

Nurses' knowledge and practice regarding implantable cardiac devices in Egypt

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Sudden cardiac death (SCD) is the cause of up to 450 000 deaths around the world each year (Deo and Albert, 2012). SCD is usually caused by an unstable, fast ventricular rhythm, predominantly ventricular tachycardia (VT) and ventricular fibrillation (VF) (Chen et al, 2003; Kirkpatrick et al, 2012). When either arrhythmia occurs, the heart cannot pump enough blood throughout the body. Unless treatment is delivered within a few minutes, death is eminent. Long-term treatment options for people who survive life-threatening ventricular rhythms include medication, surgery, implantable cardioverter defibrillator (ICD) or a combination of treatments. ICDs are devices that sense these life-threatening arrhythmias automatically and deliver electrical therapy or lifesaving shock directly to the myocardium (Chen et al, 2003; Kirkpatrick et al, 2012).

The last two decades have witnessed a dramatic rise in implantation of cardiovascular implantable electronic devices (CIED) for management of numerous life-threatening cardiac rhythm disorders as well as non-arrhythmic conditions, such as heart failure and chronotropic incompetence (Baddour et al, 2010). One recent survey indicated that there was almost a 50% increase in the rate of CIED being fitted (including permanent pacemakers (PPMs) and ICDs) between 1991 and 2003 (Baddour et al, 2010).

With more and more patients receiving pacemakers, ICDs and combination devices, a need for multidisciplinary approaches to meet these population-specific needs has become obvious. Nurses who have a holistic outlook on patient care can play a key role in this by supporting patients and their families during and after implantation. To accomplish this task, nursing intervention must be multilevel. Moreover, nurses play an important role in patient education, which can adversely affect proper device function and will increase adherence to the follow-up treatment. Finally, by providing psychological and emotional support, the nursing staff can address the immediate concern of the patient and help them cope successfully with their new life situation. To be able to

meet the requirements of this complex role, it is essential that nurses taking care of patients with implanted devices receive training and continuing education in this rapidly evolving field (Angelidou, 2009).

ABSTRACT

Background: patients with implanted cardiac devices constitute a growing segment of contemporary health practice. Nurses have a unique role providing care in hospitals, long-term health care, education and psychological support to these patients. **Aim:** to assess critical care nurses' knowledge and practice regarding implantable cardiac devices. **Research design:** a descriptive exploratory design used research questions: a) what is the nurses' knowledge level regarding implantable cardiac devices? b) How do nurses manage patients with implantable cardiac devices? **Setting:** at selected critical and coronary care units in Egypt. **Sample:** a convenient sample of 40 nurses with a minimum 1 year of experience was included in the study. **Tools for data collection:** Tool 1: background data that included gender, age, educational level, area of work and years of experience. Tool 2: questionnaire to assess nurses' knowledge regarding implantable cardiac devices. Tool 3: implantable cardiac devices observational checklist to assess nurses' practice when caring for patients who are being fitted with implantable cardiac devices. **Results:** the current findings revealed that nurses have low knowledge and practice scores and no significant correlations existed between gender, age, years of experience, and their level of knowledge and practice, except negative correlation which existed between practice and years of experience regarding implantable cardiac devices. **Conclusion:** critical care nurses have inadequate knowledge and practice regarding implantable cardiac devices. **Recommendations:** replication of this study on a larger probability sample from the different geographical locations of the Arab Republic of Egypt and further research to explore why nurses do not have the knowledge or skills regarding implantable cardiac devices.

KEY WORDS

- ◆ Implantable cardiac devices ◆ Nursing knowledge
- ◆ Best practice

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Significance of the study

In Egypt, the documented medical records and the statistical data of the critical care department at El-Manial University Hospital revealed that the percentage of patients who were admitted for pacemaker insertion was 7.59% in 2004, 8.52% in 2005 and 9.4% in 2006 (El-Manial University Hospital, 2007).

Over a period of 3 years in the critical care units at El-Manial University Hospital (the biggest teaching hospital in Egypt), empirical observation showed that patients' outcomes and self-care abilities were influenced to some extent, and there was readmission of some patients suffering from different complications. Most of these complications were life-threatening yet preventable, but were not documented. Nurses who have a holistic outlook on patient care can play a key role in this prevention by using an approved protocol of care that is based upon the different educational needs of nurses and considers other relevant factors, as well as addressing the immediate concerns of the patient and helping them cope successfully with their condition.

Furthermore, this research could be beneficial in determining the level of nurses' knowledge and practices, highlighting areas of deficiency in nursing performance while caring for patients with these devices.

Aim

This study assesses critical care nurses' knowledge and practice regarding implantable cardiac devices.

Research questions

To fulfil the aim of this study, two research questions were formulated:

- ♦ What is the nurse's knowledge about implantable cardiac devices?
- ♦ How do nurses manage patients with implantable cardiac devices?

Method

Research design

A descriptive exploratory design was used in the study.

Setting

This study was conducted in three different critical and coronary care units at Cairo University Hospitals, Egypt. It encompasses two medical critical care units and one coronary care unit, which employ around 45 nurses who are educated to different levels.

Sample

All nurses working at the selected critical and coronary care units who had a minimum of 1 year's work experience and provide direct nursing care to patients fitted with an implantable cardiac device constituted the sample of this study. Criteria for inclusion were aged 25 or over, both sexes and different educational categories. The exclusion criteria were subjects who refused to voluntarily participate in the study.

Tools

Three tools for data collection were used:

- ♦ Tool 1: background data sheet, which covered data related to age, sex, educational level, work areas and years of experience.
- ♦ Tool 2: knowledge questionnaire sheet, which was designed by the researchers to assess nurses' knowledge about implantable cardiac devices. It consisted of 34 multiple choice and true/false questions that covered knowledge related to general information about pacemakers, ICDs, cardiac resynchronization therapy (CRT), patient preparation, post-implantation care, complications and patients' discharge instructions. The total score of the questionnaire was 34. The scoring system classified as follows; scores less than 75% was considered unsatisfactory and the scores equal or more than 75% considered satisfactory. This percentage was decided by a panel of experts, who felt that 75% was a high level in an area of a critical nature.
- ♦ Tool 3: Implantable cardiac devices observational checklist, which was designed by the researcher after a literature review to assess nurses' practices regarding implantable cardiac devices during preparation and post-implantation phases. The designed tool consisted of 26 steps distributed between patient preparation and post-implantation care. It was carried out three times for each nurse while they provided care for patients who had planned implantable cardiac devices insertion and the average mean of three observational checklists was obtained. The scoring system was distributed as follows; complete took two grades, incomplete took one grade and incorrect/not done took zero grade. The total score of the questionnaire was 52 grades. The scoring system classified scores less than 75% as unsatisfactory and scores equal or more than 75% as satisfactory.

Validity and reliability of tools

The developed tools were examined by a panel of three medical and critical care nursing experts to determine whether the included items were clear and suitable to achieve the aim of the study. The knowledge questionnaire was tested for reliability using interrater reliability with Cohen's kappa=0.85. A test and retest of the observational checklist was carried out to test its reliability and the correlation coefficient was = 0.82.

Pilot Study

A pilot study was carried out on 6 nurses to test feasibility, objectivity, and applicability of the study tools. Based on the results of the pilot study, refinements and modifications were made about some questions which were not understood and answered by the nurses, so the researcher simplified these questions.

Ethical approval

After approval from the institutional review board for the protection of human rights at the faculty of nursing at Cairo University was obtained, nurses were contacted

and each potential subject in the study was informed about the purpose, procedure, benefits, and nature. They were ensured that participation in this study was voluntary and confidentiality and anonymity of each subject was assured through coding of all data. All subjects had the right to withdraw from the study at any time without any rationale.

Procedure

The current study was conducted through two phases.

- ♦ Preparation phase: it was concerned with constructing, testing and piloting data collection tools. In addition, the managerial arrangements were made to conduct the current study. Nurses who agreed to participate were interviewed individually by the researcher to explain the nature and purpose of the study and finally written consent was obtained.
- ♦ Implementation phase: data were collected from July 2013 to December 2013. The researcher visited the selected critical care and intensive care units on a daily basis during morning shift. Each potential nurse was interviewed for 20–30 minutes to fill out the demographic and background data as well as the knowledge questionnaire. The researcher clarified any obscure questions. Later, each nurse was observed individually for three times while caring for their patients who were undergoing planned implantable cardiac device insertion, using the observational checklist.

Results

The study revealed that the majority of the participants were female (92.5%) and 32.5% were aged between 31 and 35 years old with a mean age of 34.85 + 5.385. Regarding educational level, the majority of participants (70%) were diploma nurses while the remainder were nursing technicians (20%) and baccalaureate nurses (10%). Among the participants, 30% had experience which ranged between 21 and 25 years with the average mean 15 + 6.433. Finally, the majority of the subjects (62.5%) were working in medical critical care while the remainders were working in the coronary care unit.

Table 1 clarifies total and subtotal mean knowledge scores of the participants in relation to implantable cardiac devices among the studied sample. It showed that the total mean knowledge scores of the study subjects were 20.927 + 3.696 out of 34. In relation to knowledge sub-items, the patient's discharge instructions received the highest mean (7.45 + 1.218 out of 10), while the sub item related to CRT showed the lowest mean (1.43 + 0.90 out of 3).

Figure 1 presents percentage distribution of correct and incorrect answers of knowledge questions related to implanted cardiac devices among the study sample. It shows that most of the participants gave correct answers to questions related to patient preparation (90%), discharge instruction (75%) and general CIED (68%). Alternatively, almost half of the studied sample gave incorrect answers to questions related to ICDs (57%), CRT (52.5%) and pacemakers (50%).

Table 1. Total and subtotal mean knowledge scores of the studied subjects in relation to implanted cardiac devices (n=40)

Items	Total score	Mean ± SD (standard deviation)
General information regarding implanted cardiac devices	4	2.73 ± .82
Pacemakers	5	2.45 ± 1.32
Implanted cardioverter defibrillator	4	1.73 ± .88
Cardiac resynchronisation therapy	3	1.43 ± .90
Patient's preparation	2	1.8 ± .52
Post-implantation care	4	2.25 ± .74
Complications	2	1.13 ± .61
Patient's discharge instructions	10	7.45 ± 1.218
Total knowledge score	34	20.927 ± 3.696

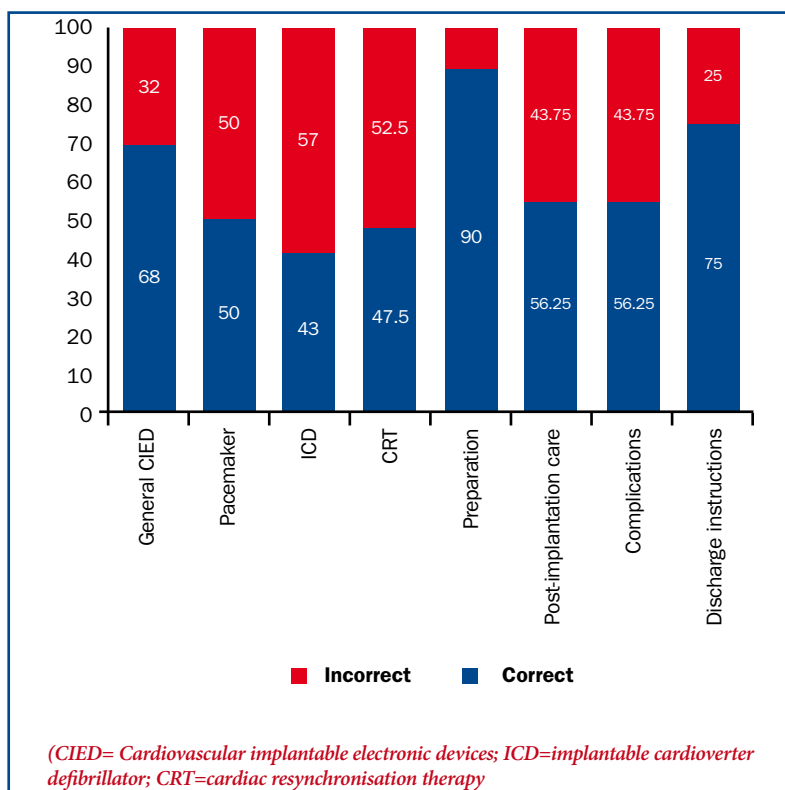


Figure 1: Percentage distribution of correct and incorrect answers to knowledge questions related to implanted cardiac devices among the studied sample (n=40)

Table 2 clarifies total and subtotal mean practice scores in relation to implantable cardiac devices among the study sample. It shows that the total practice mean score was 36.45 ± 2.484 and that the higher subtotal mean, although low, was in the phase of preparing patients undergoing implantable cardiac device insertion (24.6 ± 1.218) when compared to the other phase.

Figure 2 clarifies percentage distribution of the correct and incorrect/not done total practices regarding implantable cardiac devices during preparation and post-

implantation phases among the participants. It shows that more than half of nurses have incorrect practices regarding implantable cardiac devices (60%) during the post-implantation care phase. However, the preparation of their patients was much better (67.5%).

Table 3 presents comparison of total mean knowledge and practice scores regarding implantable cardiac devices among the studied sample by their background variables. It showed that there is a high significant statistical difference among the means of the knowledge and practice scores of the studied subjects by their educational level ($f=7.243$; $p=0.002^*$; $f=12.27$; $p=.000$). The participants who have baccalaureate degrees have higher means in both knowledge and practice when compared to participants who have technical and diploma degrees. However, there is no significant statistical difference among the means of knowledge and practice scores of participants by their gender and working areas, but there is a significant statistical difference between mean knowledge scores and working areas ($t=-.878$; $p=0.023$), as the participants who had worked at critical care units one and two have got a higher knowledge means when compared to those work in cardiac care units.

Table 4 clarifies correlation of selected background variables with knowledge and practice regarding implantable cardiac devices among the participants. It revealed that there was no correlation between age and total mean knowledge and practices scores among the studied sample,

while there was a significant statistical correlation between years of experience and total mean practices scores among the studied sample ($r=-0.328$; $p=0.039$).

Discussion

ICDs can save lives in multiple populations at risk of sudden death. Pacemakers have saved lives for individuals with bradyarrhythmias for five decades and CRT devices have more recently been shown to improve symptoms and survival (Kirkpatrick et al, 2012) As indications for device therapy continue to expand, the population of patients with these devices continues to grow (Kirkpatrick et al, 2012). Nurses are responsible for caring for patients who have planned insertion of a cardiac device so should be aware of indications, functions, contraindications and complications. Moreover, nurses should be knowledgeable when preparing patients for the procedure and when providing post-implantation care that includes close observation, continuous monitoring, and providing pre-discharge education and instructions to help patients and their families deal with any potential problems that may arise.

In this study, the findings that answered the first question regarding nurses' knowledge about implantable cardiac devices revealed that the majority have an unsatisfactory knowledge level with the mean 20.927 + 3.696 out of 34 scores. The percentage distribution of correct and incorrect answers for the knowledge questions revealed that the questions which had got the lowest score were regarding indications for using ICDs, CRT, and indications and coding systems for pacemakers. The investigator interpreted that the reason for lack of knowledge about implanted cardiac devices was that this topic is not incorporated in the curriculum of critical care medicine and nursing, which negatively affected nurses' knowledge and practices. Upon questioning, it transpired that lack of training sessions, supervision, evaluation of performance, cooperation between multidisciplinary team members and standard guidelines were part of the cause. The investigator's point of view is supported by Degavi (2013) who studied the effectiveness of planned teaching programmes on knowledge regarding cardiac rehabilitation among staff nurses working in critical care units of KLES Dr. Prabhakar Kore Hospital & M.R.C, Belgum, India, which revealed that half of the subjects had poor knowledge levels pre test while all had satisfactory knowledge scores post test. The study findings are also supported by Anushk's (2011) study of nursing care protocol for patients with implantable defibrillators among 400 nurses in Delhi in 2008. The result of that study showed that there was change among nurses in assisting patients to assume the role of being their own most important health-care manager and concluded that nurses should be educated in effective management of patients with implantable cardiac devices (Anushk, 2011). Amin (2008) carried out a study on the effectiveness of teaching programmes on nursing care of

Table 2. Total and subtotal mean practice scores of the studied subjects in relation to implanted cardiac devices (n=40)

Variable	Mean ± SD	Minimum	Maximum
Preparation	24.6 ± 1.218	22	28
Post-implantation care	11.858 ± 1.944	8	16
Total mean practice	36.45 ± 2.484	30	44

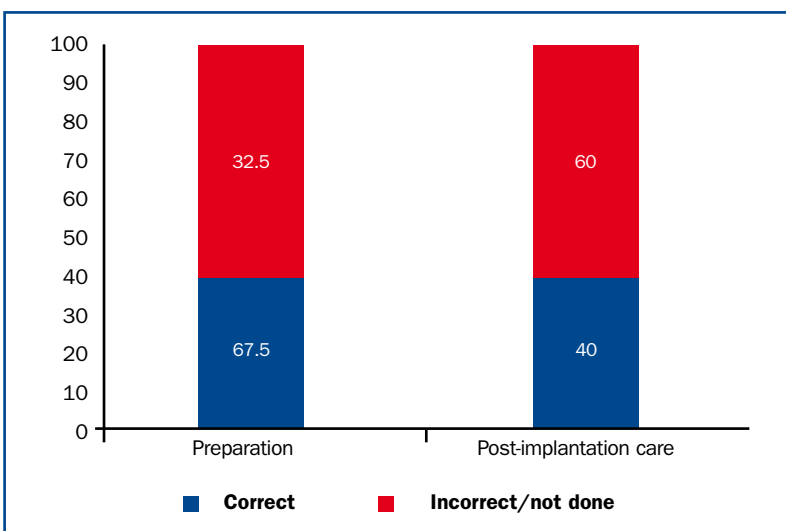


Figure 2: Percentage distribution of the correct and incorrect/not done practices regarding implantable cardiac devices during preparation and post-implantation phases among the studied subjects (n=40)

Table 3. Comparison of total mean knowledge and practice scores regarding implantable cardiac devices by their background variables (n=40)

Variables	Knowledge			Practice		
	X ± SD	t/f value	p value	X ± SD	t/f/ value	p value
Gender						
Male	22 ± 5.29	t=0.519	p=0.396	36.66 ± 3.79	t=0.155	p=0.26
Female	20.84 ± 3.62			36.43 ± 2.43		
Academic qualification						
Diploma	20 ± 3.34	f=7.243	p=0.002*	35.66 ± 1.84	f=12.28	p=.000*
Technical	21.37 ± 3.55			37.43 ± 1.91		
Bachelor	26.5 ± 3.42			40.5 ± 3.32		
Working units						
Medical ICU	21.32 ± 4.31	t=-.878	p=0.023*	36.8 ± 2.55	t=-1.151	p=0.44
CCU	20.266 ± 2.31			35.87 ± 2.33		

SD=Standard deviation; ICU=Intensive care unit; CCU=Coronary care unit
*p < 0.05 significance value

patients with cardiac assist devices among in Columbia; the results revealed that nurses' knowledge post test was high compared to pre test and concluded that patients are the beneficiaries of professional, competent nursing care provided by teaching programmes.

In thier study, Terzi (2006) mentioned that nurses are present during all stages of pacemaker implantation and are therefore an important member of the multidisciplinary team involved in the procedure. The nurse's various roles highlight the need for knowledge and skills, concerning all aspects of general nursing principles, along with details of this specialised cardiac procedure. Angelidou (2009) added that knowledgeable and skilled nurses play an important role in counselling patients with implanted cardiac devices; to be able to meet the requirements of this complex role, it is essential that nurses caring for patients with implanted devices receive training and continuing education in this rapidly evolving field.

In relation to the nurses' performance regarding implantable cardiac devices, this study's findings revealed that the majority of the study subjects had low performance levels. Moreover, more than half of the study sample practice post-implantation care incorrectly, while more than two thirds (67.5%) of them correctly practice pre-implantation care. This low practice level may have relevance to low knowledge levels in addition to increased number of patients and workload. These findings agreed with Bavnbeek et al (2010) whose study on wound management and restrictive arm movement following cardiac device implantation, found that certain aspects of established practice are based on tradition rather than evidence and nurses are lacking knowledge in some aspects of care giving. Accordingly, they concluded that nurses should play a key role in identifying and addressing research questions that lead to improved patient outcomes.

Table 4. Correlation of selected background variables with knowledge and practice related to implantable cardiac devices among the studied sample (n=40)

Variables	Knowledge		Practice	
	r	p	r	p
Age in years	-0.140	p=0.390	-0.269	p=0.093
Years of experience	-0.206	p=0.202	-0.328	p=0.039*

* p < 0.05 significance value

This study's findings are supported by Tagney's (2004) study about nurses in cardiology areas preparing patients for ICD implantation and life at home. This study used a purposive sample of 152 nurses from cardiology areas in four large teaching hospitals and a 28-point postal questionnaire to explore knowledge of the device and its impact. Most subjects were not confident in their abilities to prepare patients for implant or life at home after implant. Knowledge of the device and its effects appeared poorly understood by all nurses, irrespective of additional qualifications, length of time since qualifying or area of work. Many participants were aware of the poor knowledge level of nurses and identified it as a weakness in current care practices (Tagney, 2004).

This finding is in accordance with Anushk (2011) who studied nurses' knowledge and practice on management and outcome of patients with permanent pacemaker and ICD infections in California, which showed a lack of timely management by nurses. This is emphasised by Rezaei et al (2010) who studied cardiac ward nurses' performance in caring for patients who have been fitted with temporary and permanent pacemakers. This revealed that during hospitalisation, particularly at discharge time, nurses do not provide sufficient information to patients with pacemakers about the control and prevention of complications of this device, which may lead to some difficulties in future life.

Therefore, because of the potential for complications in pacemaker patients, it is necessary for nurses to receive periodic training in providing educational and functional content to patients.

The researchers examined the relationship between total knowledge and total practice scores regarding implantable cardiac devices. It revealed that there was a strong correlation between total knowledge score and total practice score. This correlation may be interpreted as lack of knowledge and may have an effect on nurses' practices regarding implantable cardiac devices. This finding is in agreement with Tagney (2004), who mentioned that many participants were aware of their inadequate knowledge and identified it as a weakness in current care practices. Lack of understanding may impair preparation of patients for implantation of, or for living with, an ICD.

The researcher investigated other factors that may have relevance to lack of knowledge and practice regarding implantable cardiac devices, such as educational level, years of experience and area of work. The study findings revealed that there were significant statistical differences among nurses' educational levels regarding knowledge and practice ($f=7.243$; $p=0.002$; $f=12.28$; $p=0.000$ respectively), as baccalaureate nurses had higher knowledge and practice scores than diploma and technical institute nurses. This is reflected in Al-Ftlawy's (2014) study on nurses' knowledge towards care provided to patients with acute myocardial infarction in Al-Najaf City, which revealed a significant relationship between nurses' level of knowledge and education. Alternatively, the present study finding contradicts Thomas' (2013) findings which revealed that there was no significant association between pre-test knowledge scores, pre-test practice scores and educational qualifications. This is also supported by Degavi (2013) who found no significant association between pre-test knowledge scores and educational qualifications.

With nurses' years of experience, there was a significant statistical difference with total mean practice scores. This finding is consistent with Thomas' (2013) study, which revealed that there is a highly significant association between practice scores and work experience. This is also

in accord with Aziz (2014) who evaluated nurses' care practices provided to patients who undergo open heart surgery in the Sulaimani Center of Heart Diseases, and revealed that there was significant statistical association between nurses' practice and their years of experience.

In relation to correlation between work area and total knowledge, this study finding revealed that there was a significant statistical correlation. This finding is supported by Al-Ftlawy (2014) who found that there was a significant association between knowledge level and work setting in nurses caring for patients who experienced a myocardial infarction.

Conclusion

Based on the findings of the current study, it can be concluded that critical and coronary care nurses have inadequate knowledge and practice regarding implantable cardiac devices. No correlation existed between gender, age, and their levels of knowledge and practice, while there were significant statistical differences between level of education and their level of knowledge and practice.

Recommendations

- ♦ Incorporation of management of cardiac devices in undergraduate nursing curricula and different nursing categories
- ♦ Provide nurses with continuous educational programmes regarding implantable cardiac devices with evidence-based guidelines to improve their knowledge and practice related to these devices.
- ♦ Provide nurses with periodic training sessions and evaluations to improve and assess their knowledge and practices regarding implantable cardiac devices.
- ♦ Establish collaborative interaction between nurses and other health team members, as they are working in a multidisciplinary system to improve the health services provided to patients with implantable cardiac devices
- ♦ Replication of this study on a larger probability sample from the different geographical locations at the Arab Republic of Egypt and further research to explore why nurses do not always have the appropriate knowledge or skills regarding implantable cardiac devices. **BJCN**

KEY POINTS

- ♦ The findings of this study concluded that critical and coronary care nurses have inadequate knowledge and practice regarding implantable cardiac devices
- ♦ No correlation existed between gender, age, and their levels of knowledge and practice, while there were significant statistical differences between their level of education and their levels of knowledge and practice
- ♦ Replication of this study on a larger probability sample from the different geographical areas is recommended to explore why some nurses do not have adequate knowledge or skills regarding implantable cardiac devices

References

- Al-Ftlawy, D. M. H. (2014) Determination of nurses' knowledge toward care provided to patients with acute myocardial infarction in Al-Najaf City. *Kufa Journal for Nursing Sciences* 2(2) www.uokufa.edu.iq/journals/index.php/kjns/article/view/2299 (accessed 2 December 2014)
- Amin A (2008) Hospitalized patients with acute decompensated heart failure: recognition, risk stratification, and treatment review. *J Hosp Med* 3(6 Suppl): S16–24. doi: 10.1002/jhm.392
- Angelidou D (2009) Counseling patients with implanted cardiac devices: the nurse's role. *Hospital Chronicles* 4(2): 56–62
- Anushk J (2011) A study to assess the knowledge and practice of staff nurse regarding post operative cardiac care in selected hospitals at Bangalore with a view to develop information booklet. Rajiv Gandhi University of health sciences. [AQ2 - I have typed into Google and still cannot find this reference. Can you send a link to it please]
- Aziz SO (2014) Evaluation of nurses' practices provided to the patients who undergo open heart surgery in Sulaimani Center of Heart

- Diseases (SCHD). *Kufa Journal for Nursing Sciences* 3(1) www.iasj.net/iasj?func=fulltext&ald=74815 (accessed 2 December 2014)
- Baddour LM, Epstein AE, Erickson CC et al (2010) Update on cardiovascular implantable electronic device infections and their management: a scientific statement from the American Heart Association. *Circulation* 121(3): 458–77. doi: 10.1161/CIRCULATIONAHA.109.192665
- Bavnbek K, Ahsan SY, Sanders J et al (2010) Wound management and restrictive arm movement following cardiac device implantation—evidence for practice? *Eur J Cardiovasc Nurs* 9(2): 85–91. doi: 10.1016/j.ejcnurse.2009.11.008
- Chen PS, Wu TJ, Ting CT et al (2003) A tale of two fibrillations. *Circulation* 108(19): 2298–303
- Degavi G (2013) effectiveness of planned teaching programme (PTP) on Knowledge Regarding Cardiac Rehabilitation among staff Nurses working in ICCU of Heart Foundation of KLEs Dr. Prabhakar Kore Hospital & MRC Belgaum (Doctoral dissertation, KLE University, Belgaum, Karnataka). [AQ 2 - Still cannot find this and the link you provided did not work - do you have a link or scan please?]
- Deo R, Albert CM (2012) Epidemiology and genetics of sudden cardiac death. *Circulation* 125(4): 620–37. doi: 10.1161/CIRCULATIONAHA.111.023838
- Kirkpatrick JN, Gottlieb M, Sehgal P (2012) Deactivation of implantable cardioverter defibrillators in terminal illness and end of life care. *Am J Cardiol* 109(1): 91–4. doi: 10.1016/j.amjcard.2011.08.011
- El-Manial University Hospital (2007) Reports of Statistical Administration and Medical Records [not in public domain]. Critical Care Department, El-Manial University Hospital. Egypt
- Rezaei H, Ranjbar H, Abbaszadeh A (2010) Heart wards' nursing staff performance in caring of heart temporary and permanent pacemakers. *Iranian Journal of Critical Care Nursing* 3(3): 119–124
- Smith JM (2009) The Experiences of Women Who Live with an Implantable Cardioverter-Defibrillator (ICD). UNF Theses and Dissertations. Paper 198. <http://digitalcommons.unf.edu/etd/198> (accessed 2 December 2014)
- Tagney J (2004) Can nurses in cardiology areas prepare patients for implantable cardioverter defibrillator implant and life at home? *Nurs Crit Care* 9(3): 104–14
- Terzi, A. B. (2006) The nurse's role in the prevention of infection after pacemaker implantation. *Hospital Chronicles* 1(1 sup): 183–6
- Thomas MP (2013) A study to evaluate the effectiveness of video assisted teaching programme on knowledge and practice regarding cardioversion and defibrillation among staff nurses working in cardiac unit in selected hospitals of Bagalkot. Dissertation, SHRI. B.V.V. Sangha's, Sajjalashree Institute of Nursing Sciences, Navanagar, Bagalkot, Karnataka