

The Role of Nurses in Patients with Intra-aortic Balloon Pump: Involvement, Understanding, and Management of the Patient's Comfort

Shweta Rasaria¹, Suchita Sawant²

¹Department of Child Health Nursing, Bombay Hospital College of Nursing, Mumbai, Maharashtra, India, ²Department of Medical Surgical Nursing, Bombay Hospital College of Nursing, Mumbai, Maharashtra, India

Abstract

Health is pivot on which the man's whole personality and its well-being depend. Coronary artery serves as a fuel pipelines to the heart muscles. Intra-aortic balloon pump (IABP) is considered as the first hemodynamic support device to help in improvements in the myocardial oxygen supply/demand ratio and circulatory support. It remains the most widely used mechanical cardiac support device due to its simplicity, ease of insertion, and long clinical track record. To achieve the best possible outcome for a patient managed with IABP, nursing and medical staff required specialized skills. Nurses play a crucial role in caring patient with IABP. Nurses who care for patients managed with IABP require knowledge of the mechanism and actions of this therapeutic device. Cardiovascular nurses are caring for these patients requiring skills and knowledge that enable prompt recognition and treatment of sometimes life-threatening complications associated with balloon pump therapy. To gain a greater understanding of IABP therapy, nurses should become familiar with specific institutional policies regarding operation of this device. The critical care nurse needs to be aware of various factors to adequately assess for and ensure optimal IABP performance.

Keywords: Cardiovascular problems, intra-aortic balloon pump, knowledge, nurses

INTRODUCTION

Health is pivot on which the man's whole personality and its well-being depend. A person is called healthy when all systems in his body are functioning harmoniously. It is here that protection and care are needed so that each organ functions well, each organ develops naturally, and there are no deformities, disabilities, and diseases. Every organ requires a rich supply of oxygen and nutrients for its proper functioning; the heart is the organ which serves this function.^[1] A cardiovascular system begins its activity when the fetus is barely 4 weeks old and is the last system to cease activity at the end of the life. This body system is so vital that it helps to

define the presence of life. Hence, a healthy heart is inevitable for sound health.^[2]

Coronary artery serves as a fuel pipelines to the heart muscles. Patient with one or more risk factors for coronary artery disease are more susceptible to the increased accumulation of material in the inner layer of vessel which effects the free flow of blood through the coronary artery. This may cause blockage in the arteries leading to decreased blood supply to the heart muscle. This imbalance between the supply and demand of oxygen can lead to complications such as angina, myocardial infarction, and stroke.^[3]

According to the American Heart Association, coronary artery disease caused one of every six deaths in the United States. It estimates that 1.2 million Americans will have an myocardial infarction (MI) annually and about one-fourth of these will die in an emergency department or before reaching hospital. One in nine death certificates in the United States mentioned heart failure, and more than 2200 Americans die of coronary vascular

Access this article online

Website: <http://innovationalpublishers.com/Journal/ijnh>

ISSN No: 2454-4906

DOI: <https://doi.org/10.31690/ijnh/33>

Address for Correspondence:

Mrs. Shweta Rasaria, Department of Child Health Nursing, Bombay Hospital College of Nursing, Mumbai, Maharashtra, India. E-mail id: harishweta@yahoo.com

This is an open-access journal, and articles are distributed under the terms of the Creative Commons Attribution Noncommercial Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms

disease each day.^[4] India has the highest number of persons suffering from heart diseases. About 45 million people are affected with coronary artery diseases. One-fifth of the death in India occurs due to coronary artery diseases. India is also the fourth largest country in the world conducting heart surgeries, and more than 50,000 cardiac surgeries are performed every year in our country.^[5,6]

ROLE OF INTRA-AORTIC BALLOON PUMP (IABP) IN HEART DISEASES

IABP therapy was first introduced in the 1960s for the treatment of cardiogenic shock. IABP is considered as the first hemodynamic support device to help in improvements in the myocardial oxygen supply/demand ratio and circulatory support. Since then, it has assumed a pivotal role in the treatment of those with heart failure and myocardial ischemia and is the most widely used mechanical support. Impaired left ventricular function causes low cardiac output and inadequate coronary artery perfusion. IABP counterpulsation is a widely accepted therapeutic method of temporarily supporting the patient with impaired left ventricular function.

Counterpulsation helps to balance the myocardial oxygen supply and demand in these patients. The hemodynamic effect of counterpulsation is immediate, predictable and most importantly decreases morbidity and mortality.^[7] IABP counterpulsation therapy is a volume displacement device designed to provide partial assistance to the left ventricle of the heart. Successful reduction in mortality has been achieved using IABP therapy for patient with acute left ventricular failure after cardiac surgery. IABP counterpulsation therapy is used to wean patients from cardiopulmonary bypass and to provide post-operative circulatory assistance until left ventricular recovery occurs.^[8]

IABP is a valuable option in cardiac surgeries and end-stage cardiac diseases; patients are prone to many complications due to IABP therapy. This device may be used in patients with a wide range of disorders that cause low cardiac output or cardiac instability, such as refractory angina, ventricular dysrhythmias associated with ischemia, pump failure caused by cardiogenic shock, intraoperative myocardial infarction, or low cardiac output after bypass surgery.^[9] It is the most widely used temporary mechanical circulatory assist device for supporting failing circulation. Today, more than 160,000 patients worldwide receive this therapy annually. This primary purpose of IABP is the support of the failing heart by simultaneously increasing myocardial oxygen supply and decreasing myocardial oxygen demand^[10] while at the same time increasing cardiac output. Increasing cardiac output increases coronary blood flow and therefore myocardial oxygen delivery increases.^[11]

It remains the most widely used mechanical cardiac support device due to its simplicity, ease of insertion, and long clinical track record. IABP catheter consists of single, sausage-shaped

polyurethane balloon that is wrapped around the distal end of vascular catheter and positioned in the descending thoracic aorta just distal to the take off the left subclavian artery and is attached to an external drive console which inflates and deflates the intra-aortic balloon in synchrony with cardiac contraction.^[12]

IABP SUPPORTIVE STUDIES

Bhatia and Patel conducted a study in Ahmadabad to assess the risk score to predict 30-day mortality in patients with IABP implantation in April 2007.^[13] They performed a retrospective analysis of 120 patients receiving pre- or post-operative IABP support. Univariate and multivariate analysis was carried out to assess variable potentially influencing 30-day mortality to develop a risk score for the prognosis of survival and for the decision on optimal patient-specific treatment. The four parameters (mean arterial pressure, adrenalin dose, central venous pressure, and blood concentration) at 6 h of IABP use were independently related to 30-day mortality. This data demonstrated that intra-aortic balloon implantation is necessary to reduce the mortality rate.^[13]

RATIONALE AND UNDERSTATING OF NURSES FOR IABP PROCEDURE IN PATIENTS

A retrospective cohort study was conducted to describe the contemporary utilization, clinical outcomes, and complication rates of IABP therapy.^[14] 150 consecutive patients who received IABP therapy were included in the study. They found that thrombocytopenia occurred in 50%, fever in 36%, bleeding in 27%, and vascular embolic events in 1%. Thrombocytopenia was the most common adverse event and was not significantly associated with the use of antiplatelet agent. In this contemporary cohort of IABP patients, complication rates of thrombocytopenia, fever, and bleeding were relatively high.^[14]

The nurse's role require the operation of the IABP, while at the same time, the ability to deliver quality nursing care, knowledge of physiology, coordination of the principles of timing with hemodynamic effects, and skillful problem-solving assure critical care nurse that they can effectively manage the IABP challenge. Knowledge regarding IABP therapy is vital to safe, efficient patient care in the cardiothoracic intensive care unit (ICU) and should be so regarded by everybody involved. Lewis, Ward, and Courtney conducted a study in 2009 regarding IABP in heart failure management, and they concluded that, to achieve the best possible outcome for a patient managed with IABP, nursing and medical staff required specialized skills.^[15] Nurses must continually assess changes in patients' condition which require knowledge of the cardiovascular system, therapeutic effects of IABP, and potential adverse events.^[15] Cardiovascular nurses caring for coronary artery disease patients require proper skills and knowledge that enable prompt recognition and treatment of sometimes life-threatening complications associated with balloon pump therapy.^[15]

Nurses working in intensive care and cardiac units not only have to know complications and how to monitor and operate IABP but also, before insertion of IABP, a baseline assessment is performed incorporating lower and upper limb perfusion. Upper limb assessment is essential so that balloon migration obstructing blood flow down the left subclavian artery can be detected promptly. Nurses should be familiar with the IABP device. The IABP actively deflates in systole increasing forward (heart) blood flow by reducing afterload (pressure) thus and actively inflates in diastole increasing blood flow to the coronary arteries. These actions have the combined result of decreasing myocardial oxygen demand and increasing myocardial oxygen supply. This process is in great demand by nursing staff during certain incidence of MI complications and shock treatment.^[16]

An article on tackling IABP therapy shows that nurses should gain a comprehensive understanding of IABP therapy to intervene when complications arise. The IABP is frequently used as an aid in stabilizing cardiac patients.^[17] Units such as the ICU, critical care unit, and cardiac cath lab are common places where IABP therapy is performed. To gain a greater understanding of IABP therapy, nurses should become familiar with specific institutional policies regarding the operation of this device.^[17] Nursing care of patient connected with IABP involves care of the pump as well as assesses patients from a cardiovascular and hemodynamic perspective. The management of the pumping console and its timing functions is performed by the critical care nurse caring for the patients. There are multiple factors that may affect the efficacy of the IABP, including positioning of the balloon within the aorta, the balloon displacement volume, inflation, deflation timing, signal quality, the patient cardiac function, and hemodynamic variables, which include circulating blood volume, blood pressure, and vascular resistance. The critical care nurse needs to be aware of these factors to adequately assess for and ensure optimal IABP performance.^[18]

ROLE OF NURSES IN IABP

In addition to regular patient monitoring and assessment, the nurses need to focus on issues specific to IABP. Nurses play a critical role in caring for patients receiving IABP therapy. Nurses who care for patients managed with IABP require knowledge of the mechanisms and actions of this therapeutic device as well as addressing IABP's indications, contraindications, physiology of functions, potential complications, and safety considerations.^[18] Aside from gathering the equipment specific to IABP insertion, nursing care involves preparing the patients (attaching the patient to the pump's electrocardiogram leads and labeling them, setting up the transducer and leveling it with the patient's phlebostatic axis, and preparing the groin site).

The patient is assessed for their tolerance of lying flat and their needs for sedation or anxiolytics as per hospital guidelines. Following insertion, nursing care involves cardiovascular/

hemodynamic assessment. Furthermore, nursing care involves maintenance of fluid balance, positioning and pressure area care, observation of the balloon catheter and line, the catheter insertion site, limb perfusion, neurological status and providing psychological support for patient and family etc.^[18]

Other nursing care involves checking the insertion site every hour for bleeding or hematoma formation ooze or symptoms suggestive of retroperitoneal bleed every 15 min for the 1st h, half hourly for the next 2 h, and thereafter hourly document the findings. In addition, the full blood count and anticoagulation screen are observed for a decrease in hemoglobin and platelet count. Lower limb perfusion is assessed to confirm adequate perfusion and presence of pedal pulses.

In addition, the insertion site dressing should be transparent which enables visual inspection of the site. Change of dressing in IABP surgery patients must be carried out as per clinical need and hospital guidelines under aseptic technique to minimize the risk of infection.^[19] Frequency of monitoring depends on patient's clinical condition. Indications of bleeding in IABP patents may manifest as oozing, bruising or hematoma formation at the insertion site or by swelling in the thigh area.^[20] The IABP pump in patients should be checked hourly for correct setting parameters such as timing and maximum inflating capacity of balloon.

As with any intensive hemodynamic monitoring system, the pressure bag should be inflated and maintained at 300 mm/hg, thus ensuring optimal flush system, which is requiring for line patency. The level of the transducer is at the phlebostatic axis that is confirmed using the spirit level and is changed as per patient position. Patient position is an important consideration if the IABP is to be effective. The patient should be no higher than 300, which ensures patency of the balloon and continuous flow to the balloon and reduces the risk of catheter kinking and obstructing the passage of helium into and out of the catheter.^[21]

Once the patient condition is stabilized, the IABP is considered for removal. This is preceded by a process of weaning the pump from 1:1–2:2 and finally 1:3 and observing the patient by critical care nurse for ischemic chest pain or development of heart failure symptoms such as breathlessness, hypotension, and tachycardia. Post-removal, the patient is kept on bed rest with the leg kept straight as per local guidelines.

As per above-mentioned evidence, nurses play a crucial role in caring patient with IABP. Nurses who care for patients managed with IABP require knowledge of the mechanism and actions of this therapeutic device. Besides these nurses must have knowledge of IABP physiology, benefits, potential complications and safety considerations.

Above information reveals that nursing care involves care of the pump as well as assesses patient from a cardiovascular and hemodynamic perspective. Critical care nurses are expected to manage IABP therapy. It is therefore important that the critical nurse has the knowledge to manage IABP therapy in a safe and therapeutic manner.

FUTURE PERSPECTIVE

As technology evolves in the treatment of cardiovascular disease, critical care nurses must continually examine and revise clinical practice standards.^[22] Conducting nursing research is one way for improving the existing body of knowledge in the field of nursing. The change could be brought about using the data of research and utilizing it in improving the quality of care.

CONCLUSION

This review involved the knowledge and practice of staff nurse regarding the management of patient with IABP. Knowledge and practices of staff nurses must be adequate to achieve the best result of IABP. It is important to have regular in service education programs for nurses to improve their knowledge and practical skills while caring the patient, to achieve quality care as well as prevent complications associated with IABP.

REFERENCES

1. Kapil S. Short Essay on the Importance of Good Health, Preserve Articles; 2011. Available from: <http://www.preservearticles.com/health/essay-on-the-importance-of-health/5081>.
2. Williams SM, Wilkins JS. Pathophysiology Two in One Reference for the Nurses. 1st ed. Philadelphia: Lippincott; 2005.
3. Abdulla AM. Coronary artery Disease; 2012. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4440543/>.
4. Roger VL. Heart disease and stroke statistics. American heart association. Circulation 2011;123:e18-209.
5. Das MK, Kumar S, Deb PK, Mishra S. History of cardiology in India. Indian Heart J 2015;67:163-9.
6. Kalam AP. Speech on 32nd Convocation of AIIMS. Available from: <http://abdulkalam.nic.in/sp261102-1.html>.
7. Quaal SJ. Comprehensive Intra-aortic Balloon Pumping. St. Louis: Mosby; 1984.
8. Susan LW, Froelicher S, Underhill S. Cardiac Nursing. 6th ed. New York: Philadelphia Wolter Kluwer; 2005.
9. Williams and Wilkins. Nursing-Interpreting Intra-aortic Balloon Pump Waveforms. Vol. 39. Philadelphia, PA: Spring: Lippincott Williams and Wilkins Publishers; 2012. p. 9-10.
10. Urden L, Stancy K, Lough M. Critical care nursing, Diagnosis and Management. Milano: An Imprint of Elsevier Inc.; 2012. p. 534-6.
11. Leotsinidis P M, Akbar MT, Dougenis A. The need for intra-aortic balloon pump support following open heart surgery: Risk analysis and outcome. J Cardiothorac Surg 2010;5:20.
12. Intra-Aortic Balloon Pump Free Encyclopedia. Available from: <https://www.texasheart.org/heart-health/heart-information-center/topics/ventricular-assist-devices/>.
13. Bhatia A, Patel M. Department of Cardiothoracic Surgery and Heart Centre. Ahmadabad: National University Hospital; 2007. p. 1085-7.
14. Vales L, Kanei Y, Ephrem G, Misra D. Intra-aortic balloon pump use and outcomes with current therapies. J Invasive Cardiol 2011;23:116-9.
15. Lewis SM, Heitkemper MM, Dirksen SR. Medical Surgical Nursing. 6th ed. America: Mosby Publishers; 2000.
16. Valk SD, Cheng JM, den Uil CA, Lagrand WK, van der Ent M, van de Sande M, *et al*. Encouraging survival rates in patients with acute myocardial infarction treated with an intra-aortic balloon pump. Neth Heart J 2011;19:112-8.
17. Ali M. Position Statement on Intra-aortic Balloon Pump Therapy Endorsed by SAGES. Vol. 12. ASMB S Guidelines/Statements; 2016. p. 462-7.
18. Ward L, Courtney D, Mary D. The intra-aortic balloons pump in heart failure management: Implications for nursing practice. Aust Crit Care 2009;22:125-31.
19. Morton PG, Fontaine DK. Essentials of Critical Care Nursing, A Holistic Approach. 10th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams and Wilkins; 2012. p. 173.
20. Parissis H, Leotsinidis M, Akbar MT, Apostolakis E. The need for intra-aortic balloon pump support following open heart surgery: Risk analysis and outcome. J Cardiothorac Surg 2012;5:20.
21. Huang YH, Hsu LL. Clinical teaching program: Standardized operating procedure for intra-aortic balloon pump support. Hu Li Za Zhi 2012;59:88-93.
22. Homes L, Hollabaugh SK. Using the continuous quality improvement process to improve the care of patients after angioplasty. Crit Care Nurse 1997;17:56-65.

How to cite this article: Rasaria S, Sawant S. The Role of Nurses in Patients with Intra-aortic Balloon Pump: Involvement, Understanding, and Management of the Patient's Comfort. Innov J Nurs Healthc. 2019;5(2):16-19.