Assessment of Nurses' Knowledge and Practice Regarding Intra-Abdominal Pressure Measurement and Abdominal Compartment Syndrome Prevention Omnia Ramzy Reyad Abd El-gwaad*, Furat Hussein Mahmoud, Sabah Nazeh Mohmmed Eldriny

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ABSTRACT

Background: Intra-abdominal pressure monitoring helps in the early detection of patients who are susceptible for developing intra-abdominal hypertension and enabling prompt treatment to prevent the development of abdominal compartment syndrome. The management of critically ill patients and the identification of potential causes for clinical worsening are the main role of critical care nurses.

Objective: The objective of the present study is to assess nurses' knowledge and practice regarding intra-abdominal pressure measurement and abdominal compartment syndrome prevention.

Patients and methods: A descriptive exploratory design was utilized in this study. The study was carried out at intensive care units, cardiac care units and emergency unit at Kom Hamada and Itay El Baroad Hospital. A convenient sample of 60 male and female nurses was recruited. Two tools were used for data collection; (I) Knowledge assessment questionnaire and (II) Observational checklist to assess nurses' practices regarding intra-abdominal pressure measurement. **Results:** Most studied nurses had poor knowledge regarding all items related to intra-abdominal pressure measurement, intra-abdominal hypertension, and complications of abdominal compartment syndrome. Moreover, about more than two-third of the studied nurses had an unsatisfactory level of practice regarding intra-abdominal pressure measurement. **Conclusion:** The majority of the studied nurses had unsatisfactory level of knowledge and incompetent level of practice regarding intra-abdominal pressure measurement and abdominal compartment syndrome the prevention. **Recommendation:** Continuous educational programs should be planned to nurses for enhancing their knowledge and practice to achieve a high quality of care.

Keywords: Intra-abdominal pressure, Intra-abdominal hypertension, Abdominal compartment syndrome, Critically ill patients, Descriptive study.

INTRODUCTION

Critical care patients are extremely vulnerable to serious health problems that could kill them. Patients who are more critically ill require nursing care that is more intensive and watchful. Nurses are knowledge workers because they can swiftly assemble several bits of information to make decisions on subtle or deteriorating conditions. This is possible because nurses have high levels of attentiveness, intelligence, and cognition. They employ both technical and theoretical expertise in their job ⁽¹⁾.

Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are two problems for critical care patients that need quick diagnosis and rapid management. Increases in intraabdominal pressure that are higher than the range of physiologically normal values may have an impact on how well organs are vascularized and, ultimately, may cause organ function to cease. Although critical care nurses are responsible for measuring intraabdominal pressure, there is little literature that focuses explicitly on registered nurses' understanding of IAH and ACS⁽²⁾.

The intra-abdominal pressure (IAP) is the steadystate pressure within the abdominal cavity. It is dynamic and varies with breathing (raising with inhalation and falling with expiration), as well as the volume of the intra-abdominal volume (IAV). IAP and IAV function well together. Whether it is filled with fluid, diseased masses, or solid organs, as the volume grows, the abdominal cavity's compliance decreases, which raises intra-abdominal pressure. IAP's typical range is (0- 5 mmHg). This rises in the critically ill to 5–7 mmHg ⁽³⁾. An IAP of 12 mmHg or more is known as intraabdominal hypertension (IAH). IAH is further divided into four classes based on increasing pressures (grade 1: 12 -15 mmHg; grade 2: 16-20 mmHg; grade 3: 21 -25 mmHg; and grade 4: >25 mmHg). IAH may be acute or chronic and might turn into a fatal abdominal compartment syndrome in case of sudden functional changes in vital organs such as cardiovascular, respiratory, and renal systems ⁽⁴⁾.

When the IAP is greater than 20 mmHg, with or without an abdominal perfusion pressure (PP) less than 60 mmHg, abdominal compartment syndrome (ACS) is considered and is a constellation of signs and symptoms of end organ dysfunction or failure. It can also be divided into primary, secondary, and recurrent categories. Primary ACS results from adisease or damage to the abdominal/pelvic region. Conditions that originate outside of the abdominopelvic cavity can cause secondary ACS. Abdominal compartment syndrome that persists despite radiological or surgical treatment is known as recurrent ACS ⁽⁵⁾.

Among critically ill patients, IAH and ACS are associated with higher morbidity and mortality rates. Because of the limited space and its close anatomical contact with adjoining cavities, it not only affects the function of intra-abdominal organs but also causes physiological alterations and malfunction of organs beyond the abdominal cavity. From the pathophysiological perspective, IAH and ACS can cause cardiovascular, respiratory and renal dysfunction and ultimately cause multiple organ failure ⁽⁶⁾. In the absence of original intra-peritoneal injury or intervention, IAH and ACS emerge from a disorder that starts outside the abdomen. This condition seems to be associated with visceral, abdominal wall, and retroperitoneal edema, including severe hypovolemic shocks, in which the patient needs to receive huge quantities of various fluids to revive and recover their hemodynamic status. In the trauma setting, hemorrhagic shock requiring laparotomy for hemorrhage control is a major risk factor for IAH and ACS ⁽⁷⁾.

When identifying, evaluating, and managing patients with intra-abdominal hypertension or abdominal compartment syndrome, advanced nursing practice enables professional nurses to display enhanced clinical discretion, accountability, and autonomy. Assessment of organ function, pain management, vital signs, perfusion to the lower extremities, assessment of wound drainage and output, ongoing assessment for recurrence of intra-abdominal hypertension or abdominal compartment syndrome, and support for patients and their families are the main specific nursing management tasks ⁽⁸⁾.

Significance of the study: According to the world society of abdominal compartment syndrome, an Australian study examined critical care nurses' knowledge of IAP, IAH, and ACS and discovered that less than 20% could identify the less obvious causes of intra-abdominal hypertension. Nearly half of respondents identified a lack of knowledge regarding intra-abdominal pressure monitoring as the main obstacle to monitor intra-abdominal pressure ⁽⁹⁾.

The aim of this study was to assess nurses' knowledge and practice regarding intra-abdominal pressure measurement and abdominal compartment syndrome prevention.

SUBJECT AND METHODS

Research design: A descriptive exploratory research design was utilized.

Study setting: This study was conducted at intensive care units (ICU), cardiac care units (CCU) and emergency unit (ER) at Kom Hamada and Itay Elbaroud hospitals.

Subjects: Subjects of the study included a convenience sample of about 60 male and female nurses with different educational level representing approximately all practitioner nurses working at intensive care unit, cardiac care units and emergency unit at Kom Hamada and Itay el Baroad Hospital and willing to participate in the study.

I. Tools for data collection:

Two tools were used for the purpose of data collection: Tool I: "Nurses' self-administered interview questionnaire"

It was adapted from **Wise** *et al.* ⁽¹⁰⁾. It was written in simple Arabic language based on the extensive review of relevant and recent literatures to assess nurses' Knowledge and practice regarding intra- abdominal pressure measurement and abdominal compartment

syndrome prevention, and was divided into two parts as the following:

Part (1): Demographic data of nurses:

It was developed by the investigator, and it was designed to collect demographic data of the subjects as gender, age, level of education, years of experience, and place of work.

Part (2): Nurse's knowledge assessment questionnaire:

This part of the questionnaire includes 13 multiple choice and closed and open ended questions, it was constructed to assess nurse's knowledge related to measuring intra-abdominal pressure and prevention of abdominal compartment syndrome. Three questions in relation to definition of intra-abdominal pressure, intraabdominal hypertension, and abdominal compartment syndrome. Five questions in relation to measurement of intra-abdominal pressure technique, frequency and its indication. Another one question related to normal range of intra-abdominal pressure.

The latest four questions related to the awareness of the level of intra-abdominal hypertension, sign and symptoms of abdominal compartment syndrome, its complication and awareness of the world society of abdominal compartment syndrome which possess the latest guidelines for prevention and management of abdominal compartment syndrome.

Total score for nurses' self-administered interview questionnaire was classified as follows:

The total nurse's knowledge score was calculated and transferred to percentage as the following:

- Scoring of or more than (80%) of the scores was considered as "fair knowledge" satisfactory.
- Scoring less than (80%) of the scores was considered as "poor knowledge" un satisfactory.

Tool II: The observational checklist.

It was adapted from **Tayebi** *et al.* ⁽¹¹⁾ based on the extensive review of recent and relevant literatures to evaluate nurses' practices regarding intra-abdominal pressure measurement.

Part (1): Before the procedure:

It included items related to:

- Nurse preparation.
 - Equipment preparation.
 - Patient preparation.

Part (2): during the procedure:

It included 8 items related to: adjusting the transducer, Clamping the drainage tube, cleaning sampling port, filling syringe with 25 ml solution of normal saline and injecting it in to the bladder, waiting for 30 to 60 seconds for equilibrium to occur, opening the clamp to let the saline solution flow past the clamp, and finally getting the mean intra-abdominal pressure reading at the end of expiration.

Part (3): post the procedure:

It included 2 items: Once a reading has been obtained, unclamp the urinary drainage system, the pressure monitoring system may be left connected or disconnected and capped to maintain sterility of the system, Recording the bladder pressure on the patient flow sheet and remembering to subtract the 25 ml of instilled saline solution from hourly urine output.

II. Operational item:

Preparatory phase: The tools of the study were adapted based on review of the recent relevant literatures. Tool one was translated into Arabic language to be easily answered by nurses.

Validity: The adapted tools were submitted to a jury of 5 experts in the fields of Medical-Surgical Nursing department, Faculty of Nursing, Helwan University to check its content validity, construction clarity, and completeness of items and accordingly, all necessary modifications were introduced.

Reliability: All tools I and II were tested for its reliability using Cronbach's Alpha statistical test. Results illustrated that, the reliability of the tool I was 0.719 related to 18 items, and for tool II it was 0.969 related to 10 items which indicated that both tools were reliable.

Pilot study: A pilot study was conducted on 6 nurses, to test tools for its clarity and feasibility. Based on the result of the pilot study no modification was done and all nurses were included in the study.

Field work:

- Approval from Ethical Committee, Faculty of Nursing, Helwan University was obtained.
- An official written letter was obtained from the Faculty of Nursing, Helwan University to the directors of the selected setting to take permission to carry out the study after explaining its purpose.
- An official written permission was obtained from the directors of the selected setting after explanation of the aim of the study.
- Written consent for the questionnaire was obtained from each nurse after explanation of the aim of the study.
- For knowledge assessment regarding intraabdominal pressure measurement and abdominal compartment syndrome prevention (tool I), all nurses were asked to fill the questionnaire through face to face interviewing at the previously mentioned setting during morning and afternoon shifts. It took from 15-20 minutes for every nurse to complete the structured questionnaire, according to their break time in their nursing room. Any clarification or instruction statements were given to all nurses during filling the questionnaire.
- The investigator observed each nurse during their implementation of the measurement, by using tool II for different patients, throughout the morning

and afternoon shifts, to assess nurses' practices regarding intra-abdominal pressure measurement.

- The data were collected throughout a period of four months from the beginning of November 2021 up to February 2022.
- Data collection was done 2 days/ week by the investigator in the morning and afternoon shifts.

III. Administrative item:

After explanation of the study aim and objectives an approval to carry out this study was obtained from the dean of the Faculty of Nursing, Helwan University and the general managers of Kom Hmada and Itay Elbaroad hospital asking for cooperation and permission.

Ethical considerations:

The investigator introduced herself to the nurses and explained the purpose of the study, then assured that the study was for educational purpose only. Written consent for the questionnaire was obtained from each nurse after explanation of the aim of the study. Written consent was obtained from the head nurse after explanation of the aim of the study, for the application of the observation checklist. Privacy and anonymity were maintained for all participant nurses. Confidentiality of the collected data was assured. Participation in the research was voluntary. The right to withdraw from the study was confirmed.

Statistics analysis

The collected data were coded and entered in a special format to be suitable for computer feeding. Following data entry, checking and verification process were carried out to avoid any errors. Data were analyzed using the SPSS (Statistical Package for Social Sciences) version 26 for Windows® (IBM SPSS Inc, Qualitative data were represented as frequencies and relative percentages. Chi-square test (χ 2) and Fisher's exact test to calculate difference between two or more groups of qualitative variables. Correlation coefficient was used to correlate the knowledge and practice scores. P-value ≤ 0.05 indicates significant result(S), while P-value ≤ 0.05 was considered as highly significant (NS).

RESULTS

Table 1 indicates that more than three quarters of the studied nurses (78.3%) within the age group (20-30) and about two thirds of them were female. Half of the studied nurses (50%) were having a bachelor degree in nursing science, while about one quarter (23.3%) of them was graduated from a technical institute of nursing and the last quarter (26.7) had a master's degree in nursing science. The majority of the studied nurses (80%) working in a general intensive care unit and about two thirds of them (65%) their years of experience from (1 to 5 years).

Table (1): Frequency and percentage distribution of demographic data of the studied nurses (n=60):-

	Variables	The studied Nurses (N=60)
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	No	%
Age:		
• 20-30	47	78.3
• 31-40	11	18.3
• 41-50	0	0
• 51-60	2	3.3
Gender:		
• Male	22	36.7
• Female	38	63.3
Level of education:		
	0	0
Diploma nursing degree	0	
Technical Institute of Nursing	14	23.3
Bachelor nursing degree	50 16	50 26.7
• Master's in nursing science	10	20.7
Work place:		
• Emergency unit	10	16.7
General intensive Care unit	48	80
Cardiac care unit	2	3.3
Years of experience:		
• Less than 1 year	4	6.7
• 1 to5 years	39	65
• 6 to 10 years	15	25
• 11to15 years	2	3.3
• More than 15 years	0	0

Figure 1 illustrates that 80% of the studied nurses had an unsatisfactory level of total knowledge, while only 20% had a satisfactory level of total knowledge.





Figure 2 demonstrates that more than two thirds (71.7%) of the studied nurses had an incompetent level of total practice, while about one quarter of them (28.3%) had a competent level of total practice.



Figure (2): Percentage distribution of the total nurses' practice (N =60).

Table 2 shows that there was no statistically significant association between age, gender, level of education, place of work, and years of experience and the nurses' knowledge (P-values 0.752, 0.466, 0.222, 0.771, and 0.751 respectively).

ntra-abdominal pressure and abdominal compar	tment syn	drome (N	I =60).			-
X 7 · 11	N	lurses' K	Test	D 1		
variables	Un satis	Un satisfactory		factory		<i>P</i> -value
	No	%	No	%		
Age:						
• 20-30	37	61.7	10	16.7	<i>x2</i> =0.571	0.752
• 31-40	9	15	2	3.3		
• 41-50	0	0	0	0		
• 51-60	2	3.3	0	0		
Gender						
• Male	17	28.3	5	83	Fisher's	
Female	31	51.7	7	11.7	Exact test	0.466
		0117			= 0.161	
Level of education:						
Technical institution	9	15	5	8.3	$x^2 =$	0 222
Bachalorious	26	43.3	4	6.7	3.010	0.222
Master degree	13	21.7	3	5		
Work place:						
Emergency	8	13.3	2	3.3	<i>x</i> 2 =	0 771
General intensive Care unit	38	63.3	10	16.7	0.521	0.771
Cardiac care unit	2	3.3	0	0		
Years of experience:						
• Less than 1 year	3	5	1	1.7		
• 1 to5 years	30	50	9	15	<i>x</i> 2 =	0.751
• 6 to 10 years	13	21.7	2	3.3	1.210	
• 11to15 years	2	3.3	0	0		

Table (2): Correlation between percentage of nurses' knowledge and their demographic characteristics regarding
intra-abdominal pressure and abdominal compartment syndrome (N =60).

Table 3 shows that there was no statistically significant correlation between age, gender, level of education, place of work, & years of experience and the nurses' practice (P-values 0.582, 0.224, 0.804, 0.314, and 0.581 respectively).

	Total practice			Test		
Items	Incom	Incompetent		petent		<i>P</i> -value
	No	%	No	%		
Age: • 20-30 • 31-40 • 41-50 • 51-60	33 9 0 1	55 15 0 1.7	14 2 0 1	23.3 3.3 0 1.7	x2 = 1.070	0.586
Gender: • Male • Female	14 29	23.3 48.3	8 9	13.3 15	Fisher's Exact test = 1.103	0.224
 Level of education: Technical institution Bachalorious Master degree 	11 21 11	18.3 35 18.3	3 9 5	5 15 5	x2 = 0.437	0.804
 Work place: Emergency General ICU Cardiac care unit 	9 33 1	15 55 1.7	1 15 1	1.7 25 1.7	x2 = 2.319	0.314
 Years of experience: Less than 1 year 1 to5 years 6 to 10 years 11to15 years 	3 29 9 2	5 48.3 15 3.3	1 10 6 0	1.7 16.7 10 0	x2 = 1.957	0.581

Table (3): Correlation between nurses' practice and -demographic characteristic regarding intra-abdominal pressure measurement (N =60):

Table 4 reveals that there was no statistically significant difference among the studied nurses regarding the correlation of total knowledge and their practice with *P*-value 0.779.

Table (4): Correlation between knowledge and practice of the studied nurses regarding intra-abdominal pressure measurement and abdominal compartment syndrome prevention.

Variable	Total knowledge			
	Correlation Coefficient (r)	<i>P</i> -value		
Practice	-0.037	0.779		

*: Significant at P ≤ 0.05

DISCUSSION

Demographic characteristic of the studied nurses.

The findings of the present study showed that, in terms of the investigated nurses' demographic features: it was noted that; concerning "age", more than three quarters of the studied nurses (78.3%) within the age group (20-30 years). based on the investigator point of view, these findings may be interpreted by the older nurses' reluctance to work in ICUs and CCUs, as well as the fact that senior nurses in the upper age categories fulfill administrative roles. These findings agree with the study done by **Mobed** *et al.* ⁽¹²⁾, and was contradicted with **Chipu et al.** ⁽¹³⁾.

As regarding to" sex", the results of the current study revealed that about two thirds (63.3%) of the studied nurses were female. These findings explained by the investigator's experience that studying nursing in Egyptian universities has not been exclusive for females only. This finding is in the same line with **Bahnasawy** *et al.* ⁽¹⁴⁾; but in disagreement with **Kadhim and Hamza** ⁽¹⁵⁾.

With respect to their" level of education", half of the studied nurses (50%) were having a bachelor degree in nursing science, while about one quarter (23.3%) of them was graduated from a technical institute of nursing and the last quarter (26.7) had a master's degree in nursing science. From researcher point of view this result is related to the policy of the hospital at El-Behiera governorate which is placing high quality nurses at intensive care units and special units. The result of the current study is supported to some degree by the findings of a study done by **Musa** *et al.* ⁽¹⁶⁾, and contradicted with results of **Ali and Jasim** ⁽¹⁷⁾.

Concerning to the "place of work ", the majority of the studied nurses (80%) working in a general intensive care unit. These findings are in contrast of the result of the study done by **Nowacka** *et al.* ⁽¹⁸⁾.

Additionally, more than half of the studied nurses (65%) had from (1 to 5 years) years of experience. These findings explained by the investigator's experience may be due freshly hired, recently graduated nurses newly appointed to the intensive care units. This result is congruence with **Abo Al-ata** ⁽¹⁹⁾. Conversely; this result is in disagreement with **Hamed** *et al.* ⁽²⁰⁾.

Assessment of nurses' knowledge regarding intra-abdominal pressure measurement and abdominal compartment syndrome prevention.

As regarding to distribution of the nurses according to their 'level of knowledge regarding intraabdominal pressure measurement and abdominal compartment syndrome prevention", the results of the current study revealed that half (50%) of the studied nurses did not know the definition of IAP its normal value and IAH also, more than half (66.7%) of the studied nurses were unaware of the definition of ACS. These findings explained by the investigator's experience may be due to lack of education and information about IAP, IAH and ACS at under graduate. This result is in harmony with a study done by **Mahran** *et al.* ⁽²¹⁾, who implicated that the answer of nurses regarding definitions, values and grades of IAP, IAH and ACS were poor pre-teaching program and a noticeably improved post-teaching program.

In contrast, **Wise** *et al.* ⁽¹⁰⁾ study which indicated that more than half of respondents (60.3%) were aware of the consensus definitions and normal range of IAP, cut-off levels for IAH and ACS for adult patients and related organ dysfunctions.

Regarding the total level of nurses' knowledge it was determined that the majority (80%) of the studied nurses had an unsatisfactory level of total knowledge regarding all items related to intra-abdominal pressure measurement, intra-abdominal hypertension, and complications of abdominal compartment syndrome. While only one fifth of them (20%) had a satisfactory level of total knowledge.

This can be explained by the investigator's experience may be due to no previous in-service ACS training or work shop and the nurses were eager to learn. Another cause is the nurses' fatigue brought on by the increased ICU workload, which may prevent them from reading and maintaining their knowledge.

This result is congruence with study done by **Hunt** *et al.* ⁽²²⁾, who discovered that Critical care nurses' general knowledge about intra-abdominal hypertension and abdominal compartment syndrome was lacking.

As opposed to the finding of the study done by **Strang** *et al.* ⁽²³⁾ who founded that the definitions of IAH and ACS and the related diagnostic and therapeutic challenges are relatively well known by Dutch surgeons.

Nurses' practice regarding intra- abdominal pressure measurement.

Regarding the total nurses' level of practice the current study revealed that more than two thirds (71.7%) of the studied nurses had an incompetent level of practice regarding measuring intra-abdominal pressure, while roughly (28.3%) had a competent level of practice.

From the researcher's point of view, these findings may be due to lack of guideline adherence, lack of supportive systems, lack of knowledge, lack of individual responsibility for implementation, lack of acceptance and perceived lack of need in some clinical areas.

The result of the current study agreed with **Mahran** *et al.* ⁽²¹⁾, who discovered that 68.8% of the pre-teaching group lacked proficiency in measuring IAP.

On the other hand, contradictory a study done by **Newcombe** *et al.* ⁽²⁴⁾, who found that most pediatric CCNs were performing IAP measurements.

Relations and correlations with nurses' total level of knowledge.

Regarding to correlation between nurses' total level of knowledge and their demographic

characteristics, relation's analysis showed that There was no statistically significant association between nurses' total level of knowledge and their age, gender, level of education, place of work and years of experience regarding intra-abdominal pressure measurement and abdominal compartment syndrome prevention. concerning correlation between nurses' total level of practice and their demographic characteristics, in the current study, the result showed that there was no statistical significant differences were found between nurses' total level of practice and their age, gender, level of education, place of work, & years of experience regarding intra-abdominal pressure measurement. These findings were in line with the study done by El-Gawad et al. (25).

Concerning the correlation between the total nurses' level of knowledge and their total practice mean scores, the results of the current study revealed that no statistical significant differences were found between nurses' practice mean scores and their knowledge levels with P-Value (0.779). These alarming findings reveal that nurses may not follow the best recommended practices, even if they are known and available. These findings are to some degree consistent with the study done by **Zhang** *et al.* ⁽²⁶⁾.

On other hand were in contrast to a study done by **Mahran** *et al.* ⁽²¹⁾ who conducted a study about "Effect of Teaching Program on Nurses' Knowledge and Skills And Development Of Abdominal Compartment Syndrome Among Intensive Care Patients. " and found that there was a significant positive correlation found between total score of nurses' knowledge and skills after teaching program (r-value =0.781, p<0.001). The current study also, contradicted with a study done by **El Sayed Khaliel** *et al.*⁽²⁷⁾.

CONCLUSION

In the light of the present study, it can concluded that the majority of the studied nurses had unsatisfactory level of knowledge related to intra-abdominal hypertension and abdominal compartment syndrome, diagnosis and intra-abdominal pressure normality values, frequency measurement and volume of injected liquid. Also, the majority of nurses had an incompetent level of practice regarding most of items related to intraabdominal pressure measurement. In addition, there were no statistically significant correlations between the studied nurses' demographic characteristics and the nurses' level of knowledge and practice.

It is necessary to establish an ongoing educational programme that covers the methodology for measuring intra-abdominal pressure as well as information on intra-abdominal hypertension, its clinical implications, and how to prevent abdominal compartment syndrome.

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Author contribution: Authors contributed equally in the study.

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