship between total nurse's knowledge about mechanical ventilation and high frequency oscillatory ventilation pre and post the intervention and their characteristics

variables	Total nurses 'knowledge pre intervention			Total nurses' knowledge Post intervention		
	Score (Median)	**Z1**	**P1**	**Score (Median)**	**Z2**	**P2**
Age <35 years >35 years	42.49 (0 - 57.44) 37.76 (14.89- 51.06)	1.89	0.059	86.16(68-100) 85.1 (68-100)	0.472	0.637
Educational level Diploma Baccalaureate	38.29 (0- 51) 40.42 (0- 57.44)	1.45	0.146	79.78 (68- 100) 86.17 (0-57)	1.58	0.113
Experience <_10 years >10 years	37.23 (0- 57) 39.36 (14.89-55.31)	0.915	0.360	78.72 (68.08-94) 87.23 (14.89-55.31)	2.31	***** **0.02**

Table (5) Correlation between knowledge and practice about HFOV among the studied nurses post intervention.

Items	Nurses' knowledge about HFOV post intervention.	
	R	P
Nurses' practice about HFOV post intervention	**0.624**	**0.000****

Discussion

The findings of the current study revealed that nurses' knowledge about mechanical ventilation was good in less than half of them pre intervention , but post intervention it improved to be approximately three quarter .Also the current study revealed that , nurses' knowledge about high frequency oscillatory ventilation pre intervention was poor because they haven't receive courses about it before , but post intervention it improved to be more than half of them good and less than half of them had average knowledge , this showed the effect of educational sessions . Finally total knowledge of mechanical ventilation and high frequency oscillatory ventilation improved post intervention and the majority of the studied nurses had good knowledge.

The current results showed that , high frequency oscillatory ventilation was new machine in the PICU, and nurses in PICU havn't previous knowledge and training about it so, they can't deal with it without having any course .The findings of current study revealed that, approximately three fourths of PICU nurses have poor knowledge ,and quarter of them had average knowledge about mechanical ventilation before course. This result was in contrast with **Fathimath, George, Thomas, Chacko, Jithu, et al. (2013)**, who stated that , in assessment of knowledge regarding mechanical ventilation among staff nurses working in selected hospitals, mangalore with a view to develop an

information pamphlet that their study revealed that more than half of the studied nurses were having poor knowledge, more

than quarter of them having average knowledge and only few of them have good knowledge. This study revealed that there was a positive correlation between knowledge and
practice of the studied nurses, as when give an adeqate knowledge , practice should improved after that ,this finding was agree with **Rahul Pandit, (2013)** who revealed that there is a positive correlation and marked relationship between knowledge and practices of nurses in his study effectiveness of self instructional module on knowledge and practice of nurses regarding care of the patient on mechanical ventilator.

The findings of the current study revealed that more than the three quarter of the studied nurses had experience in PICU about (10 years and more), most of them aged from (31-36) years and they aren't attend any program about mechanical ventilation, this findings in contrast with the study by **Mohamed , Afaf (2017)** in her study Effect of Training Program on Nurses' Knowledge and Skills Regarding Mechanical Ventilation Coreat Khartoum State , who revealed that , the three quarter of the staff nurses were Bachelor , quarter of them Diploma holder , the majority of them were not trained and more than third of them had experience of one year or less, but her study in agreement of the current study as there was association between both knowledge and practice and their qualification , year of experience and training .

The current study clarified that , all of the studied nurses didn't receive training courses about mechanical ventilation and their knowledge and practice improved after this course this findings was in contrast with **Guilhermino,Inder,Sundin, Kuzmiuk (2014)** who revealed that ,the majority of intensive care unit nurses improved their knowledge and more than half of them reported that they didn't receive education about mechanical ventilation prior to working in Intensive Care Unit as in the study of Education of ICU nurses regarding invasive mechanical ventilation.

The current study clarified that continuous program for PICU nurses improved their knowledge and practice regarding this was in agreement with **Raiju, Gireesh, Sachina, Barnes, (2015)** who showed in their study the effectiveness of structured teaching programme on knowledge regarding modes of mechanical ventilator among staff nurses at a selected hospital, Bangalore

This study revealed that, all nurses work in Mansoura PICU haven't courses about high frequency oscillatory ventilation before intervention. So, they didn't answer any question about it and cant' deal with it before intervention, then after intervention their knowledge and practice improved.

Conclusion

Based on the findings of the current study , the study concluded that, nurses' knowledge and practice about mechanical ventilation and high frequency oscillatory ventilation in PICU were improved immediately after the course than before. In addition, after this course PICU nurses have not problem in dealing with the new machine of high frequency oscillatory ventilation and give good care of children connected with it.

Recommendations

- Good management strategies for nursing care of child on mechanical ventilation and high frequency oscillatory ventilation in PICU to improve the pediatric patient out come.
- Training program and refreshing courses concerned with evidence-based guidelines for prevention of infection has to be conducted periodically to nurses working in PICU.
- Nurses'working in PICU must be

qualified and had baccleor degree

Limitation of the study:

- High frequency oscillatory ventilator is new machine in PICU in Mansoura, so the researcher found some problems to encourage nurses to know about it and how to use the given knowledge in dealing with pediatric patient connected with it.
- Deficit of children cases with ARDS who need High Frequency Oscillatory Ventilation
- Shortage of references about nursing care of pediatric patient conncted with high frequency oscillatory ventilation that help researcher

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