

Effect of Teaching Program on Nurses' Knowledge and Skills And Development Of Abdominal Compartment Syndrome Among Intensive Care Patients

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Abstract

Background: Of the life-threatening conditions for critically ill patients are to have intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS). Teaching of nurses is the first line of defense that benefits patients and prevent access to complications. **Aim:** This paper was aimed to evaluate the effect of teaching program about ACS on (1) nurses' knowledge and skills and (2) development of ACS among critically ill patients. **Design and methods:** A quasi experimental research design was used. Convenience sampling of 32 nurses working in General and Trauma ICUs and two groups of patients (pre-teaching patients =20) and (post teaching patients=25) were included in the study. All nurses were evaluated pre and post teach program for their knowledge and skills. Along with, all patients were evaluated for development of acute compartment syndrome for two consecutive months. The study took approximately eight months. **Results:** nurses' knowledge and skills about ACS improved significantly after implementing teaching program ($p < 0.001$). Development of ACS was identified in 20% of pre-teaching patients versus none of post teaching patients. Mean score of IAP was significantly higher among pre-teaching than post teaching patients on fifth day ($p = 0.003^{**}$). **Conclusion:** teaching is important to clarify, remind, and master nurses' knowledge and skills. Highlighting the importance of monitoring IAP of most vulnerable patients help to early detection of IAH and prevent access to ACS.

Keywords: abdominal Compartment Syndrome; intra-abdominal pressure, nurses' knowledge.

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I Introduction

Despite the importance of monitoring the intra-abdominal pressure (IAP) because of its dramatic effect if it rises on the rest of the organs, still research prove that IAP is neglected or not a priority in intensive care units. A research published in 2017 concluded that critical care clinicians' knowledge about IAH, ACS and its outcome is generally low and required teaching (Hunt et al, 2017). Moreover, expanding the research about IAP along with management of intensive patients indicates that IAH and ACS can not be developed if detected early among the high vulnerable patients (Kirkpatrick et al, 2013).

Abdominal Compartment Syndrome (ACS) occur in intra-abdominal pressure (IAP) of 20 mmHg or plus associated with new organ dysfunction or failure (with or without an abdominal perfusion pressure (APP) of < 60 mmHg). Intra-abdominal hypertension (IAH) is a sustained or repeated pathological elevation in IAP of 12 mmHg or greater. The incidence of IAH among critically ill is reported to be half of ICU admitted patients, of these 50%, 32.1% develop IAH and 4.2% develop ACS within their first day of ICU (Inal et al., 2011; Newcombe, Mathur, & Ejike, 2012).

Elevated pressure intra-abdomen can threaten the perfusion and thus sustainability of organs in the abdominal compartment. Increased attention for IAH/ACS is also due to advance the diagnostic interventions and changing treatment algorism in patients with traumatic injury and critically ill patients. There are still barriers to

adoption of systematic screening and monitoring practices even with increased awareness and guidance recommendations (Balogh & Leppäniemi, 2009; Murcia-Sáez et al., 2010).

The significance of nurses' role among the health team has been established in all hospitals. Advancing the nursing care in ICU requires continuous in-service education. This education must be planned based on nurses' prerequisites of knowledge and skills (Geravandi et al., 2018). The Nursing Code of Ethics and Nurses Code of Conduct support the concept that knowledge and continuing education are both legal and ethical requirements for nurses. Nurses need continuous professional development to maintain, improve, and broaden their professional knowledge, expertise and competence to meet their obligation to provide ethical, effective, safe and competent practice (Nurses and Midwifery Board Australia, 2016)

Early recognition of IAH is cornerstone in the prevention of ACS and needs close assessment of IAP in high risk patients. Critical care nurses (CCN) who providing a direct patient care are often responsible for serial of IAP monitoring through constant observation and recognition of subtle and dynamic changes in the status of intensive care patients. Therefore, CCN should able to identify and recognize the concept of IAP, IAH and ACS and their clinical effect on patients and guidelines which needed to identify and manage these conditions (Newcombe et al., 2012).

As mentioned earlier there is also research showing that there is a lack of awareness of nurses in identifying high risk patients, clinical signs of IAH/ACS (Cheatham M L, 2009) . Additionally, the early detection of intra-abdominal hypertension will lead to early treatment and prevention of ACS or multi-organ system dysfunction (Saggi et al., 1998; Ivatury et al., 2000). Therefore, critical care nurses must have knowledge and skills about IAH and ACS and their clinical implication on critically ill patients.

II Research Objectives:

- Evaluate the effect of teaching program on the nurses' knowledge and skills regarding abdominal compartment syndrome.
- Evaluate the effect of the teaching program on the development of abdominal compartment syndrome among critically ill patients.

III Research Hypothesis

- 1- Nurses' knowledge and skills increase significantly post-teaching program about IAH and ACS than pre-program.
- 2- Intensive care patients demonstrate lower development of ACS post-nurses teaching program than pre-nurses teaching program.

IV Subjects And Methods

Design: A quasi experimental pre -post-test research design was applied in this study.

Study variables:

The independent variable in this study was the teaching program while the dependent variables were nurses' knowledge and skills, and the development of ACS among intensive care patients.

Setting: the study was conducted in General and Trauma ICUs at Assiut University Hospitals. In these settings, IAP didn't measure routinely for patients.

Subjects:

- 1- All critical care nurses (32 nurse) who provide direct patient care, one year of ICU experience, approve to participate and complete the teaching program were included as pre-teach group and post-teach group of the study.
- 2- A convenience sampling of 45 adult intensive care patients who met all inclusion measures were included in the study. The subjects were alienated into two groups:
 - a. Pre-teach group (control group): it consisted of intensive care patients who admitted patients for three consecutive months before implementation of the teaching program (n=20).
 - b. Post-teach group (study group): it consisted of intensive care patients who admitted for three months after implementation of the teaching program (n=25).
- 3- **Inclusion Criteria** are :(1) Age >18 years old; (2) Mechanically ventilated patient.; (3) Have indwelling urine catheter in place; (4) length of ICU stay \geq 5 days.
- 4- **Exclusion Criteria** are patients with bladder abnormalities, neurogenic bladder, pelvic trauma, and pelvic hematomas (**Figure .1**)

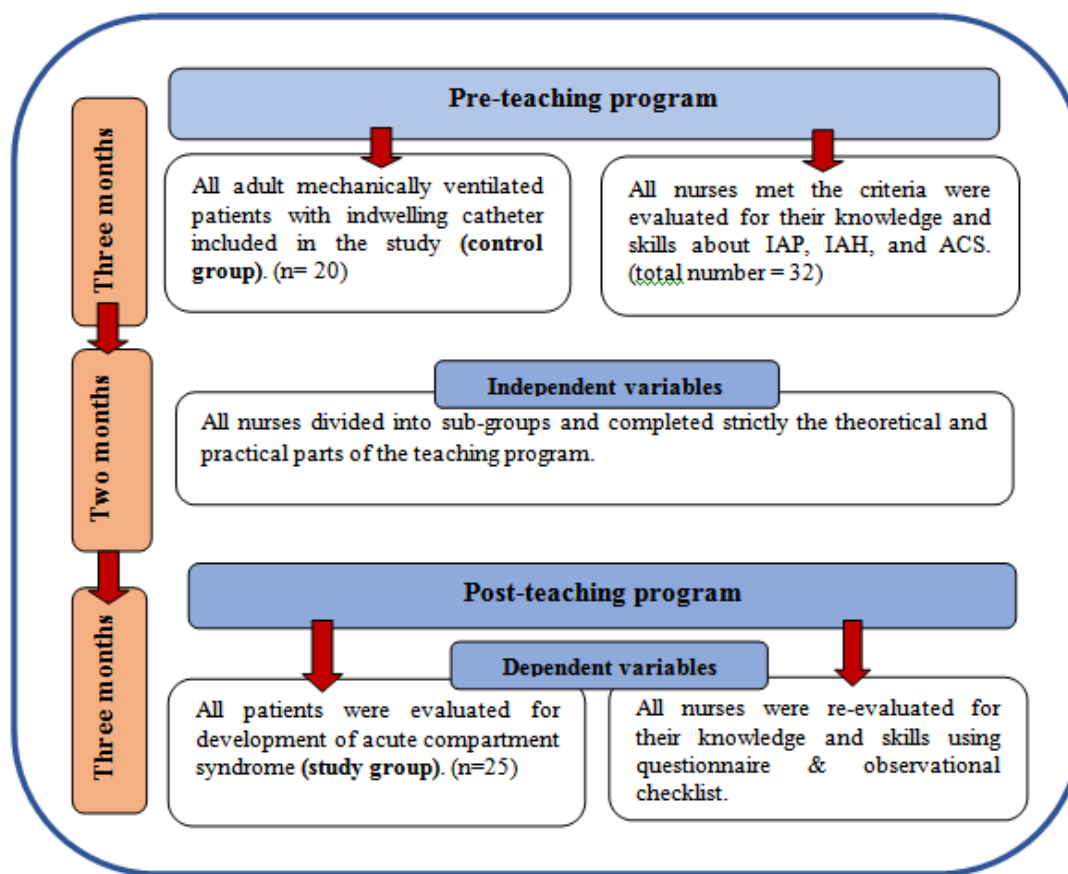


Figure (1) the pathway of the study

Tools: three tools were formulated and utilized in this study.

- **Tool I: nurses' knowledge questionnaire** to evaluate the nurses' knowledge pre and post the teaching program. Twenty-five closed end questions were designed to explore nurses' knowledge about definitions, values and grading of IAH, APP and ACS (6 questions), clinical signs and risk factors of IAP and ACS (5 questions), effect of IAH and ACS (5 questions), methods of measuring IAP (3 questions), nursing care (3 questions), and management algorithm (3 questions).

- **Tool II: intra-abdominal pressure observation checklist** to evaluate the nurses' skills of measuring IAP using urinary catheter pre and post the teaching program. World Society of abdominal Compartment Syndrome (WSACS) considered the trans-bladder pressure measurement the gold standard for assessing IAH (Kirkpatrick et al., 2013)..

- **Tool III: patient assessment tool.** This tool was used to assess patients on admission for one week from their admission to identify the IAP and the development of ACS and management algorithm (**see the appendix**). In addition to patient's profile, clinical data medical diagnosis, duration of mechanical ventilation, and length of ICU stay.

- **Scoring system:** Nurses who achieved a score of 80% or above in knowledge questionnaire were judged as correct, while those whose achievements were below 80% were scored as incorrect. Regards nurses' skills, the score of 75% or plus were considered good, 74-60 % were considered fair, and below than 60% were considered poor.

Data collection period:

- The study took approximately eight months. The pre-teaching period was from October 2015 to December 2015 (three months), teaching period was from January to February 2016 (two months) and the post-teaching period was from March to May 2016 (three months).

Procedure:

- An official Permission to conduct the study was obtained from the hospital responsible authorities in the anesthesiology department, General ICU and trauma ICU after explaining the objectives and nature of the study.

- An approval was obtained from the Human Ethics Committee at Faculty of Nursing, Assiut University. and the study was followed the common ethical principles in clinical research.
- The tools used in this study were developed by the researcher based on reviewing the relevant literature (Cheatham M L, 2009) , (Hunt, L., Frost, S. A, 2014), (Rogers W, and Luis Garcia, 2018), (Kirkpatrick et al., 2013)..
- **Content validity:** The tools were tested for content related validity by jury of 3 specialists in the field of critical care nursing and anesthesiology from Assiut University, and the necessary modifications were done regarding Arabic translation of questions.
- **A pilot study** was conducted on 3 nurses and 3 patients from other critical care units and not included in the study to test the feasibility and applicability of the tools. The analysis of the pilot study revealed that minimal modifications are required related to phrases of questions. These necessary modifications were done, and the pilot study subjects were excluded from the actual study.
- **Ethical considerations:** Informed consent was obtained from nurses, and each patient or from the responsible person for the unconscious patients. The researcher emphasized that the participation is voluntary, and the confidentiality and anonymity of the subjects was assured through coding the data. Subjects were also assured that can they withdraw from the study at any time without any rational.
- **Teaching program** was developed by the researchers based on literature review and the pre-teaching evaluation for nurses. The program was carried out in the teaching class room in ICU. All nurses divided into subgroups and completed strictly the theoretical and practical parts of the teaching program.
- The program consisted of three sessions for three consecutive days for each subgroup. Every session took approximately one hour. a) Session one of program comprised of the objectives of the research study, introduction about intensive care patients, definitions of IAP, IAH and ACS, causes, and risk factors of IAH and ACS, clinical signs of IAH and ACS, methods of measuring IAP. b) Session two of the program consisted of IAP measuring technique using urinary catheter, nursing care and management algorism for IAH and ACS. c) Session three involved the redemonstrations of IAP measuring and summary of the teaching program.
- **Teaching methods** were using group discussion with power point media. Teaching media were hand out and demonstrative graphs.
- Post-teach: all nurses were evaluated for their knowledge and skills about IAP, IAH, and ACS. Along with, all patients were evaluated for development of acute compartment syndrome for two consecutive months using tool III.
- Each nurse was interviewed twice to evaluate their knowledge using tool 1 pre and post teaching program. An observational method was carried out individually to evaluate the nurses' skills using tool II pre and post teaching program.
- The researcher measured IAP for all patients at first, third, and fifth day of ICU admission once each day at 7 am by the same investigator to avoid inter-observer variability.
- Every patient diagnosed with IAH and ACS followed management algorithm which constituted: (1) Therapies to improve abdominal wall compliance: Consider supine position < 20°- Avoid prone position and removing constrictive dressings on the abdomen. (2) Therapies to evacuate intraluminal contents: Nasogastric/colonic decompression, Promotility agents and Enemas when not contraindicated. (3) Management of fluid: Restriction of fluids/ permissive hypotension in trauma, Negative fluid balance, Use of diuretics/albumin, Organ support and reducing capillary leak, Maintain APP >60 mmHg with vasopressors, Optimize ventilation, alveolar recruitment, and Antibiotic therapy in septic patients (Cheatham M L, 2009) & (Hunt, L., Frost, S. A, 2014) &(Rogers W, and Luis Garcia, 2018)
- The socio-demographic patient's profile and patient's clinical data; medical diagnosis, duration of mechanical ventilation, and length of ICU stay were assessed. The incidences of intra-abdominal hypertension and abdominal compartment syndrome in pre- and post-training periods were compared statistically.

Statistical analysis:

The data was summarized as frequencies, percentiles, mean and SD. For statistical analyses, Chi-Square test was used as appropriate. $P < 0.05$ was considered as statistically significant. Logistic regression analysis was conducted to assess the association between nurses' knowledge and skills.

V Results

The first formulated research hypothesis was supported as presented in the following figure (2), tables (1 and 2) and figure (3).

Figure (2) illustrates that the percentages of correct answers were higher among pre-teaching group than post teaching group.

Table (1) shows that knowledge about the definitions, values and grading of IAP, APP and IAH were good (6.3% and 81.3%) among pre and post teaching group respectively. Regarding clinical signs and risk factors of IAH & ACS, (93.8%) of nurse's responses were poor pre-teaching program, while (50 % and 37.5 %) of them were moderate and good post teaching program respectively. As regard the effect of IAH & ACS, all nurse's answers were poor pre-teaching program, versus 56.3% were good post teaching program. Moreover, none of nurse's answers about methods of measuring IAP were good pre-teaching versus 62.5% of them were good post teaching. In addition to, all nurse's answers about nursing care of IAH & ACS were poor pre-teaching, while (68.8%) of them were good post teaching. Furthermore, the nurse's answers about the management algorithm were poor (93.8%) pre-teaching program, and (56.3%) of them were good post teaching. Finally, the total nurses' knowledge considered poor among all pre-teaching group compared to 81.3% good among post teaching group. The statistical significant differences ($P < 0.001$) were found between both groups regarding all knowledge items.

Table (2) represents that the nurses' skills about preparing patients and equipment's before procedure were poor (by 65.6%) pre-teaching program and were good (by 87.5 %) post teaching program. Regarding to the skills of measuring IAP, 68.8% of pre-teaching group had poor skills and 87.5 % of post teaching group had good skills. In relation to skills of documenting and interpreting the results of IAP measurement, it was observed that (84.4%) of nurse had poor skills before the teaching program and good skills post the teaching program respectively. Statistical significant differences were found between pre-teaching and post teaching nurses regarding all total skills categories indicating that the nurses mastering the skills post teaching program.

Figure (3) represents a significant positive correlation was found between total score of nurses' knowledge and skills after teaching program ($r\text{-value}=0.781$).

Table 3 reveals that mean age of control and study groups were (54.80 ± 12.31) and (54.08 ± 11.84) respectively. Moreover, no statistical significant differences were found between both groups regards age, sex and diagnosis.

The second formulated research hypothesis was supported as presented in the following tables (4 and 5).

In table (4), on admission, sixteen of control group patients had IAH. Of those, 5 had grade III IAH (25%). While 21 of study group patients had IAH. Of those, 6 had grade III IAH (24%). **By the fifth day**, the number of control group patients with IAH increased to be 19 patients. Of those, 5 patients had grade III IAH (25%) and 4 patients had grade IV (20%) (Abdominal compartment syndrome). While the number of study group patients with IAH decreased to be 20 patients. Of those, 3 had grade III IAH (12%) and none developed abdominal compartment syndrome.

Table 5 summarize the mean & SD of IAP, the mean of IAP was (16.65 ± 3.84 & 18.05 ± 4.60) among control group and (17.24 ± 3.52 & 15.72 ± 3.78) among study group in the 1st and 3rd day respectively without statistical significant differences between both groups. By the fifth day, the mean IAP increased among control group to be 19.45 ± 5.28 and decreased among study group to be 15.24 ± 3.83 with statistical significant differences between both groups $p=0.003^{**}$.

Figure (2): Comparison between the correct answer of nurses' pre and post implementing the teaching program.

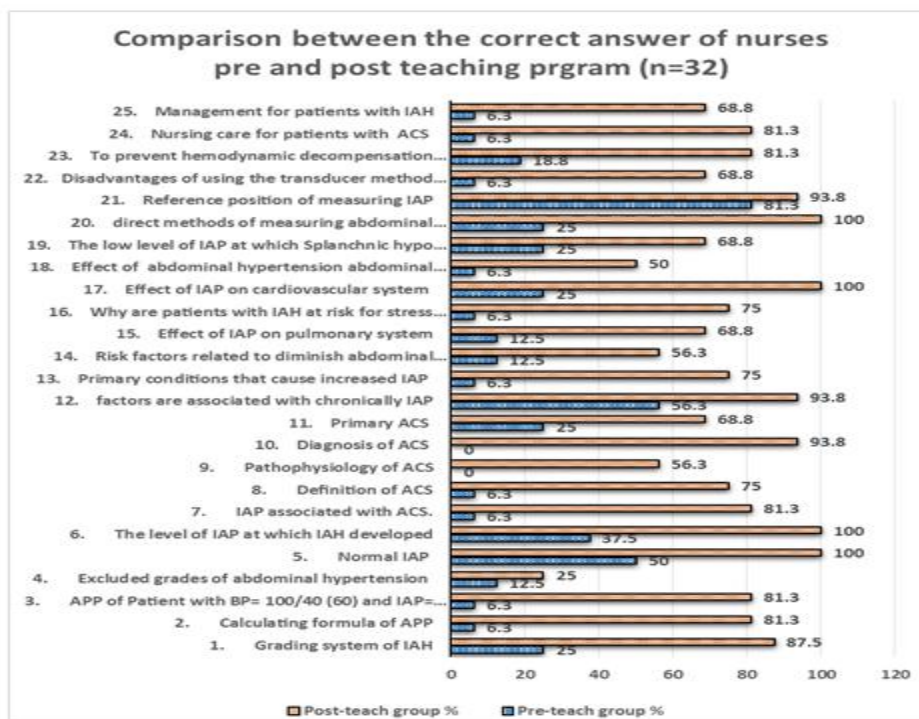


Table (1): Comparison between total nurses' knowledge pre and post implementing the teaching program about IAH & ACS.

Knowledge items	Pre-teaching group (n=32)						Post-teaching group (n=32)						P. value
	Poor		Moderate		Good		Poor		Moderate		Good		
	n.	%	n.	%	n.	%	n.	%	n.	%	n.	%	
Definitions, values and grading of IAP, APP & grades of IAH	26	81.3	4	12.5	2	6.3	2	6.3	4	12.5	26	81.3	<0.001**
Clinical signs & risk factors of IAH & ACS	30	93.8	2	6.3	0	0.0	4	12.5	16	50.0	12	37.5	<0.001**
Effect of IAH & ACS	32	100.0	0	0.0	0	0.0	2	6.3	12	37.5	18	56.3	<0.001**
Methods of measuring IAP	22	68.8	10	31.3	0	0.0	0	0.0	12	37.5	20	62.5	<0.001**
Nursing care of IAH & ACS	32	100.0	0	0.0	0	0.0	4	12.5	6	18.8	22	68.8	<0.001**
Management algorism	30	93.8	0	0.0	2	6.3	4	12.5	10	31.3	18	56.3	<0.001**
Total nurses' knowledge	32	100.0	0	0.0	0	0.0	0	0.0	6	18.8	26	81.3	<0.001**

IAP= Intra-abdominal Pressure

IAH= Intra- abdominal Hypertension

ACS= Abdominal Compartment Syndrome

Table (2): Overall score of nurses' skills pre and post implementing the teaching program

Total Score of Nurses' Skills Categories	Pre-teaching group (n=32)		Post-teaching group (n=32)		P-value
	N.	%	N.	%	
Skills of preparation patients and equipment's before procedure:					0.000*
Poor	21	65.6	0	0	
Moderate	10	31.2	4	12.5	
Good	1	3.1	28	87.5	
Skills of measuring IAP:					0.000*
Poor	22	68.8	0	0	
Moderate	9	28.1	4	12.5	
Good	1	3.1	28	87.5	
Skills of documenting and interpreting the results of IAP measurement:					0.000*
Poor	27	84.4	1	3.1	
Moderate	4	12.5	4	12.5	
Good	1	3.1	27	84.4	
Total skills:					0.000*
Poor	23	71.9	0	0	
Moderate	8	25	2	6.2	
Good	1	3.1	30	93.8	

Figure (3): Correlation between total nurses' knowledge and practice after implementation the teaching program.

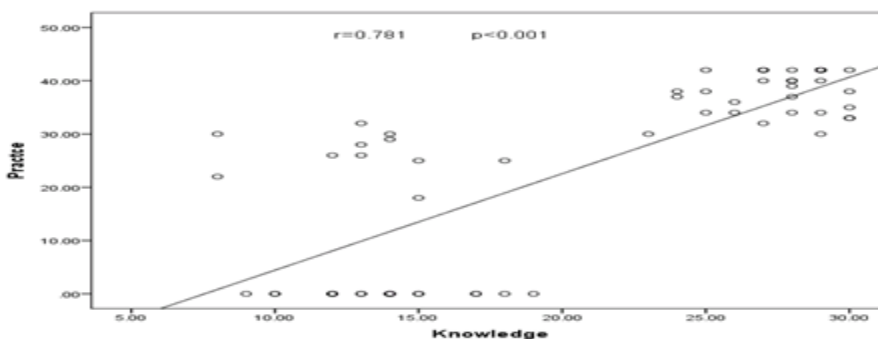


Table 3: Characteristic of the studied patients pre and post teaching program about IAH&ACS.

Patients' characteristic		Control group (n=20)		Study group (n=25)		P value
		N	%	n	%	
Age (Mean±SD)		50.80±12.31		50.08±11.84		0.843 •
Sex	Male	16	80	20	80	1.0
	Female	4	20	5	20	
Diagnosis	1. Abdominal trauma	4	20	6	24	0.999
	2. Multiple fracture ribs	4	20	5	20	
	3. Motor car accident, brain edema	6	30	7	28	
	4. Acute lung injury	2	10	3	12	
	5. septic shock	4	20	4	16	

Chi-square test •Independent samples t-test

Table 4: Comparison between the two studied groups in relation to the development of IAH and ACS at 1st, 3rd, and 5th day of ICU admission.

Day	Groups	Grading of IAP mmHg				
		Normal IAP	IAH patients		ACS patients	
		< 12	Grade 1 = 12-15	Grade 2 = 16-20	Grade 3 = 21-	Grade 4 = >25

					25	
1st day of admission	Control group (n=20)	4(20%)	4(20%)	7(35%)	5 (25%)	0
	Study group (n=25)	3(12%)	5(20%)	11(44%)	6 (24%)	0
P value		0.876				
3rd day of admission	Control group (n=20)	2(10%)	5(25%)	8(40%)	5(25%)	0
	Study group (n=25)	3(12%)	10(40%)	9(36%)	3(12%)	0
P value		0.595				
5th day of admission	Control group (n=20)	1(5%)	5(25%)	5(25%)	5(25%)	4(20%)
	Study group (n=25)	5(20%)	13(52%)	4(16%)	3(12%)	0
P value		0.034*				

Chi-square test * Statistical Significant difference (P < 0.05) IAP=
 Intra-abdominal Pressure IAH= Intra- abdominal Hypertension

Table 5: Mean intra-abdominal pressure among the two studied groups pre and post the teaching program:

Day	Groups	Intra-abdominal pressure (mmHg)				P value	Confidence interval	
		Mean	SD	St. error mean	St. error difference		Lower	Upper
1st day of admission	Control group (pre-program)	16.65	3.84	0.859	1.10	0.595	-2.81	1.36
	Study group (post program)	17.24	3.52	0.705	1.11			
3rd day of admission	Control group (pre-program)	18.05	4.60	1.029	1.24	0.069	-0.18	4.84
	Study group (post program)	15.72	3.78	0.756	1.27			
5th day of admission	Control group (pre-program)	19.45	5.28	1.182	1.35	0.003**	1.46	6.95
	Study group (post program)	15.24	3.83	0.766	1.40			

VI Discussion

Undoubtedly, continuing education of the health care team increases the skills and updates their knowledge which has a positive effect on the care of patients. As known, it is not professional in the critical care nursing to do the bed side skills solely "on the job". Whilst, knowledge and skills development should be based on evidence-based guidelines, continues education and competency standards (Witt, 2011 and Hall,2005). The present study this leads to decrease incidence of ACS development and thus improve patient's outcome.

The current study figured out that, the overall level of knowledge and skills of studied nurses was generally poor pre-teaching program and improved significantly post-teaching program this leads to decrease incidence of ACS development and thus improve patient's outcome. This contributed that the researcher had enough time, proper ICU environment, suitable learning media and material for teaching. The teaching program focuses on concepts of IAP, values and grading of IAH, clinical signs of IAH, effect on other organs, methods of IAP measurement, nursing care and management algorithm of IAH and ACS. Also, the improvement of nurse's practice depending on improvement of nurse's knowledge. This is in line with Hunt et al, 2017 who surveyed the nurses' knowledge and stated that the overall knowledge of them about IAH and ACS was inadequate.

The current study implicated that the answer of nurses regarding definitions, values and grades of IAP, IAH and ACS were poor pre-teaching program and considerably improved post-teaching program. On the contrary, **Wise R et al, 2015**, reported that most of subjects were acquainted with IAH & ACS and nearly 70% were recognizable the equation of mean arterial pressure minus IAP equal to abdominal perfusion pressure. Management of ACS may be neglected because of nurses who unable to detect, interpret or even understand the pathophysiology of ACS.

These results were similar to the results revealed by (Ejike, Newcombe, Baerg, Bahjri, & Mathur, 2010) who stated that most pediatric health care practitioners in their survey incorrectly defined ACS as an increase IAP via number alone. Only 46.8% of the studied subjects identified that the progress of new organ dysfunction or failure plus an increase IAP indicated the diagnosis of ACS. Moreover, these findings were supported by in other researchers (Newcombe et al, 2012 and Wise et al, 2015).

Moreover, the nurses' answer about clinical signs and risk factors of IAH & ACS improved significantly post-teaching program than pre-teaching. The current results were supported by the survey of **NAGAPPAN R et al., 2005** indicated that almost all of the subjects (34/36) affirmed their knowledge about primary risk factors as abdomin-pelvic pathology, but nearly half of them couldn't identify the secondary factors. On contracting, the study done by **Zhou et al., 2011** found that the majority of studied subjects were constructing correctly the diagnosis and clinical signs of IAH/ACS on both clinical and IAP values.

Additionally, the current nurse's knowledge about methods of measuring IAP and effect of IAH and ACS, were poor pre-teaching program and became good post-teaching program significantly. Furthermore, nurse's answers about nursing care and management algorithm of IAH & ACS were poor pre-teaching program and improved to be good post-teaching. Ultimately ACS ends with multi-organ failure. Without appropriate management, this condition identifies as an independent predictor for high morbidity, and mortality among critically ill (Ejike , et al, 2010, and Ravishankar and Hunter , 2005).

According to the survey performed by **Newcombe et al., 2012** which indicated that pediatric CCNs were the most of nurses who perform IAP measurement. Nurses who applied the IAP measurement were almost doubled in 2010 versus to 2006. At the same time, the using of clinical examination only to monitor IAP had decline among them. This is reassuring, as using clinical examination alone to diagnose IAH and ACS is inaccurate with a sensitivity of about 40%.

These results were supported by the survey of **NAGAPPAN R et al., 2005**, indicated that ICU registrars revealed widespread knowledge about the concept of IAP and how it measures. In the clinical practice, 92% of ICU registrars stated that IAP has been used. Only 52% who correctly measure IAP had applied it infrequently less than 10 times, and 25% of them measured it less than 25 times.

The present study showed that nurses' skills were poor in all items before the teaching program and changed to good performance after teaching program. This improvement might be related to the fact that majority of them are young, no previous in-service ACS training or workshop, have < 5 year of experience, and the nurses were enthusiastic to learn. But, the independent self-learning has many barriers and blocks. Another cause is the nurses' exhaustion due to increased ICU work load which may delay their time to read and update their knowledge.

The WSACS recommends the indirect measurement of the IAP via a bladder catheter; put the patient in supine position, by the end of expiration and in the absence of abdominal contractions. Unfortunately, studies still show a low practicing of ICU professionals about WSACS reference standards, as well as a common underestimation of IAH prevalence. (Zhang et al., 2016 and Bressan and Ball, 2017). In this context, **Ejike et al.,**

2010 reported that 24.2% of health care practitioner were aware of ACS had never measured IAP and showed that 21.9% of them mentioned that the only time of IAP measurement were in the clinical exam.

The present study showed that there was nearly the same percentage of grade III IAH (IAP=21-25 mmHg) on admission among the control and study patients without occurrence of ACS among both group. Then, the ratios diverged after five days, one third of control patients develop ACS versus none of study patients. Additionally, the mean of IAP was increased among control patients versus decreased among study patients. This is may be contributed to that the teaching program alarm the subjects about the importance of measuring IAP, catastrophic effect of ACS development and the management algorithm of IAH. Moreover, the in-service teaching program actually has positive and rapid effect on nurses' knowledge and skills that can benefits the patients.

This is in line with (Kyoung & Hong, 2015) who found that most of patients (91.3 %) developed IAH at 1.4 ± 1.0 days after ICU admission. In addition, (Arabadzhev, Ivanov, & Peeva, 2014) mentioned that 57.5 % of his subjects had normal IAP and 42.5 % developed IAH. On the other hand, researchers surveyed 123 ICU patients for one day and observed only a 30.1% rate of IAH (Dalfino, Tullo, Donadio, Malcangi, & Brienza, 2008). In this respect, (Chen et al., 2015) demonstrated that elevation of intra-abdominal pressure occurs around half of adult critically patients.

VII Conclusion

Based on findings, continuous nursing teaching is important to clarify, remind, and master the knowledge and skills for critical care nurses who working in most difficult setting which depend on their competence. Highlighting the importance of monitoring IAP of the most vulnerable patients could help to early detection of patients with IAH. Management of elevated intra- abdominal pressure prevent access to develop ACS which complicate the patient's condition and increase the incidence of morbidity and mortality.

Conflict of interest:

- The authors report no conflict of interest during the performance of this study.

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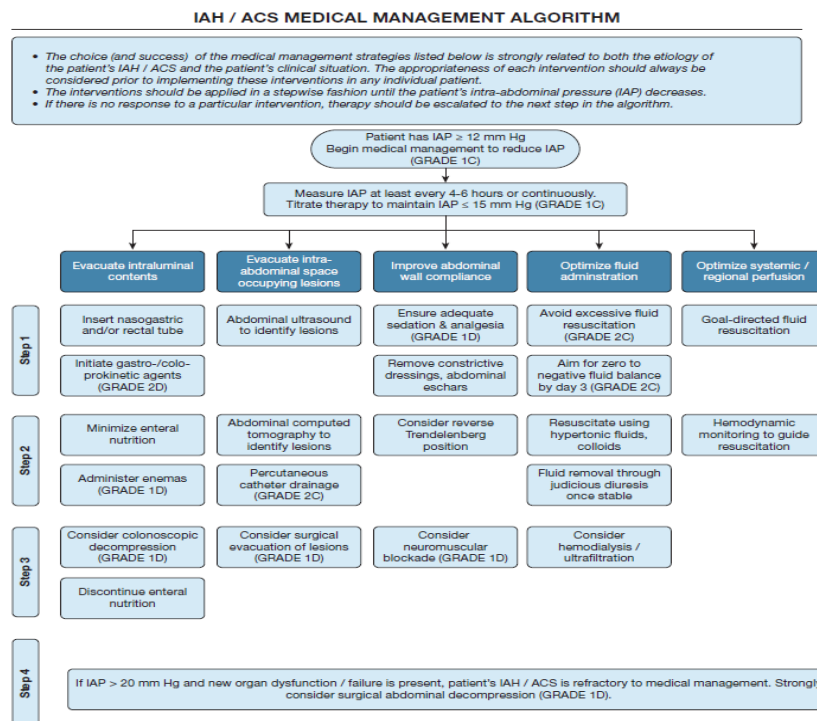
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The appendix (Rogers W, and Luis Garcia, 2018)



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