THE KNOWLEDGE OF CRITICAL CARE NURSES REGARDING INTRA-AORTIC BALLOONPUMP COUNTERPULSATION THERAPY

by

PHILLIPPUS JOHANNES OOSTHUIZEN

submitted in part fulfilment of the requirements for the degree of

MASTER OF ARTS IN NURSING SCIENCE

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: DR A D H BOTHA

JOINT SUPERVISOR: MRS M J OOSTHUIZEN

JANUARY 2000

ACKNOWLEDGEMENTS

I express my sincere thanks and appreciation to:

- Our Father for health, hope and strength.
- Peter, for meticulous typing, editing, love and patience.
- My family, for encouragement.
- Dr Botha and Mrs Oosthuizen, for all their help and the time spent on me.
- Dr Robert Routier, for answering all my questions.
- Fransonet Reyneke, for the statistics and suggestions.
- Mrs F Oates and private clinic management, for the use of their facilities and support.
- Yvonne Jamieson, for her precept and support.
- Mrs M Bosman, for her enthusiasm, motivation and inspiration.
- All the staff at the private cardiothoracic unit where the study was done. Without their support and co-operation this study would not have been possible.

SUMMARY

Intra-aortic balloonpump (IABP) counterpulsation therapy is a volume displacement device designed to provide partial assistance to the left ventricle of the heart. Critical care nurses are expected to manage IABP therapy. It is therefore important that the critical care nurse has the knowledge to manage IABP therapy in a safe and therapeutic manner. The question arises: does the critical care nurse have the knowledge to manage IABP therapy?

The purpose of this research study is to explore and describe the knowledge of the critical care nurse regarding the management of IABP therapy.

The design of this research study is a quantitative, descriptive and contextual study, in which a sample survey was performed, using a questionnaire (based on a literature study) under controlled conditions.

The knowledge of the majority of critical care nurses tested was found to be insufficient. Safe management guidelines and in-service training have been proposed to improve the situation.

---o0o---

OPSOMMING

Intra-aortiese ballonpomp (IABP) teenpulsasie terapie is 'n volume verplasings apparaat, ontwerp om gedeeltelike ondersteuning aan die linker ventrikel van die hart te bied. Kritiekesorgverpleegkundiges is verantwoordelik vir die hantering van IABP terapie. Die vraag ontstaan: beskik die kritiekesorgverpleegkundige oor voldoende kennis rakende die hantering van IABP terapie?

Die doel van hierdie studie is om die kennis van kritiekesorgverpleegkundiges te ondersoek en te beskryf rakende die hantering van IABP terapie.

Die navorsingsontwerp is kwantitatief, beskrywend en kontekstueel van aard, waartydens 'n gerieflikheidsteekproeftrekking gedoen is, met gebruik van 'n vraelys (gebasseer op 'n literatuurstudie) onder gekontrolleerde toestande.

Die resultate van hierdie navorsingstudie dui daarop dat die meerderheid kritiekesorgverpleegkundiges wat getoets was oor onvoldoende kennis beskik ten opsigte van IABP terapie. Formulering van riglyne en indiensopleiding is aanbeveel om hierdie situasie te verbeter.

---o0o---

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AEDP	Aortic end-diastolic pressure
AP	Arterial pressure
APSP	Assisted peak systolic pressure
AVC	Aortic valve closure
AVO	Aortic valve opening
BAEDP	Balloon aortic end-diastolic pressure
CO	Cardiac output
CPP	Coronary perfusion pressure
DN	Dicrotic notch
ECG	Electrocardiogram
EDP	End-diastolic pressure
IAB	Intra-aortic balloon
IABP	Intra-aortic balloonpump
IVC	Isovolumetric contraction
IVR	Isovolumetric relaxation
LVEDP	Left ventricular end-diastolic pressure
MAP	Mean arterial pressure
PAEDP	Patient aortic end-diastolic pressure
PCWP	Pulmonary capillary wedge pressure
PDP	Peak diastolic pressure
PSP	Peak systolic pressure
SV	Stroke volume
SVR	Systematic vascular resistance

CHAPTER 1

OVERVIEW OF STUDY

1.1 INTRODUCTION

Impaired left ventricular function causes low cardiac output and inadequate coronary artery perfusion. Intra-aortic balloonpump (IABP) counterpulsation therapy is a widely accepted therapeutic method of temporarily supporting the patient with impaired left ventricular function; this principle has not changed since the original inception of the IABP in 1962 (Quaal, 1984:3). Counterpulsation helps to balance the myocardial oxygen supply and demand in these patients. The hemodynamic effects of counterpulsation are immediate, predictable and most importantly, decrease morbidity and mortality (Quaal, 1984:4).

Nursing management of patients who require IABP therapy can be an overwhelming experience if the fundamentals of counterpulsation are not fully understood. Critical care nurses practicing in the cardiothoracic intensive care unit should be skilled in providing effective nursing management to the patient receiving IABP therapy. They are expected to manage the IABP as well as the patient (Shoulders-Odom, 1991:60). Nursing care is not provided in the same manner required for any critically ill patient. The critical care nurse's role in IABP therapy includes solving problems associated with the patient, the balloon catheter and/or the IABP console (Shoulders-Odom, 1991:72). Maximum benefits from IABP therapy can be derived only with highly skilled and knowledgeable critical nursing care (Goran, 1996:57).

1.2 PROBLEM STATEMENT

IABP therapy is a treatment instituted by a medical practitioner. It is, however, the function of the critical care nurse to correctly maintain that treatment, whilst monitoring the vital signs of the patient concerned (South African Nursing Council Regulation No R2598 of 30/11/1984).

IABP counterpulsation is a frequently used therapy for patients whose health is severely affected by left-ventricular dysfunction. It is therefore important that the critical care nurse should have the knowledge to manage the balloonpump in a safe and therapeutic manner.

The question arises: does the critical care nurse have sufficient knowledge to maintain intra-aortic balloonpump counterpulsation therapy?

1.3 PURPOSE

The aim of this research study is to explore and describe the knowledge of the critical care nurse regarding the maintenance of IABP therapy and to formulate guidelines to advocate safe management of intra-aortic balloonpump therapy.

1.4 OBJECTIVES

The objectives of this research study are:

- to explore and describe the critical care nurses' knowledge regarding IABP therapy in a private cardiothoracic intensive care unit, and
- to use the information obtained to formulate guidelines for the safe usage of IABP therapy.

1.5 ASSUMPTIONS OF THIS RESEARCH STUDY

1.5.1 METATHEORETICAL ASSUMPTIONS

One's philosophical position influences knowledge as well as how one views the empirical world (Burns & Grove, 1993:15).

For the purpose of this study the Whole Person Theory from the Oral Roberts University, Anna Vaughn School of Nursing is used only as a paradigmatic perspective. This theory is utilised as a framework for nursing education, nursing practice and nursing research, which focuses on the continuous quest for wholeness of the individual within the family and the community (Oral Roberts University, Anna Vaughn School of Nursing, 1990:Rand Afrikaans University, Department of Nursing, 1992).

1.5.2 THEORETICAL ASSUMPTIONS

Bergman's Model of Accountability (Bergman, 1982:8) serves as framework for this research study. In order to be accountable there are several preconditions that must be fulfilled:

- the basic precondition is to have the *ability* (knowledge, skill, values) to decide and act on a specific issue;
- the *responsibility* to carry out that action;
- the *authority*; the legal right to carry the responsibility, and
- with the preconditions, the critical care nurse can be *accountable* for the action taken (Bergman, 1982:8).

1.5.3 METHODOLOGICAL ASSUMPTIONS

The nursing model of Botes (1992:20) presents the activities of nursing on three levels. The first order is nursing practice which is the research domain for nursing and a primary source of research themes.

The second order is the theory of nursing and research methodology. This includes research and theory development. It is functional by nature in that the knowledge which is generated is applied in nursing practice. The determinants of research are the characteristics of the research domain, the assumptions of the researcher, the research objectives and the research context. The aspects on which research decisions are made are initiation, formulation, conceptualisation, research design and implementation. The knowledge gained in this study will be utilised to enhance quality care of the patient undergoing IABP therapy.

The third order is the paradigmatic perspective of nursing. The researcher selects assumptions for research from the paradigm. These serve as determinants for the research decisions.

1.6 DESCRIPTION OF CONCEPTS FOR THIS RESEARCH STUDY

1.6.1 CRITICAL CARE NURSES

Critical care nurses are highly specialised nurses. They are skilled and competent personnel who have a solid understanding of the body of knowledge of critical care nursing and of pertinent information from other disciplines. These highly competent and skilled people provide intensive care for patients requiring both close monitoring and critical care intervention (Clochesy, Breu, Cardin, Whittaker & Rudy, 1993:xiii).

1.6.2 CARDIOTHORACIC INTENSIVE CARE UNIT

Cardiothoracic intensive care units are areas of a hospital with specialised facilities and technology dedicated to the care of the pre- and post-operative cardiac and thoracic patient. Facilities include physiological monitoring devices and immediate resuscitative equipment. Staff members are specialised surgeons, cardiologists, anaesthetists and critical care nurses with post-registration qualification in critical care nursing or experience in critical care nursing. Most cardiothoracic intensive care units are also teaching areas for those studying critical care nursing for diploma or degree purposes.

1.6.3 THE INTRA-AORTIC BALLOONPUMP

The intra-aortic balloonpump exerts its effect by rapidly shuttling helium gas in and out of the balloon chamber. At a precisely timed interval, the gas enters the balloon chamber within the aorta. As the gas is shuttled into the balloon, it occupies a space within the aorta equal to its volume. The sudden occupation of space by the gas upon inflation causes blood to be moved from its original position. The blood is moved superiorly and inferiorly to the balloon (Arrow, 1996:13). There are several models of various brand-name balloonpumps available. There is only one type of balloonpump utilised in the cardiothoracic unit where this research study was conducted. The research study is therefore worded with the technical aspects of this particular balloonpump in mind.
The management of the patient receiving IABP therapy includes *cardiac monitoring devices* which display ECG (electrocardiograph) tracings. The evaluation of IABP therapy is reliant

on such devices, together with the observation of hemodynamic vital signs (Arrow, 1996:14).

1.6.4 KNOWLEDGE

Knowledge is a complex, multifaceted concept, which is acquired in a variety of ways and is expected to be an accurate reflection of reality (Burns & Grove, 1993:12). Nursing's development of a body of knowledge will give nurses the confidence that they "know" what they are doing (Burns & Grove, 1993:15).

As knowledge is a general term, it has been further divided into two categories for this study: *pre-knowledge* and essential knowledge. *Pre-knowledge* is concerned with the principles of counterpulsation therapy, left ventricular failure, the complications associated with IABP therapy and the indications for counterpulsation. This knowledge is relevant to the research study setting, but not to the area to be tested.

Essential knowledge is that which applies directly to IABP management and is to be tested. The following elements fall under essential knowledge:

- components of the balloonpump;
- balloonpump settings;
- care of the balloon catheter and the intra-aortic balloonpump;
- evaluation of the balloonpump therapy;
- complications associated with balloonpump therapy, and
- removal of the balloon catheter.

1.7 RESEARCH DESIGN AND METHOD

1.7.1 DESIGN

The design of this research study is a quantitative, descriptive and contextual study, in which a sample survey will be performed. The knowledge of critical care nurses will be explored and described, with the ultimate aim being to formulate guidelines for critical care nurses in a cardiothoracic intensive care unit on the West Rand.

1.7.2 METHOD

The research method is summarised in table 1.1 and will be discussed in detail in chapter 3.

Table 1.1 Research design and method

AIM	DATA GAHERING	SAMPLING & POPULATION	VALIDITY & RELIABILITY	DATA ANALYSIS
Explore and describe knowledge of critical care nurses regarding IABP therapy	Implementation of a questionnaire under controlled conditions	Sampling; convenience sample of voluntary critical care nurses of all qualifications, regardless of staff appointment in a private cardiothoracic intensive care unit in the West Rand area	Literature review, – professional experts critique and pilot study	Descriptive statistics

1.8 SUMMARY

Patients suffering myocardial infarction, undergoing cardiothoracic surgery or with left ventricle dysfunction, run the risk of inadequate cardiac output. Insufficient left ventricular function are treatable by means of IABP therapy. Unless complications of IABP therapy are recognised and managed timeously, the patient's life is at risk. Therefore critical care nurses' knowledge regarding IABP therapy is of mandatory importance. The knowledge of critical care nurses concerning the above-mentioned, will be tested by means of a questionnaire, based on a literature study, which is to follow in chapter 2 of this research study.

---o0o---

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this study is to explore and describe the knowledge of the critical care nurse regarding the safe nursing management of IABP therapy, and to formulate guidelines for the safe usage of the balloonpump.
Knowledge involves the issues of responsibility, authority and accountability. Knowledge and skills, together with values, form an integral part of the concept *ability* according to Bergman (1982:8-9). Bergman sites ability as being the base of a pyramid which is built further by the concepts *responsibility* and *authority*, leading to *accountability* (Bergman, 1982:8).

The critical care nurse is an independent practitioner and he/she is accountable and responsible for quality patient care.
Bergman (1982:8) describes a model of accountability which constitutes that in order to be accountable and responsible, the nurse practitioner must have the ability to render patient care. Ability implies knowledge, skills and values. Bergman's model of accountability will be the theoretical basis for the conceptual framework of this study, refer to figure 2.1.

2.2 CONCEPTUAL FRAMEWORK

The nurse is responsible for nursing practice and maintaining competence by continual learning, education and in-service training. The nurse uses both judgement and a rating of individual competence when accepting and delegating responsibilities (Kozier, Erb & Blais, 1992:196).
The critical care nurse, as an independent practitioner, functions according to the Nursing Act, 1978 (Act No 50 of 1978 as amended) within an ethical-legal framework. As an independent practitioner he/she has the right to accept or not accept a prescription. The criteria that he/she uses in accepting the prescription is whether he/she has sufficient knowledge. The independent practitioner is accountable for his/her actions and omissions and responsible for scientific nursing based on the Scope of Practice Regulations Government Notice 2598 of 30 November 1984 (South Africa 1978).

Bergman (1982:8) describes some requirements for accountability. These requirements can be presented in the form of a pyramid which implies that each requirement forms the base of the next, refer to figure 2.1.

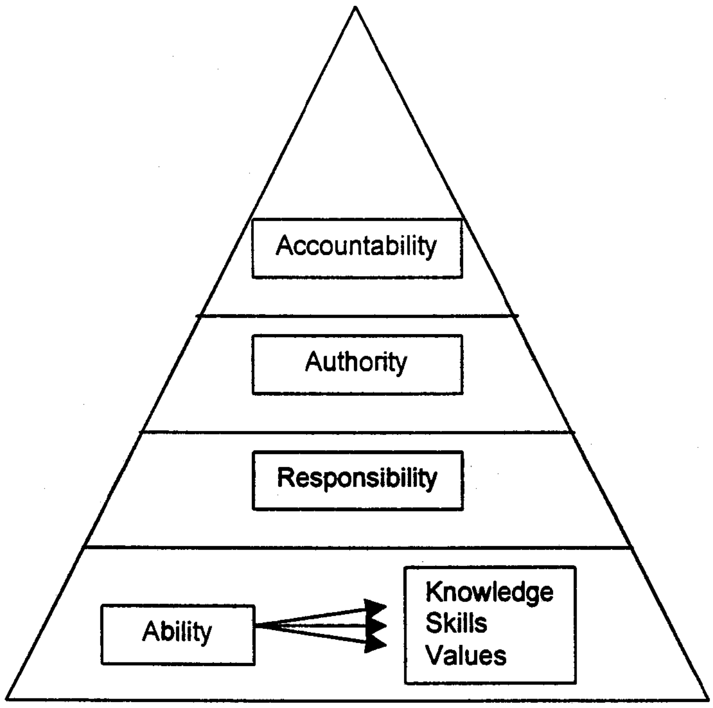


Figure 2.1. Bergman's Model of Accountability (1982:8).

In the critical care unit setting advanced technology is employed and there is a one-to-one ratio of critical care nurse to patient. The critically ill patient requires constant monitoring, as his/her condition may change at any moment. A rapid change in condition is not uncommon in the severely ill and it has to be met by prompt decision-making and action (Souhami & Maxham, 1990:543-544; Thelan, Davie & Urden, 1998:1). "Central to this process of monitoring and adjustment of the patient's physiology is the critical care nurse .... " (Souhami & Maxham, 1990:543-544). The critical care nurse is responsible for the patient to whom he/she has been allocated. Henceforth the conceptual framework will be described according to Bergman's model.

2.2.1 ABILITY

Ability is the possession of relevant knowledge, skills and values to make decisions and act appropriately (Watson, 1995:70). In order to be held accountable for actions and decisions, the critical care nurse needs to be capable of discerning correct acts and decisions and be prepared (skilled) to do so. Ability implies knowledge, skills and values (Bergman, 1982:8).

2.2.1.1 KNOWLEDGE

Knowledge results from careful systematic research and from repeated experiences in clinical practice (Meleis, 1991:130). Knowledge may be regarded as both public and personal. Public knowledge is that which is freely available in the form of books, articles and any type of literature, as well as speech in the form of talks, broadcasts or recordings. Personal knowledge is that which comprises one's internal construction of public knowledge.

After exposure to public knowledge, there is a cognitive process of knowledge construction where the critical care nurse interprets new information. Klopper (1994:3-4) refers to the thinking skills (strategics) which the independent practitioner needs in order to render quality patient care

The two basic processes are those of memory and construction. The critical care nurse has independent practitioner status; in order for him/her to function effectively and to apply the scientific method of nursing he/she requires the thinking skills of application, analysis, synthesis and evaluation. Only if these thinking skills are used, can the critical care nurse be an independent practitioner and a critical-analytical thinker.

Knowledge in this study has been divided into 'pre-knowledge' and 'essential-knowledge' to promote clarity. Pre-knowledge is defined as that which is relevant to the cardiothoracic critical care nurse and functions as background knowledge to IABP therapy. Essential-knowledge is that which is relevant to IABP therapy, and the focus of this study.

A PRE-KNOWLEDGE

The pre-knowledge in this research study aids the critical care nurse in understanding the principles of and indications for IABP therapy.

(i) PRINCIPLES OF INTRA-AORTIC BALLOONPUMPING

- ***Definition***

The IABP is a mechanical counterpulsation device that causes intra-aortic pressure to rapidly fall synchronously with ventricular systole and rise rapidly simultaneously with ventricular diastole. It is used to reduce cardiac workload and myocardial oxygen demand, whilst increasing cardiac output and coronary artery blood flow. It also reduces left ventricular end-diastolic pressure (Woods, Sivarajan Froelicher, Halpenny & Underhill Motzer, 1995:581).

- ***Placement***

A flexible catheter with a balloon mounted on the end is inserted in the femoral artery and passed into the descending thoracic aorta. The intra-aortic balloon material is called cardio-thane and was chosen for its resilience and blood compatibility. Once the balloon catheter is passed into the descending aorta, placement must be confirmed by fluoroscopy or chest X-ray. The balloon is situated 2cm below the origin of the left subclavian artery and above the renal artery branches. On daily chest X-ray, the tip should be visible between the 2^{nd} and 3^{rd} intercostal space (Thelan et al. 1998:567).

This placement is critical for proper operation and avoidance of arterial tributary obstruction. If the balloon is placed too low, then the origin of the renal arteries could become obstructed, thereby compromising renal perfusion. If the catheter is placed too high, obstruction of the origin of the left subclavian or even the left carotid artery could result.

The intra-aortic balloon should not totally occlude the aortic lumen during inflation. Ideally it should be 85% occlusive. Total occlusion could result in aortic wall trauma and damage to red blood cells and platelets (Thelan et al. 1998:568).

- ***Afterload***

Afterload is the impedance to ventricular ejection. Impedance to ejection is a result of the aortic valve, aortic end-diastolic pressure and vascular resistance. With greater impedance afterload increases and thus more oxygen is demanded by the myocardium. Deflation of the intra-aortic balloon in the aorta just prior to ventricular systole, lowers aortic end-diastolic pressure which decreases impedance. With decreased impedance, the workload of the ventricle also decreases. In this way IABP therapy effectively decreases the oxygen demand of the heart (Woods et al. 1995:581).

- ***Preload***

Preload refers to the amount of stretch on the ventricular myocardium prior to contraction (Thelan et al. 1998:349). The volume/pressure in the ventricle at end-diastole increases when the ventricles are in failure. IABP therapy helps decrease excessive preload in the left ventricle by decreasing impedance to ejection.
With decreased impedance there is more effective forward flow of blood, thus preload is decreased.

- ***Contractility***

Contractility refers to the heart's contractile force (Thelan et al. 1998:350). Although the physiologic basis of contractility is not completely understood, it is known that an increase in contractility increases myocardial oxygen consumption. IABP therapy can increase oxygen supply to the myocardium, thereby decreasing ischemia and acidosis. In this way the myocardium is better equipped for improved contractility and improved cardiac function.

- ***Heart rate***

An increased heart rate will increase myocardial oxygen consumption as each contraction utilises oxygen. By improving contractility, the IABP helps improve myocardial pumping and the ability to increase stroke volume. Decreasing afterload also increases pumping efficiency. With improved myocardial function heart rate will decrease resulting in improved blood flow and oxygen delivery to the myocardium (Woods et al. 1995:582).

- ***Volume displacement***

The intra-aortic balloon exerts its effect by volume displacement and pressure changes caused by rapidly shuttling helium gas in and out of the balloon chamber. At a precisely timed interval, the gas enters the balloon chamber within the aorta. As the gas is shuttled into the balloon, it occupies a space within the aorta equal to its volume. The sudden occupation of space by the gas upon inflation causes blood to be moved from its original position, superiorly and inferiorly to the balloon. Since the volume in the aorta is suddenly increased, and the aortic wall is fairly rigid, the intra-aortic pressure increases sharply (Bavin & Self, 1991:57).

With deflation of the intra-aortic balloon, the chain of events is in the reverse. A sudden fall in aortic volume when the balloon deflates causes a sudden decrease in aortic pressure within that localised area. In response to the local fall in pressure, the blood in adjacent areas moves to normalise the pressure within the aortic cavity as a whole (Bavin, 1991:57).

The evacuation of the helium in the balloon from the aorta is timed to occur pecisely prior to ventricular ejection (systole).

Displacement of blood volume (both away from the balloon on inflation and toward the balloon on deflation) is the mechanism by which the IABP alters the hemodynamic state. In order to obtain beneficial hemodynamic changes the inflation and deflation of the balloon must occur at optimum times in the cardiac cycle (Wojner, 1994:49).

- ***Balloon inflation: hemodynamics***

Inflation of the balloon is set to occur at the onset of diastole. At the beginning of diastole, maximum aortic blood volume is available for displacement. If balloon inflation occurs later in diastole the pressure generation from volume displacement will be lower. This is because during late diastole, much of the blood has flowed out of the periphery and there is less blood volume in the aorta to displace (Joseph & Bates, 1990:45).

- ***Balloon deflation: hemodynamics***

The balloon remains inflated throughout the diastolic phase. Deflation of the balloon should take place at the onset of systole during the isovolumetric contraction phase. At the beginning of systole, the left ventricle has to generate a pressure greater than the aortic end-diastolic pressure to achieve ejection. The sudden evacuation of helium in the balloon will cause a fall in pressure in the aorta. Properly timed deflation will cause a fall in pressure, therefore, the left ventricle will not have to generate as much pressure to achieve ejection. The isovolumetric contraction phase is shortened, thereby decreasing the oxygen demands of the myocardium. Since the left ventricle will be ejecting against a lower pressure, the peak pressure generated during systole will be less (Joseph & Bates, 1990:50).

(ii) CLINICAL CORRELATES OF INTRA-AORTIC BALLOONPUMP THERAPY

♦ ***Signs of an improved clinical condition***

The alteration of improved coronary circulation and decreased myocardial workload all affect the patient's clinical status. Many of the clinical signs reflect the benefits of both inflation and deflation of the intra-aortic balloon while some are primarily caused by one action or the other. Table 2.1 shows the clinical signs of improvement by the IABP with the primary cause indicated.

Table 2.1 Correlation between clinical status and the effects of balloon inflation and deflation

PRIMARY CAUSE	INFLATION	DEFLATION
Decreased signs of myocardial ischemia: angina, ST segment changes, ventricular arrhythmias	✔✔	✔✔
Increased coronary blood flow	✔✔	
Decreased afterload		✔✔
Decreased myocardial oxygen consumption and demand		✔✔
Increased cardiac output	✔	✔✔
Increased urine output	✔	✔✔
Decreased preload: pulmonary capillary wedge pressure and central venous pressure	✔	✔✔
Decreased pulmonary congestion, improved arterial oxygenation, improved breath sounds and clearing chest X-ray	✔	✔✔
Improved mentation	✔	✔✔
Decreased heart rate	✔✔	✔✔
Decreased lactic acidosis	✔	✔✔

PRIMARY CAUSE	INFLATION	DEFLATION
Mean arterial blood pressure increased	✔✔	✔

(iii) INDICATIONS FOR INTRA-AORTIC BALLOONPUMP THERAPY

IABP therapy is the temporary supportive mechanical treatment of choice for the management of refractory left ventricular power failure (Woods et al. 1995:580-582). Table 2.2 lists the conditions relative to patient selection. Specific clinical criteria are generally observed before the initiation of counterpulsation therapy: (1) the low cardiac output syndrome persists, unimproved by standard measures; (2) the cardiac index remains at less than 2L/min/m²; (3) the systolic blood pressure_remains at less than 80mmHg: (4) the urine output remains below 30ml/hr (Woods et al. 1995:580-582).
Patients are carefully evaluated, but the decision to institute IABP therapy is generally made in a matter of 2 to 3 hours.

Table 2.2 *Indications for intra-aortic balloonpump therapy* (Woods et al. 1995:580-582)

A	MEDICAL INDICATIONS
1.	Cardiogenic shock
2.	Pre-shock syndrome
3.	Threatening extension of myocardial infarction
4.	Unstable angina
5.	Intractable-ventricular dysrhythmias
6.	Septic shock syndrome
7.	Cardiac contusion
8.	Prophylactic support for: - coronary artery angiography - coronary artery angioplasty
9.	Bridging device for: - cardiac transplant - total mechanical assistance
10.	Support during transport from community hospitals
11.	Mechanical defects: - valvular stenosis

	- valvular insufficiency: mitral valve - ruptured papillary muscles - ventricular septal defect - left ventricular aneurysm
B	**SURGICAL INDICATIONS**
1.	Post-surgical myocardial dysfunction
2.	Inability to wean from coronary pulmonary bypass machine
3.	Prophylactic support: - induction - non-cardiac procedures

(iv) CONTRA-INDICATIONS FOR INTRA-AORTIC BALLOONPUMP THERAPY

The contra-indications for IABP therapy are listed in table 2.3. The two primary considerations are the condition of the aortic valve and the peripheral vasculature (Woods et al. 1995:582). A competent aortic valve is required for pump effectiveness and successful treatment response. A faulty valve would permit increased aortic regurgitation during balloon inflation. The presence of atherosclerosis in the peripheral vasculature would limit the safe introduction of the balloon catheter and perhaps threaten the integrity of the selected artery during insertion (Woods et al. 1995:582).

Table 2.3 Contra-indications for intra-aortic balloonpump therapy

A	**ABSOLUTE CONTRA-INDICATIONS**
1.	Aortic valve insufficiency
2.	Dissecting aortic aneurysm
B	**RELATIVE CONTRA-INDICATIONS**
1.	End-stage cardiomyopathies – unless bridging device to transplant
2.	Atherosclerosis
3.	End-stage terminal disease
4.	Abdominal aortic aneurysm

(v) INTRA-AORTIC BALLOONPUMP THERAPY AFTER CORONARY ARTERY BYPASS GRAFT SURGERY

Successful reduction in mortality has been achieved by using IABP therapy for patients 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 (Woods et al. 1995:580).

The critical care nurse's role requires the operation of the IABP, while at the same time, the ability to deliver quality nursing care. Knowledge of cardiac physiology, co-ordination of the principles of IABP therapy with it's hemodynamic effects assure critical care nurses that they can effectively manage the IABP challenge (Wojner, 1994:76).

Involvement in complex patient care situations is commonplace in the cardiothoracic unit today. Critical care nurses come in contact with situations in which new techniques and innovative ideas are being implemented. Nursing management can favourably affect the prognosis of the coronary artery bypass graft (CABG) surgery patient with left ventricular failure receiving IABP therapy.

B ESSENTIAL KNOWLEDGE

Essential knowledge implies the knowledge that the critical care nurse *must* have regarding IABP therapy in order to function effectively as an independent practitioner. Without essential knowledge, improper use of IABP therapy could lead to a deterioration in the cardiothoracic patients' condition.

(i) COMPONENTS OF INTRA-AORTIC BALLOONPUMP THERAPY

- ***Balloon catheter***

Use of the percutaneously inserted balloon catheter has broadened the application of the IABP. The percutaneous technique requires only 10 to 15 minutes for insertion in an uncomplicated case. Insertion of the catheter can be performed by any physician skilled in catheterization techniques.

All hemodynamic and physical assessment data prior to insertion should be noted accurately by the critical care nurse. Good assessment prior to insertion documents the need for therapy and provides a baseline for evaluation of treatment efficacy. The circulation to both legs should be evaluated prior to insertion to determine the best side for insertion and to establish a baseline (Hudak & Gallo, 1994:276).

- ***Intra-aortic balloonpump***

The IABP is a technologically advanced, microprocessor based system. With its computerised control system, the IABP is highly automated, freeing the clinician to provide vital care to the patient. The IABP system design allows for rapid initiation of counterpulsation and is compatible with the output of most bedside monitors and direct inputs. It maintains precise intra-aortic balloon inflation and deflation timing based on the patient's current physiological condition, and automatically adjusts timing to accommodate variations in heart rate. The IABP system's comprehensive diagnostic alarm system alerts the console of catheter malfunctions (Arrow, 1996:43).

- ***Patient connection leads***

The front of the console contains the balloon connector and all of the input and output connections required to receive the signals that allow the control system to analyse the patient's status.
To optimise the electrocardiograph (ECG) signal and minimise artifacts, the ECG leads must be placed properly.
Shave excessive hair from electrode sites. Clean skin with alcohol pad or mild soap. Rub skin slightly until it is reddened. Place the three leads on bony prominences as illustrated in figure 2.2 (Arrow, 1996:39).

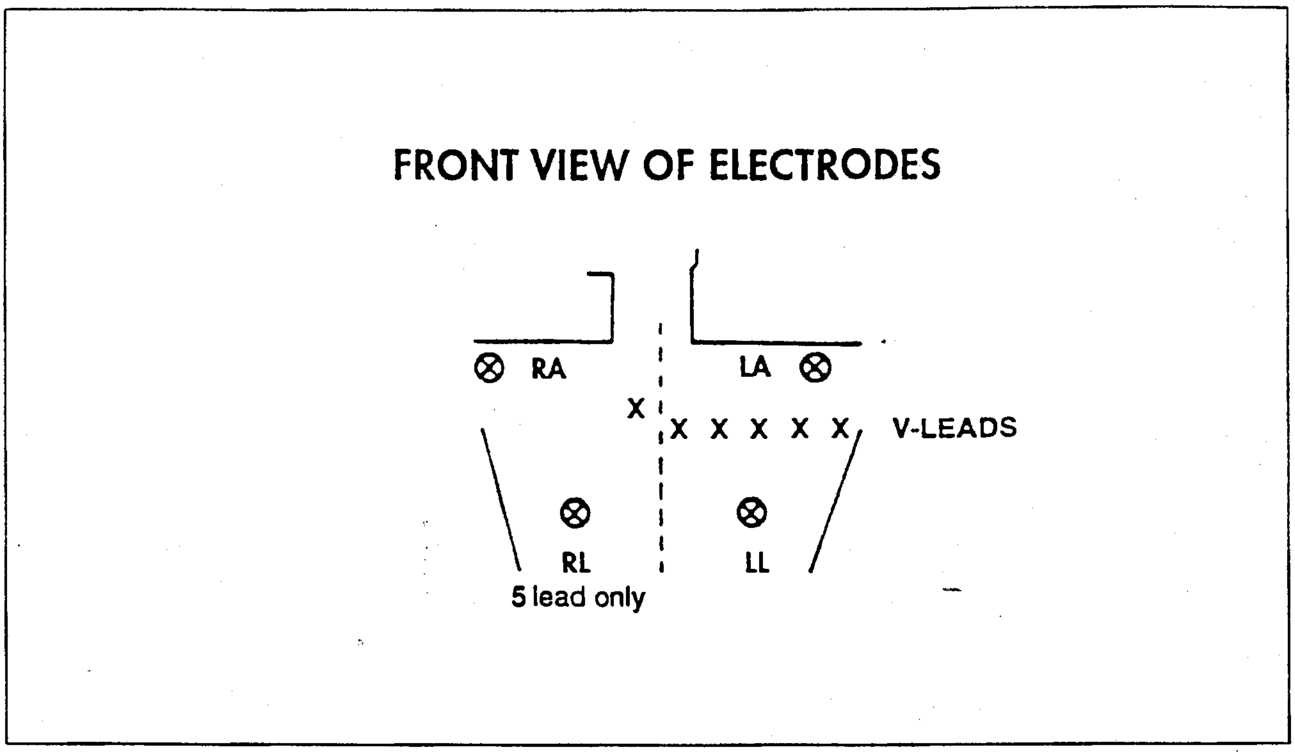


Figure 2.2 ECG electrode placement (Arrow, 1996:39)

Attach the colour-coded lead wires to the electrodes and secure clips in place, refer to table 2.4. Select the ECG lead that consistently provides the clearest, largest QRS complex (Arrow, 1996:56).

Table 2.4 Standard lead configurations (Arrow, 1996:56)

STANDARD LEAD CONFIGURATIONS		
LEAD	ACTIVE ELECTRODES	REFERENCES
I	RA (white) LA (black)	LL (red)
II	RA LL	LA
III	LA LL	RA

- ***Pneumatic drive module***

The pneumatic drive module contains the pumping system needed for IABP operation. A 500psi disposable helium tank is housed in a receptacle on the front of the module. The front of the module contains the power switch, balloon connector, electrical (AC) indicator lamp, and all of the input and output connections required to receive the signals that allow the control unit to analyse the patient's status (Arrow, 1996:31).

♦ ***System batteries***

The IABP battery system allows to use the system with full operational capabilities for a minimum of 180 minutes in case of AC power failure. The system automatically switches to battery power when AC power is removed (Arrow, 1996:31).

♦ ***Wheelbase***

The detachable wheelbase is designed for easy transport. Removal of the wheelbase allows the console to be mounted easily onto aircraft and ambulances (Arrow, 1996:32).

♦ ***Input and output connections***

The IABP will interface with most bedside monitors and can also receive inputs directly from patient cables. All input and output connectors are located on the front of the control console (Arrow, 1996:33).

♦ ***Balloon connection***

The balloon connector input connects the intra-aortic balloon's helium supply line to the IABP. This connector also limits the amount of helium which can be delivered to the intra-aortic balloon to it's maximum volume (Arrow, 1996:30).

(ii) INTRA-AORTIC BALLOONPUMP SETTINGS

The following pages describe the control keypad and individual key functions of the IABP used in this study. Control keys and selections are explained in the order of their appearance on the control module from top to bottom (Arrow, 1996:31-40).

♦ ***Inflate/deflate control keys***

INFLATE – adjusts the inflation point (seen as a green or red bar at the bottom of the screen); inflation occurs later when the bottom arrow is depressed and earlier when the top arrow is depressed; allows operator to optimise timing by monitoring the hemodynamic changes produced on the arterial pressure waveform.

DEFLATE – adjusts the deflation point (seen as a green or red bar at the bottom of the screen); deflation occurs later when the bottom arrow is depressed and earlier when the top arrow is depressed; allows operator to optimise timing by monitoring the hemodynamic changes produced on the arterial pressure waveform.

- ***Trigger control key functions***

PATTERN – uses the ECG QR slope, amplitude and width (25-135ms) to define triggers; the most precise ECG trigger; used frequently for patients with routine QRS complexes; may be used with demand pacing.

PEAK – uses the ECG QR slope and amplitude to define triggers; generally used for patients with wide QRS complexes; may be used with demand pacing.

AFIB – defines inflation triggers based on PEAK mode, and triggers deflation when the slope of the R-wave begins to rise; generally used for patients with atrial fibrillation, irregular rhythms and tachy-arrhythmias (operator cannot adjust deflation point in this mode).

VPACE – uses ventricular pacing spike to define triggers; may only be used for patients with 100% ventricular or atrial-ventricular paced ECG rhythms (A/V interval must be set at 250ms or less).

APACE – uses the atrial pacing spike to define triggers; may only be used for patients with 100% atrial pacing.

AP – uses rising slope of arterial pressure waveform (with blanking for the balloon) to define triggers; may be used when changing electrodes; for patients with 100% pacing, or when interference prevents use of ECG triggers; this mode should not be used for patients with atrial fibrillation or tachy-arrhythmias.

INT – rate is set by the operator and external patient signals are ignored. This internal trigger mode should be used only if the patient has no myocardial activity and/or ventricular ejection.

- ***Pump status***

ON – fills the pneumatic system with helium to 2.5mmHg, and starts pumping; if pressed before PUMP STBY, pumping starts after one purge cycle.

STBY – if pump is on, immediately stops pumping but does not vent the pneumatic system; if pump is off, completes a four beat purge cycle and pressurises the pneumatic system to 2.5mmHg.

OFF – immediately stops pumping, deflates the balloon and vents the pneumatic system to atmosphere.

- ***ECG gain/lead select***

The ECG lead select control keys allows the operator to choose between one of three patient leads when the three lead ECG cable is used. A choice is made by pressing the select control key to advance through each selection.

AUTO – automatically adjusts the amplitude of the QRS complex of the ECG.

I – receives signal from lead I; used when low-level ECG (ECG skin leads) input connection is made.

II – receives signal from lead II; used when low-level ECG (ECG skin leads) input connection is made.

III – receives signal from lead III; used when low-level ECG (ECG skin leads) input connection is made.

MONITOR – receives signal from ECG monitor. Lead selection will be the same as the bedside monitor.

◆ ***Assist ratio***

The assist ratio control keys are used to select the frequency of IABP assist the patient will receive (counterpulsation is usually initiated in a 1:2, or every other cardiac cycle setting). Using the select key the operator can advance through the four selection ratio settings.

1:1 – initiates one inflation-deflation cycle; generally used after timing has been optimised.

1:2 – initiates one inflation-deflation cycle for every second cardiac cycle; generally used to initiate counterpulsation and optimise timing, and to wean patient from IABP support.

1:4 – initiates one inflation-deflation cycle for every fourth cardiac cycle; generally used to wean patient from IABP support.

1:8 – initiates one inflation-deflation cycle for every eighth cardiac cycle; generally used to wean patient from IABP support.

◆ ***Calibration***

The calibration control keys allows the operator to zero pressure transducers.

ZERO – zeroes the pressure source.

AUTO – automatically calibrates pressure source to 100mmHg for disposable transducers.

◆ ***Display control***

The display freeze control key allows the operator to freeze approximately five seconds of waveform on the screen. This feature is used for examining waveforms for adequate triggering, timing and balloon pressure.

FREEZE – freezes the waveform display; the moving waveform display returns when the freeze key is pressed a second time.

♦ ***Alarm system***

The ALARM control keys allows the operator to disable or enable the IABP diagnostic alarms. The IABP used in this study's diagnostic alarm system continuously monitors operating conditions. When an alarm condition occurs, the IABP displays an alarm message on the screen, including suggested corrective actions. The ALARM RESET control key is pressed to reset the audio tone. ALARM RESET must be pressed prior to re-initiating pumping.

OFF – disables all alarms for ten minutes.

ON – restores normal alarm functions if alarms have been disabled.

RESET – silences the audible alarm tone and clears the alarm message, if pumping was interrupted, the alarm message is not cleared until PUMP STBY or PUMP ON is pressed. RESET must be pressed prior to re-initiating pumping.

(iii) CARE OF INTRA-AORTIC BALLOON CATHETER AND INTRA-AORTIC BALLOONPUMP

The intra-aortic balloon catheter is secured by sutures at the puncture site, and dressed with transparent dressing to prevent dislodgement. All the connections are to be checked hourly, or when necessary, should there be any suspicion of disconnection.

The IABP is cleaned and disinfected, using a soft cloth dampened with mild soap and water or 70% isopropyl alcohol to remove dust and dirt after each use. Condensate is removed by the critical care nurse on a daily basis whenever the bottle becomes full. This can be done while pumping is in progress. Patient cables and leads are cleaned with a bactericidal agent or alcohol (Arrow, 1996:83).

(iv) EVALUATION OF INTRA-AORTIC BALLOONPUMP THERAPY

♦ *Arterial waveform*

An understanding of the IABP waveform and assessment of hemodynamic augmentation begins with understanding the normal arterial waveform. Measured by direct access into the arterial system, the waveform represents the hemodynamic pressure generated by the components of the cardiac cycle, systole and diastole (Wojner, 1994:48).

Figure 2.3 shows the structure of the normal arterial waveform measured by a radial artery pressure line. The waveform is divided into two distinct phases: systole and diastole. The upstroke of systole represents contraction and ejection of blood from the left ventricle; the peak point of the waveform denotes peak systolic pressure (Wojner, 1994:48). Following peak systole, a period of systolic run-off occurs during which systolic ejection from the left ventricle continues but the volume of blood and the pressure exerted is reduced. The end of systole and the beginning of diastole is represented on the waveform by the appearance of the dicrotic notch, which represents competent aortic valve closure (Wojner, 1994:48).

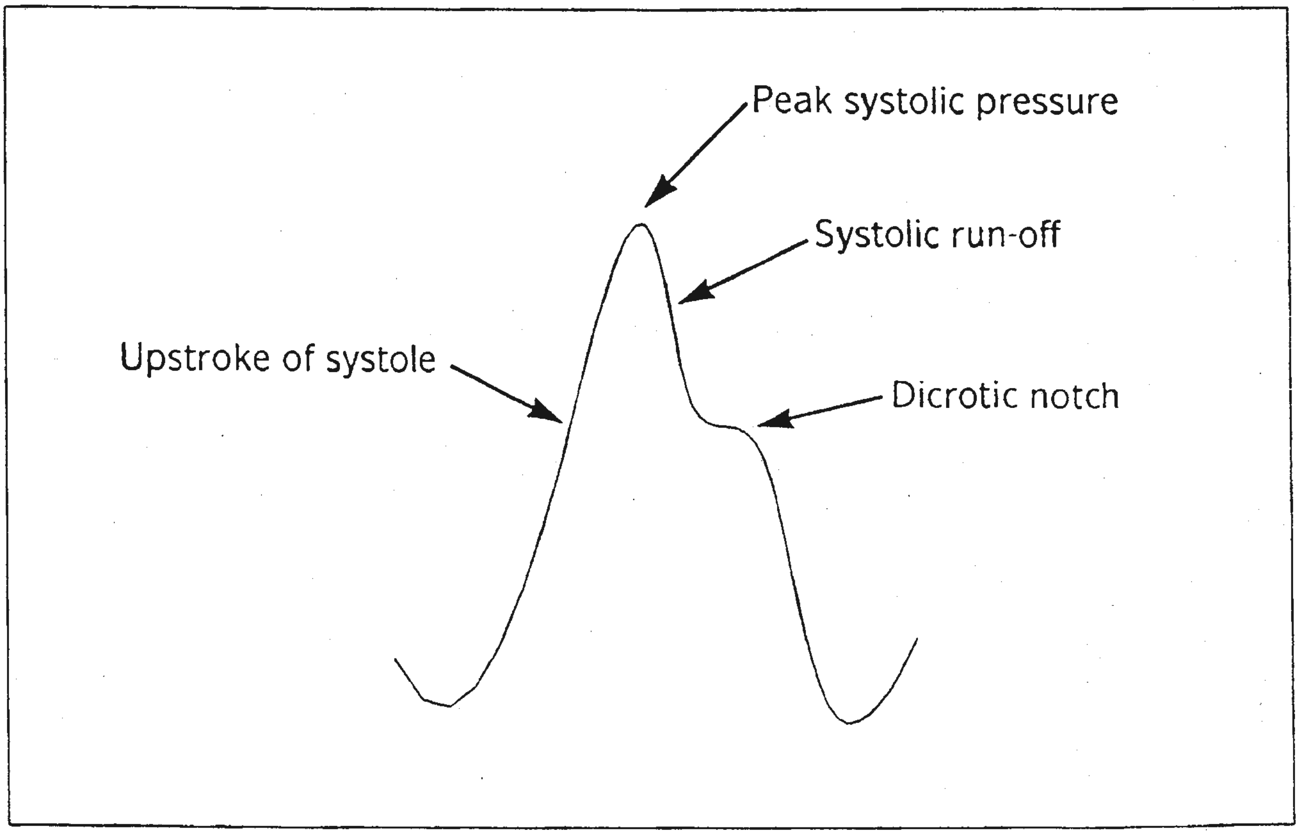


Figure 2.3 Events of systole (Wojner, 1994:48)

Figure 2.4 represents the events occurring in the diastolic phase of the cardiac cycle, beginning with the occurrence of the dicrotic notch on the arterial waveform. During the diastolic phase, ventricular relaxation and filling occur. The coronary arteries are perfused during diastole, supplying the heart muscle with needed oxygen and nutrients (Wojner, 1994:49).

The period of end-diastole represents the point just prior to the next systolic upstroke. Whereas intracardiac end-diastolic pressures reflect the volume filling of the ventricle prior to systole (preload), extracardiac end-diastolic pressure measurements such as those obtained by the arterial line reflect total peripheral resistance and the resulting left ventricular afterload (Wojner, 1994:49).

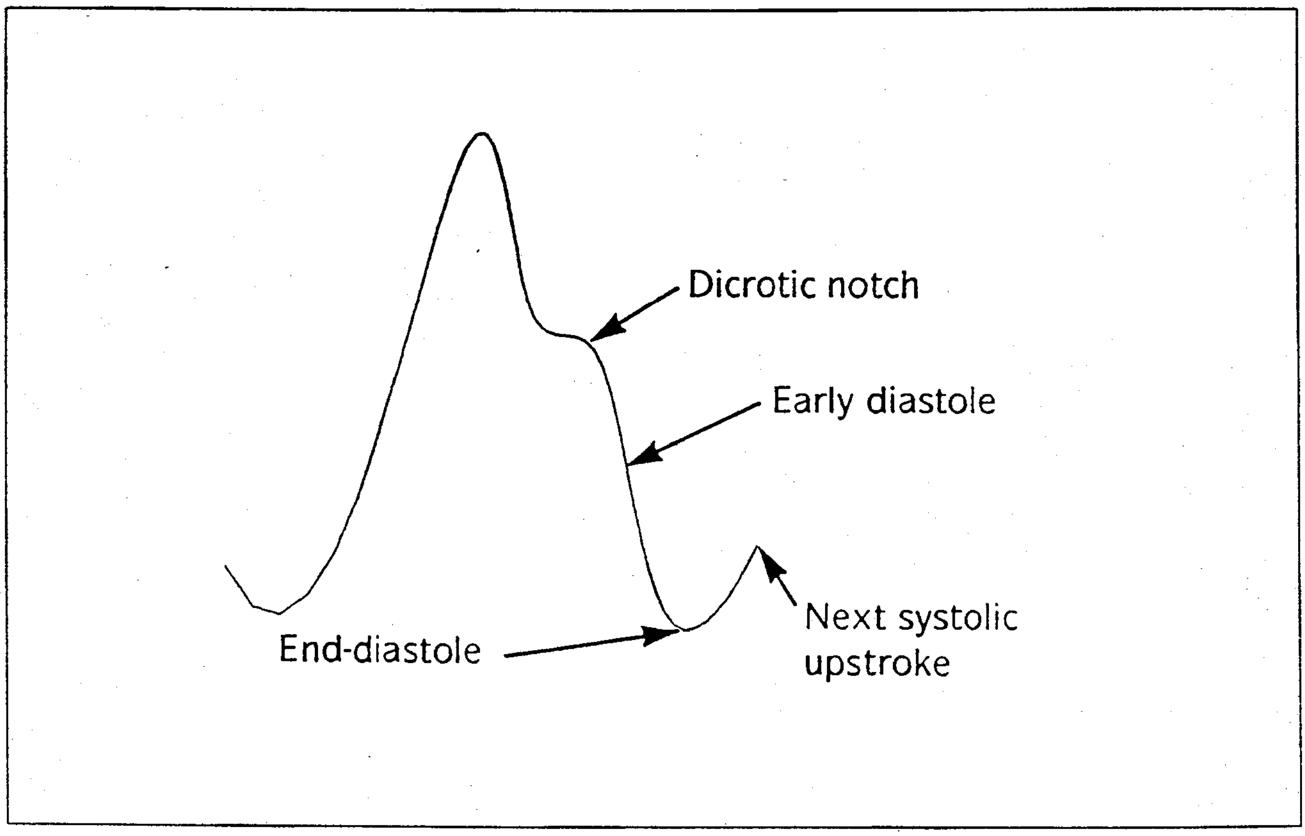


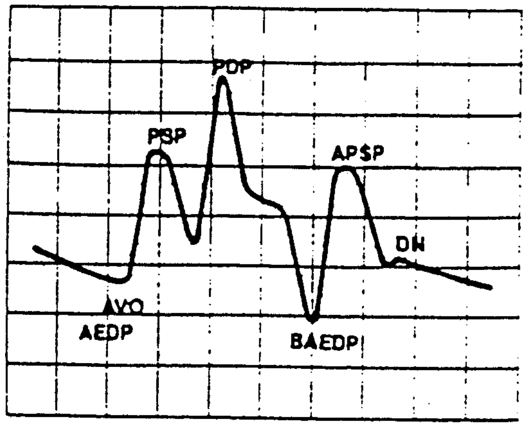
Figure 2.4 Events of diastole (Wojner, 1994:49)

- ***Arterial pressure waveform landmarks***

The IABP is a volume displacement device that effects the cardio-vascular system in a mechanical manner. In order to evaluate the timing of inflation and deflation, the physical characteristics of the unassisted and assisted arterial pressure waveform must be assessed. Timing of the IABP is always performed using the arterial pressure waveform as the guide.

Before one can appreciate the changes that occur with balloon inflation and deflation, an assessment of the arterial pressure morphology is necessary (Holloway, 1993:404).

The onset of systole first begins with the isovolumetric contraction phase. The isovolumetric phase occurs milliseconds before the upstroke on the arterial pressure waveform. The aortic valve opens when the pressure in the left ventricle exceeds the pressure in the aorta. Rapid ejection occurs and the ventricle delivers 65-75% of its stroke volume. The pressure generated is the peak systolic pressure (PSP). After the peak systolic pressure, flow velocity declines until the pressure in the ventricle falls below the pressure in the aorta, and the aortic valve closes (DN). The blood in the aorta flows to the periphery in the runoff phase. The cycle then repeats itself. The important landmarks of the arterial pressure waveform are shown in figure 2.5. Identification is necessary for proper timing of inflation and deflation. When intra-aortic balloonpumping is begun, the assist interval is set on 1:2 (the intra-aortic balloon inflates and deflates every other systole). This is done so that landmarks can be identified and the effects of inflation and deflation can be compared to the baseline hemodynamic status (Holloway, 1993:404).



AEDP - Aortic End Diastolic Pressure
AVO - Aortic Valve Opening
PSP - Peak Systolic Pressure
PDP - Peak Diastolic Pressure
BAEDP - Balloon Aortic End Diastolic Pressure
APSP - Assisted Peak Systolic Pressure
DN - Dicrotic Notch

Figure 2.5 Arterial pressure waveform landmarks (Holloway, 1993:404)

- ***The balloon pressure waveform***

During a cycle of inflation/deflation, helium is rapidly moved into and out of the balloon. The environment within the balloon and the surrounding forces that effect balloon behaviour all contribute to a predictable pattern of gas flow and pressure. The IABP console has an in-line transducer that relays the pattern of gas pressure during the inflate/deflate cycle. The gas pressure characteristics are converted into a waveform that is reflective of the behaviour of the gas. This transduced waveform can tell us much about the interaction of the balloon within the patient's aorta.
A thorough understanding of the balloon pressure waveform is important for efficient management of the balloonpump as most of the alarm states are based on this gas surveillance system (Woods et al. 1995:583).

The balloon pressure waveform has a normal configuration and also has variations that are considered normal or expected in a given clinical situation. An understanding of a normal waveform is necessary to enable identification of abnormal waveforms, unsafe operating states, and to speed the management process in the event of an alarm (Shoulders-Odom, 1991:62).

Figure 2.6 shows the normal shape of the balloon pressure waveform. The balloon pressure waveform is shown below the arterial pressure tracing on the balloonpump console. Two important points to be made about the shape of the balloon pressure waveform that are valuable considerations:

- the width of the balloon pressure waveform corresponds to the duration of balloon inflation during the cardiac cycle, and
- the plateau of the balloon pressure waveform reflects pressure within the aorta when the balloon is inflated. The balloonpump has to overcome the pressure within the aorta to fill the balloon with gas. Since the balloon material is very compliant, the pressure on either side will be approximately the same. Therefore, the plateau pressure on the balloon pressure waveform should be within a few millimetres of mercury (mmHg) of the peak diastolic pressure on the arterial pressure waveform (Shoulders-Odom, 1991:61).

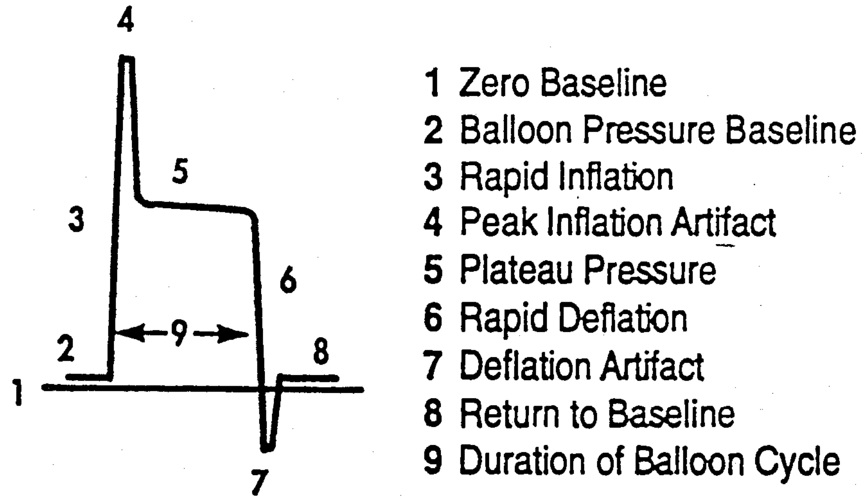


Figure 2.6 *Normal balloon pressure waveform* (Shoulders-Odom, 1991:61)

♦ ***Assessment of the intra-aortic balloonpump waveform***

Nursing assessment of the hemodynamic effects of IABP counterpulsation includes analysis of the arterial waveform during inflation and deflation (Wojner, 1994:50).

Figure 2.7 represents the IABP waveform set in a 1:2 inflation timing sequence (the IABP is set to inflate and deflate with every other cardiac cycle). Begin analysis by identifying the normal components of the arterial waveform without IABP augmentation. Note the events of systole, closure of the aortic valve (dicrotic notch) and diastole. Now compare this augmented arterial pressure waveform with that of the IABP-assisted arterial pressure waveform. Note that IABP inflation occurs at the dicrotic notch, the point of aortic valve closure. IABP inflation raises diastolic pressure to a level higher than peak systole. This peak diastolic augmented pressure (PDAP) point denotes peak perfusion pressure (Wojner, 1994:50).

Optimal augmentation produces peak diastolic pressure that is higher than peak systolic pressure, maximising coronary artery and systemic perfusion (Wojner, 1994:50).

Find the point of IABP end-diastole, which occurs with the balloon deflation just prior to the next systole.

Compare this point with that of the augmented end-diastole waveform. Note that with proper timing, the balloon aortic end-diastolic pressure (BAEDP) is lower than the unaugmented or patient aortic end-diastolic pressure (PAEDP) point. This lower pressure represents a reduction in afterload (Wojner, 1994:50).

Further assessment of afterload reduction requires a look at the peak systolic pressure generated in the complex directly following the IABP cycle. The IABP-assisted systolic pressure (ASP) should optimally be lower than its unassisted counterpart (patient systolic pressure or PSP), due to a reduction in the necessary contractile force from the decrease in afterload. The lowered assisted systolic pressure denotes reduction in the myocardial oxygen consumption (Wojner, 1994:50).

Point 1 Balloon-assisted aortic end-diastolic pressure (BAEDP)
Point 2 Patient aortic end-diastolic pressure (PAEDP)
Point 3 Assisted systolic pressure (ASP)
Point 4 Patient systolic pressure (PSP)
Point 5 Peak diastolic augmented pressure (PDAP)

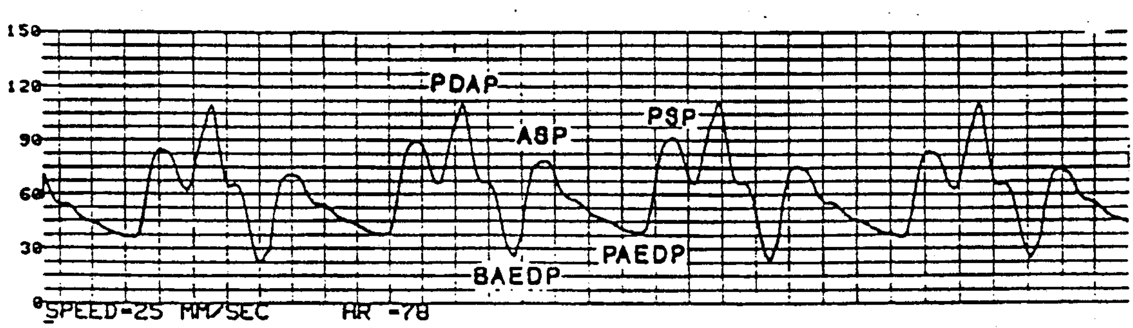


Figure 2.7 The five points in 1:2 IABP timing (Wojner, 1994:50)

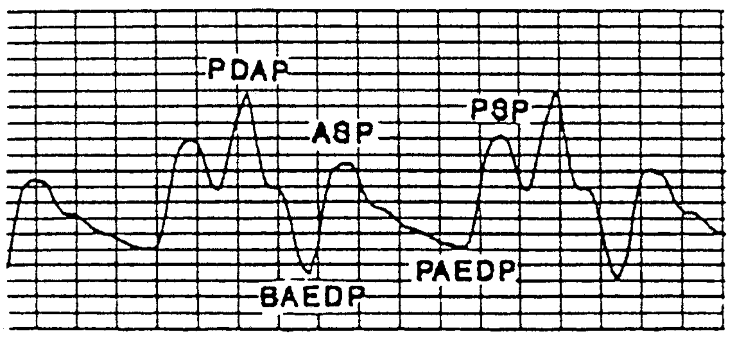
♦ *Nursing responsibilities in IABP timing*

Nursing assessment of IABP augmentation starts with identification of the following five points:

- balloon-assisted aortic end-diastolic pressure;
- patient aortic end-diastolic pressure;
- assisted systolic pressure;
- patient systolic pressure, and
- peak diastolic augmented pressure.

Figure 2.8 identifies the timing rules governing effective IABP counterpulsation. The critical care nurse responsible for patient care should attempt to maximise diastolic augmentation and afterload reduction to achieve the following effects:

Rule 1: peak diastolic augmented pressure greater than peak systolic pressure;
Rule 2: balloon-assisted aortic end-diastolic pressure lower than patient aortic end-diastolic pressure, and
Rule 3: assisted systolic pressure lower than patient systolic pressure (Wojner, 1994:50).



Rule 1: Peak diastolic augmented pressure should be greater than patient systolic pressure.

Rule 2: Balloon-assisted aortic end-diastolic pressure should be greater than patient aortic end-diastolic pressure.

Rule 3: Assisted systolic pressure should be lower than patient systolic pressure.

Figure 2.8 IABP timing rules (Wojner, 1994:51)

Although initial timing is done with the patient in the 1:2 mode, maximal augmentation of hemodynamic parameters occurs when the IABP is placed in the 1:1 timing mode, allowing the balloon to inflate and deflate with each cardiac cycle. Figure 2.8 represents the arterial IABP waveform on a 1:1 setting. Note that in the 1:1 setting the only visible points of the waveform include assisted systolic pressure, peak diastolic augmented pressure, and balloon aortic end-diastolic pressure. Measurement of each of the five points can be achieved only when the IABP is timed at a 1:2 or less frequent ratio (Wojner, 1994:51).

Point 1 Balloon-assisted aortic end-diastolic pressure (BAEDP)
Point 2 Assisted systolic pressure (ASP)
Point 3 Peak diastolic augmented pressure (PDAP)

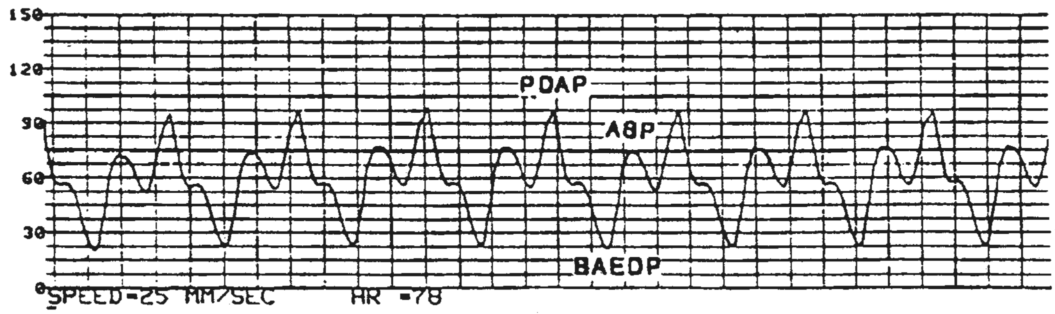


Figure 2.9 The three visible points in 1:1 IABP timing (Wojner, 1994:51)

Following pressure trends in the waveform on 1:1 and comparing these with previously noted measurements of the full five points permits ongoing evaluation of the therapeutic effects achieved. This negates the need for frequent changes in the inflation/deflation ratio to a temporary 1:2 ratio for evaluation of a stable patient.

Changes in the inflation/deflation ratio should be performed as indicated by patient status to optimise timing and augmentation. Timing should always be reassessed with changes in the cardiac rhythm and/or rate, hemodynamic deterioration, and approximately twice a shift as a routine nursing measure (Wojner, 1994:51).

When using an IABP that permits measurement of waveform pressure on the console screen, the following steps may be taken to assess the five points without delaying 1:1 IABP augmentation:

- change to a 1:2 timing ratio;
- freeze the monitor once a full screen of 1:2 complexes is present;
- resume a 1:1 timing ratio, and
- measure the five points on the console screen (Wojner, 1994:51).

Strip analysis of arterial/IABP waveforms in both 1:1 and 1:2 timing may also be used to measure the five points.

Measurement of the cardiac profile is another responsibility of the critical care nurse caring for the patient receiving IABP therapy. Trends in the profile should correlate with those noted in the IABP waveform. These should include:

- reduction in preload indicators such as pulmonary artery wedge pressure (PAWP), pulmonary artery end-diastolic pressure, and central venous pressure due to an increase in forward flow;
- increased cardiac output and cardiac index;
- decreased systemic vascular resistance (SVR), and
- optimisation of left ventricular stroke work index in proportion to the preload indicators achieved (Wojner, 1994:51).

IABP timing challenges the critical care nurse not only with a waveform analysis but also an understanding of complex physiologic concepts crucial to patient management. Optimising timing through evaluation of the five points of the IABP waveform permits the critical care nurse to increase the hemodynamic benefits of IABP therapy, potentially improving patient outcome (Wojner, 1994:51).

◆ ***Nursing care of IABP therapy***

Routine care may vary from unit to unit, but the basic principles apply to all. The common aim of nursing care is to maintain an intact balloonpump system and to facilitate patient safety at all times (Woods et al. 1995:585).

◆ ***Care of the balloon catheter insertion site***

The insertion site is inspected hourly to elicit possible signs and symptoms of infection. These include swelling, inflammation, redness, tenderness, pain and cellulitis. The dressing is changed accordingly to unit protocol, using an aseptic technique (Woods et al. 1995:586).

◆ ***Nursing management of the patient receiving IABP therapy***

Thorough cardiovascular assessment of the patient provides indicators that IABP therapy is effectively assisting left ventricular function. Assessment includes vital signs, cardiac output, heart rhythm, heart regularity, heart ischemia, urine output, colour, peripheral perfusion and mentation. All these parameters should reflect an improvement in the patient's condition.

The IABP patient is relatively immobile owing to the need to avoid hip flexion and to multiple invasive monitoring and infusion lines. Often, the patient requires endotracheal intubation and ventilator support (Woods et al. 1995:584). Care must be taken to prevent or minimise extensive atelectasis. These patients are also at greater risk for respiratory tract infection. Careful suctioning technique and prevention of aspiration reduce this risk. Prolonged hypotension from a shock state may affect renal function. Monitoring urine output and quality may contribute to early recognition and treatment of renal dysfunction, thus avoiding acute renal failure. Psychosocial support of both the patient and family is important. The patient requires nursing interventions that minimise stress, disorientation and sleep deprivation (Woods et al. 1995:584).

(v) COMPLICATIONS ASSOCIATED WITH INTRA-AORTIC BALLOONPUMP THERAPY

A number of complications can occur, both during the insertion of the intra-aortic balloon catheter, and with a relatively high frequency, during the assist therapy, as listed in table 2.5 (Hudak & Gallo, 1994:268).
Astute clinical observations, frequent patient assessment, and competent technical skills can aid in the prevention of these problems.

Arterial injury may occur involving vessel dissection or perforation. The insertion of the balloon may be impeded by plaque formation in an atheromatous femoral artery; catheter interference with this plaque may be followed by aortic thrombosis or embolus. Arterial perforation during insertion has occurred (Woods et al. 1995:582). Clinical indicators of perforation would include sudden, sharp severe back pain accompanied by a drop in blood pressure and tachycardia. Arterial thrombosis or embolus is fairly common. A thrombus can occur around the catheter even when the patient is receiving anti-coagulant therapy (heparin) in a continuous infusion, intra-flow flush solution to ensure catheter patency (Woods et al. 1995:584).
Disruption of this clot will move the embolus into the circulatory system. Symptoms may include sudden loss of distal pulses accompanied by a cool, numb, pale and occasionally painful lower extremity.

Limb ischemia occurs in approximately 14% of IABP patients and may result in limb loss (Woods et al. 1995:584-585).

Clinical indicators are diminished distal pulses and cool, mottled, cyanotic feet and toes. The balloon catheter may migrate antegrade in the aorta, producing left subclavian artery occlusion. For this reason circulation to the arms must be continuously observed.

A local hematoma may develop around the balloon catheter at the insertion site. The patient is usually fully heparinised (except fresh cardiac surgical patients) for the risk of bleeding. Frequent observation for local swelling, ecchymosis and bleeding is necessary.

Wound infection can be prevented by strict sterile technique. The catheter serves as a conduit for bacterial invasion into the body, and the immune response of the patient is suppressed. Any evidence of elevated temperature, local swelling, pain or tenderness should be noted, as well as any drainage.
Wound assessment is recommended during daily sterile dressing change. Blood cultures can be ordered, and the patient may be placed on antibiotics.

Problems specific to the balloon catheter may occur. Balloon rupture, leak or catheter fracture can usually be detected on the monitor through close observation of the arterial waveform and ECG. Indications of a balloon problem should be reported to the physician immediately (Thelan et al. 1998:570).

Table 2.5 Complications of intra-aortic balloonpump therapy

A	**DURING INSERTION (STAGE I)**
1.	Dissection of the aorta.
2.	Dislodgement of plaque producing obstruction.
3.	Obstruction of the femoral artery with compromised blood flow to the leg.
4.	Inability to pass the intra-aortic balloon catheter.
B	**DURING PUMPING (STAGE II)**
1.	Emboli to: - head - upper or lower extremities - kidneys - lungs - gastro-intestinal tract - spinal column
2.	Thrombosis associated with prolonged immobilisation.
3.	Thrombocytopenia.
4.	Infection.
5.	Rupture of the aorta.
6.	Compromised circulation to the leg.
7.	Compromised circulation due to improper intra-aortic balloon catheter placement:

	- too high (obstruction of left subclavian artery) - too low (obstruction of the renal artery)
8.	ICU psychosis.
9.	Gas emboli from intra-aortic balloon.
10.	Bleeding: - balloon insertion site - stress ulcers
11.	Inability to wean from IABP.
12.	Air emboli through the central lumen of the catheter.
C	**REMOVAL (STAGE III)**
1.	Dislodgement of a plaque or emboli producing obstruction.
2.	Bleeding at the puncture site.
D	**POST-REMOVAL (STAGE IV)**
1.	Reversal or relapse in condition.
2.	Thrombosis.
3.	Emboli.
4.	Infection at puncture site.

(vi) REMOVAL OF BALLOON CATHETER

When the patient shows evidence of hemodynamic improvement, weaning from balloon assistance can be planned – usually 12 to 24 hours after insertion. General guidelines may include an increase in the cardiac index, > 2L/min/m^2; pulmonary capillary wedge pressure < 20mmHg; systolic blood pressure > 100mmHg; and evidence of satisfactory cerebral, coronary and peripheral perfusion. There may be other reasons to discontinue IABP therapy; severe vascular insufficiency where there is evidence of ischemia in the leg or left arm; balloon malfunction due to leakage; or the presence of a deteriorating, irreversible condition (Bavin & Self, 1991:58).

Weaning may be achieved by gradually decreasing the assist ratio, by decreasing diastolic augmentation, or by decreasing the balloon volume. Weaning should be carried out over a predetermined period of time (8 – 24 hours) with continuous hemodynamic monitoring during the process. If the patient's clinical status falters, weaning attempts should be discontinued. The persistence of unfavourable symptoms in the absence of pump assist is considered to be unsuccessful weaning, and the patient is considered balloon-dependent.

Once successful weaning is achieved, the intra-aortic balloon catheter can be removed (Bavin & Self, 1991:54-57).

Upon removal of the IABP catheter, digital pressure and pressure dressing are applied to assist with hematosis (Bavin & Self, 1991:56-57). Careful observation of the extremity for any sign of bleeding or occlusion is important. The patient usually remains on bedrest for 12 – 24 hours after balloon removal. Poor positioning and/or vigorous coughing can activate bleeding; the patient should be so advised. A sterile dressing changed daily is appropriate until wound healing is accomplished.

- ***Removal procedure technique***

Removal of a percutaneously inserted balloon catheter can be done quickly and safely. All anchoring ties and sutures are removed. The balloon catheter is disconnected from the console. The cuff is removed from the sheath connector. While holding the sheath with one hand, the balloon catheter is slowly withdrawn with the other hand until resistance is met. This resistance means the balloon material is entering the end of the sheath. The balloon and sheath are then removed simultaneously. Firm pressure is then applied to the femoral artery immediately above and below the sheath puncture site (Bavin & Self, 1991:57).

Post-removal care includes the continuous assessment of circulation to the cannulated leg. Monitoring and recording of peripheral pulses and the circulatory status of the cannulated extremity should be done every hour for the first 24 hours post-removal. The patient should not be allowed to flex the hip greater than 30 degrees for 24 hours to ensure a solid, organised clot. The patient should also avoid the valsalva manoeuvre for the first 24 hours. Coughing exercises should not be done too vigorously and the insertion site area splinted during coughing periods (Bavin & Self, 1991:59).

2.2.1.2 SKILLS

According to Bergman (1982:8) skills are inevitable part of ability. In nursing science the critical care nurse must have knowledge in order to demonstrate skills. As the focus is on *knowledge* in this research study and the study is of limited scope, detail will not be given to skills per se.

2.2.1.3 VALUES

Values honoured by the critical care nurse direct his/her management and cognition in such a way as to effectively attain the purpose of the management guidelines (Botes, 1989:105). Values are obtained from philosophy which is derived from ethics.
Ethics gives practice-oriented management guidelines. The attainment of goals within the nursing context implies the facilitation of professional and personal wholeness. The reviewing of any nursing interaction is value-oriented (Botes, 1989:106; Klopper, 1994:94).

2.2.2 RESPONSIBILITY

Critical care nurses are encouraged to be responsible for their nursing actions, as conscious responsibility will contribute to overall higher levels of accountability.
Watson (1995:154) defines responsibility as being "dependent upon knowledge, discretion, judgement and the ability to make decisions about one's work".

The critical care nurse has a responsibility toward:

- his/her patient;
- the multi-professional team;
- his/her employer, and
- his/her profession.

The responsibility of the critical care nurse is detailed in GR No.R2598 of 30/11/1984. The aspects pertinent to this study are:

"(a) The diagnosing of a health need and the prescribing, provision and execution of a nursing regimen to meet the need of a patient or group of patients or, where necessary, by referral to a registered person;
(b) the execution of a programme of treatment or medication prescribed by a registered person for a patient, and
(c) the treatment and care of and the administration of medicine to a patient, including the monitoring of the patient's vital signs and of his reaction to disease conditions, trauma, stress, anxiety, medication and treatment."

2.2.2.1 ETHICAL FRAMEWORK OF NURSING PRACTICE

The critical care nurse as an independent nurse practitioner is responsible and accountable for his/her acts and omissions. It is important for the nurse practitioner to practice ethical decision-making within the context of his/her profession, which implies that his/her decision-making is influenced by the values of nursing and practice guidelines (Botes, 1989:2; Klopper, 1994:96).

According to Searle (1987:248), one of the most important characteristics of the profession is that it has a professional code, based on personal morality which forms a foundation of trust between the nursing community and the patient. She maintains that the most important duty of the independent nurse practitioner is to 'be careful' when taking care of a patient. When a person consents to becoming registered as an independent nurse practitioner, he/she becomes contracted with society to "..... provide safe care within the context of the nurse-patient relationship, which puts the [critical care] nurse in a position of power and protection vis a' vis the patient" (Searle, 1991: 276).

The critical care nurse, according to the Acts and Omissions in terms of South African Nursing Council Regulation No R387 of 15 February 1985 (South Africa 1978), functioning in the position of an independent practitioner in the intensive care setting, requires knowledge to fulfil her obligation to give "specific care and treatment of the very ill ...." and "..... the monitoring of all vital signs of the patient concerned". According to Searle (1987:154), the quality of nursing practice is an ethical issue. She maintains that the professional nurse, whatever his/her position (in this instance, the critical care nurse) has a legal and ethical responsibility to ensure he/she has the appropriate knowledge, skills and values to practice safe, effective nursing. This effective practice includes calling for specialised assistance, should the patient's condition deteriorate, as well as his/her duty to do what he/she can in the event of an emergency, to "prevent deformity and shock" (Searle, 1987:154).

Knowledge is the basis of responsibility (Bergman, 1982:8). When the critical care nurse as independent practitioner accepts a prescribed treatment, namely IABP therapy from a physician for a patient, it is his/her legal and moral responsibility to undertake the maintenance of that treatment. It is also his/her responsibility to observe the patient's vital signs and monitor the patient's response to that treatment.

The actions of observation and monitoring constitute various attributes of the critical care nurse. They are:

- his/her values – human life is valuable and the patient is worthy of care;
- his/her knowledge – the rationale behind the actions, the implications of the patient's condition and understanding of the prescribed treatment, and
- his/her skills: the actual undertaking of a specific premeditated action.

These constituents – values, knowledge and skills form the critical care nurse's ability (Bergman, 1982:8).

The critical care nurse in the cardiothoracic unit works within a certain legal framework. According to Searle (1991:275), ".... fundamental to the practice of a profession are two cardinal issues, namely: the competence and skill relevant to the particular field of practice, and the behaviour of the practitioner which should be beneficial but that might be deleterious to the patient, the public and the profession itself". When managing IABP therapy, the critical care nurse is in the position of either benefiting or incapacitating a patient, who by nature of the fact of being in a cardiothoracic intensive care unit, is particularly dependent on his/her clinical skills and knowledge.

2.2.2.2 LEGAL FRAMEWORK

The legal framework of the nursing profession induces values and norms within the profession and this framework falls within the external environment (Klopper, 1994:99).

(i) NURSING ACT

The nursing profession is under the legal dictate of the Nursing Act as amended by Act No 21 of 1992 (South Africa, Act No 50 of 1978). The critical care nurse must familiarise herself with the regulations that affect her practice. The most important regulations are those concerning the scope of practice of the registered nurse – Government Notice No.R2598 of 30/11/1984 – and acts and omissions – Government Notice No.R387 of 15/02/1985.

(ii) SCOPE OF PRACTICE OF THE REGISTERED NURSE

The practice of a profession requires knowledge of the professional scope and the rules and conditions whereby a person may practice. In the nursing profession, these requirements are defined by the regulations found in Article 45(9) of the Nursing Act as amended by Act No 21 of 1992 (South Africa, Act No 50 of 1978).

♦ ***Assumptions***

The contents of the Scope of Practice Government Notice No.R2598, 30/11/1984 is based on assumptions. According to Searle (1987:192-193) and the Nursing for the Whole Person Theory, these assumptions may be assembled as follows:

- the professional nurse is involved with the person's health care from his/her birth to his/her death;
- the professional nurse is involved with the person in his/her quest for wholeness, which is determined by his/her interaction with his/her internal and external environment;
- the professional nurse esteems the value and vulnerability of the person in the health services;
- nursing is a profession which is practised within legal and ethical parameters;
- nursing comprises a large variety of scientifically planned interventions, based on biological, physical, chemical, psychological, educational, medical and technological knowledge and skills;
- nursing is not procedures performed on a patient, but represents a unique nurse-patient interaction of which care and support are the important components;
- the professional nurse is accountable for his/her professional acts and omissions;
- the professional nurse will uphold caring standards and will continue to develop his/her knowledge and skills; and
- the professional nurse is a practitioner in his/her own right and with the right to perform his/her nursing actions corresponding to his/her professional judgement, knowledge and skills.

(iii) ACTS AND OMISSIONS

The professional nurse, according to Government Notice No.R387 of 15/02/1985 can be found guilty of misconduct in an act or omission in the following instances (Botes, 1989:13; Klopper, 1994:104):

- omission of scientific methodical nursing and the consequent unlawful management of an emergency;
- within her function as a member of the team she mismanages or omits management with regard to teamwork, referral, coordination, advocacy, hindrance of consultation, malign another's professional reputation, exploitation and supersession;
- in the case of her violating the rights of the patient regarding identification, injury, trauma, infection, professional secrecy and neglecting to identify, plan or manage a patient at risk.

2.2.3 AUTHORITY

The critical care nurse is accountable to the authorities over his/her, namely his/her employer, the registered person who is managing the patient medically, his/her nursing superiors and his/her profession (Government Notice No.R2598 of 30/11/1984).
The critical care nurse has authority over those entrusted to his/her care: the patient, and to some extent, members of the multi-professional health team with whom he/she co-ordinates his/her nursing care regime.

2.2.4 ACCOUNTABILITY

The concept of accountability is closely related to the concept of professionalism. Accountability is an inclusive term for a commitment to be responsible for any elements of nursing (Watson, 1995:33).
According to biblical principles, the Christian is always accountable for his/her actions (Peter, 3:15). The acts and omissions of the professional nurse – Government Notice No.R387 of 15/2/1985 determines the accountability of the professional nurse (Klopper, 1994:96).

In order to be able to exercise accountability, the critical care nurse must be well educated and knowledgeable about his/her nursing care.

2.3 SUMMARY

The safe management of IABP therapy does not wholly consist of the knowledge of the critical care nurse, but also involves his/her values and skills, his/her responsibility, authority and accountability (Bergman, 1982:8).

The critical care nurse in the cardiothoracic intensive care unit is an independent practitioner, who undertakes to maintain IABP therapy. In order for this to be done in a safe manner, knowledge (the focus of this study) is required and exactly which knowledge was described in this chapter. Other issues pertaining to the critical care nurse's decisions were also discussed to a lesser degree.

---o0o---

CHAPTER 3

RESEARCH DESIGN AND RESEARCH METHODOLOGY

3.1 INTRODUCTION

The research design and method are discussed in detail in this chapter. For clarity purposes, the aim of this study is reiterated: the purpose of this research study is to explore and describe the knowledge of the critical care nurse regarding the safe management of intra-aortic balloonpump (IABP) therapy, and to formulate guidelines for its safe usage. Table 3.1 is a summary of the content.

Table 3.1 Research design and method

AIM	DATA GAHERING	SAMPLING & POPULATION	VALIDITY & RELIABILITY	DATA ANALYSIS
Explore and describe knowledge of critical care nurses re: intra-aortic balloonpump counter-pulsation therapy	Implementation of a questionnaire under controlled conditions	Sampling; convenience sample of voluntary critical care nurses of all qualifications, regardless of staff appointment in a private cardiothoracic intensive care unit on the West Rand	Literature review, professional experts critique and pilot study	Descriptive statistics

3.2 RESEARCH DESIGN AND METHOD

3.2.1 RESEARCH DESIGN

The design of this research study is a quantitative, descriptive, contextual study, in which a sample survey was performed:

- quantitative to investigate the knowledge of critical care nurses regarding IABP therapy; for measurement and quantification of data (Polit & Hungler, 1997:466);
- descriptive where data is reduced and presented as an accurate description. When a study is descriptive (Talbot, 1994:90), it is more structured and organised according to themes, and the saturated themes will provide guidélines intended to support this study (Straus & Corbin, 1990:29);
- contextual as the study uses an idiographic approach because it focuses on the critical care environment (Straus & Corbin, 1990:96). This study is contextual in that it deals with the knowledge of critical care nurses regarding IABP therapy and who are committed to a critical care environment of a specific private cardiothoracic intensive care unit.

3.2.2 RESEARCH METHOD

The purpose of the literature study was two-fold: firstly, to establish a conceptual framework for the research study and secondly to identify the criteria to be considered critical points in the research study. The research assessment tool (a questionnaire) was developed from these criteria.
Questionnaires can be designed to determine the levels of knowledge of a subject (Burns & Grove, 1993:369).

3.2.2.1 DATA GATHERING

A questionnaire was used to ascertain and describe the critical care nurse's knowledge of IABP therapy. The greatest advantages of survey research using a questionnaire are it's flexibility and broadness of scope. It can be applied to many populations, it can focus on a wide range of topics, and its information can be used for many purposes (Polit & Hungler, 1997:175).

The specific context in which this research study was held, was a private cardiothoracic intensive care unit on the West Rand that consented to take part in the research study.

The development of the questionnaire is set out as follows:

- development phase;

- types of questions;
- compilation of questionnaire;
- refinement of questionnaire;
- confirmation phase, and
- degree of difficulty of questions.

◆ ***Development phase***

The literature study was used to identify the criteria to be considered as critical points in the study. From the critical points, a questionnaire was developed to test knowledge relevant to those critical points. The questionnaire was chosen by the researcher for it is less costly, requires less time to administer and offers the possibility of complete anonymity (Polit & Hungler, 1997:259).

A covering letter (see Annexure I) accompanied the questionnaire, explaining the purpose of the study, the name of the researcher, the approximate amount of time required to complete the questionnaire, and the institutions supporting the study.

◆ ***Types of questions***

The majority of questions are multiple-choice questions. The purpose of using structured, multiple-choice questions is to ensure comparability of responses and to facilitate analysis of data (Polit & Hungler, 1997:256).
The time for completion of the questionnaire was approximately twenty five minutes (Uys & Basson, 1991:67).
Two questions were asked where participants had to respond by listing items in their own words, where the response alternatives were not designated by the researcher.

◆ ***Compilation of questionnaire***

- The questionnaire (see Annexure I) consists of ten sections. The layout is described in table 3.2.

Table 3.2 Layout of questionnaire

SECTION	NUMBER & DESCRIPTION OF QUESTION
I. Demographic data.	2 questions: 1 and 2. The level of qualification / experience and staff appointment of each participant was identified by these questions. The data was required in order to describe the population group that the guidelines (one of the goals of the study) would have to address.
II. Fundamental principles of the intra-aortic balloonpump.	2 questions: 12 and 13. Question (12) concerned inflation with onset of diastole, and question (13) concerned deflation with onset of systole.
III. Intra-aortic balloonpump settings.	7 questions: 14,15,16, 26, 30, 32 and 37. Question (14) concerns the triggering setting for inflation and deflation of the IABP. Question (15) concerns the arterial waveform setting to accurately time balloon inflation and deflation. Question (16) refers to the timing of the balloonpump for optimal augmentation. Question (26) refers to the peak and pattern triggering modes. Question (30) refers to the most used triggering mode. Question (32) refers to the ECG used for triggering the IABP. Question (37) concerns changing the volume of helium while in the standby mode setting.
IV. Alarm system of the IABP.	2 questions: 24 and 36. Questions (24 and 36) refer to the causes of high pressure alarms.
V. Principles of coronary circulation and physiology of the cardiac cycle.	5 questions: 3. 4. 6. 7 and 17. Question (3) concerns the definition of preload; question (4) concerns the definition of afterload.

SECTION	NUMBER & DESCRIPTION OF QUESTION
	The physiology of coronary perfusion is found in question (6). Question (7) concerns the physiology of isovolumetric contraction. Question (17) refers to the explanation of the dicrotic notch on the arterial waveform.
VI. Physiological effects of intra-aortic balloonpump therapy.	1 question: 5. Question (5) refers to the physiological effects of counterpulsation therapy.
VII. Identification of arterial and intra-aortic balloonpump waveforms.	2 questions: 19 and 22. Question (19) refers to the description of the arterial waveform. Question (22) refers to the description of the intra-aortic balloonpump waveform.
VIII. Indications, contra-indications and complications associated with intra-aortic balloonpump therapy.	<u>Indications:</u> 1 question: 9. Question (9) concerns the listing of four medical or surgical indications for using the IABP. <u>Contra-indications:</u> 1 question: 8. Question (8) relates to contra-indications to balloon pumping. <u>Complications:</u> 3 questions: 10, 11 and 35. Question (10) concerns the listing of two possible complications of IABP insertion or pumping. Question (11) refers to complications with insertion of the intra-aortic balloon catheter. Question (35) refers to possible damage to the balloon catheter.
IX. Evaluation of IABP therapy.	11 questions: 18, 20, 21, 23, 25, 27, 28, 29, 31, 34 and 38. Question (18) refers to the hemodynamic effects of proper timing on the cardiac output.

SECTION	NUMBER & DESCRIPTION OF QUESTION
	Question (20) concerns the effects of late inflation of the balloon on myocardial function and question (21) refers to the effects of late deflation of the balloon on myocardial function (Joseph & Bates, 1990:45,50). Questions (23 and 25) refer to the evaluation of the balloonpump pressure waveform. Question (27) concerns the dicrotic notch as the landmark used to set balloon deflation, and question (28) refers to timing of deflation to occur during the period of isovolumetric contraction. Question (29) concerns that the balloon should not occlude the aorta when inflated. Question (31) evaluates pacing spikes in peak and pattern modes. Questions (34 and 38) refer to the evaluation of nursing care to the patient receiving IABP therapy.
X. Removal of the intra-aortic balloon catheter.	2 questions: 33 and 39. Questions (33 and 39) deal with nursing actions when the intra-aortic balloon catheter is to be removed.

- ***Refinement of Questionnaire***

Professionals with expertise in the field of cardiology, cardiothoracic intensive care nursing and nursing education were identified; one is a cardiologist, with specialist knowledge on IABP therapy; the other is the trained critical care nurse of the supplier of balloonpumps and catheters which are used in the unit where the research was conducted, and three critical care nursing experts, with qualifications / experience in nursing education. All were approached and agreed to be of assistance to review the questionnaire. Changes to the questionnaire were made accordingly.

- ***Confirmation phase***

- The questionnaire was revised and presented to the department of advanced nursing sciences of the University of South Africa for approval.

- A pilot study was conducted on a *small scale* to refine the research instrument (Burns & Grove, 1993:48): the participants were two diploma intensive care students not involved in the study population. No further changes were deemed necessary by these two participants.

♦ ***Degree of difficulty of questions***

In order to discern whether the questionnaire was set at a level in keeping with the knowledge level of the participants, the degree of difficulty of each question was computed. If the questionnaire was set at an unattainable level, all (or most) of the questions would be answered incorrectly. If the questionnaire was set at a level below the knowledge extent of the participants, all or nearly all of the questions would be answered correctly. Perception of the complexity of the questionnaire will indicate if the researcher has too high expectations of the participants, if the questionnaire is unnecessarily too difficult or requires little effort.

The degree of difficulty of the questions is computed by using a formula as recommended by the consulting statistician:

$$\frac{\text{TOTAL CORRECTLY ANSWERED QUESTIONS}}{\text{TOTAL QUESTIONS ANSWERED}} \quad \text{X} \quad \frac{100}{1}$$

The higher the number of correctly answered questions, the lower the degree of difficulty. Therefore, the highest numbers denote the lowest degree of difficulty, that is, the question is found to be easy by the participants and the lower numbers denote that less respondents are able to answer the question correctly (van der Merwe, 1991:62-63). Figure 3.1 is a graph showing the degree of difficulty of the questions asked in the questionnaire.

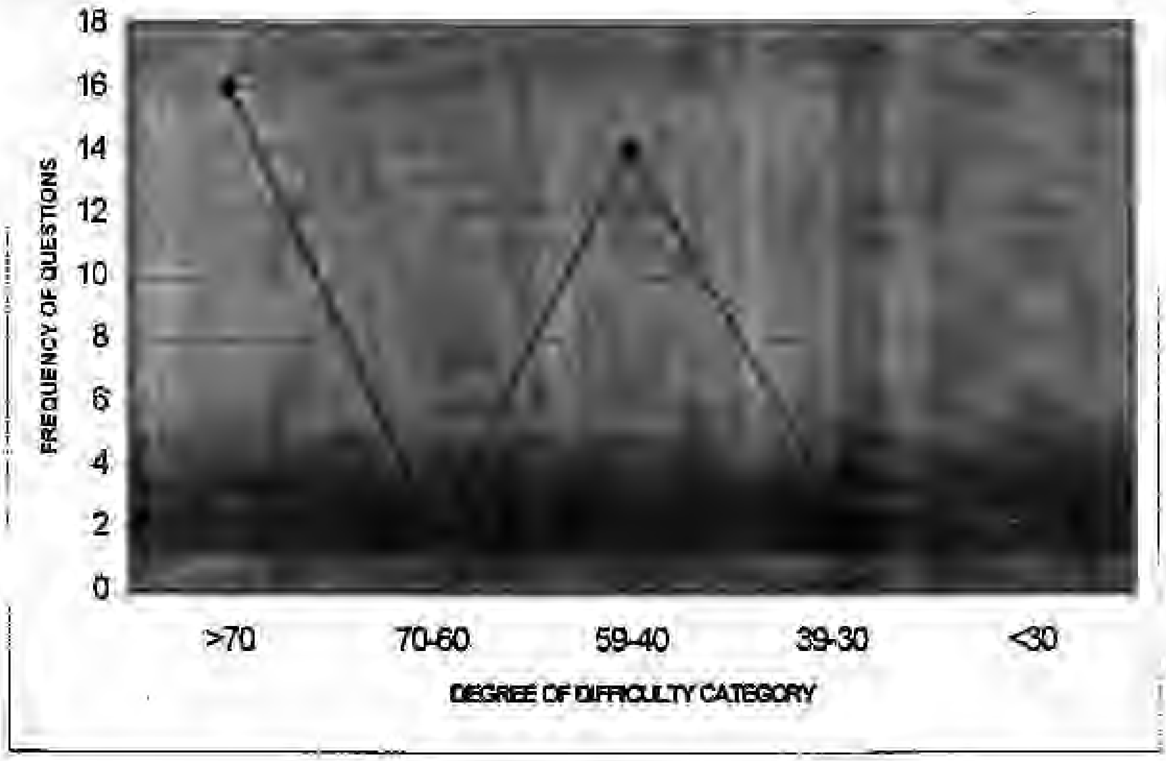


Figure 3.1 Degree of difficulty of the questions

Key:

>70	=	Very easy;
70 – 60	=	Moderately easy;
59 – 40	=	Average;
39 – 30	=	Moderately difficult, and
< 30	=	Very difficult (van der Merwe, 1991:63)

Figure 3.1 shows that the majority of questions (16) fall in the "very easy", and (14) in the "average" categories; two questions fall in the "moderately easy" category; the remaining (3) questions fall in the "moderately difficult" category and only (2) questions for the "very difficult" category. It may be concluded by these findings that the questionnaire was not unacceptably above or below the participants extent of knowledge.

3.2.2.2 POPULATION AND SAMPLING

♦ ***Population***

The researcher decided to target a private sector cardiothoracic intensive care unit (in the West Rand area) for the research study. This private clinic was chosen as it was within convenient proximity of the researcher. Written permission to implement the questionnaire was obtained (see Annexure III) from the management of this private institution.
Critical care nurses working in the cardiothoracic intensive care unit in the month of July 1999 were requested to participate in the study. They participated irrespective of their intensive care training and experience status. Full-time, part-time, session workers and intensive care students were all included in the study.

♦ ***Sampling***

The questionnaire was implemented on a convenience sampling basis: all personnel on duty at given times who were registered professional nurses and who *volunteered* to fill in the questionnaire took part in the study (n = 24). Convenience sampling is inexpensive, accessible and requires less time to acquire than other types of samples. Unfortunately, the convenience sampling method limits the extent of generalization (Burns & Grove, 1993:245).

3.2.2.3 VALIDITY AND RELIABILITY

"Validity refers to the degree to which an instrument measures what it is supposed to be measuring" (Uys & Basson, 1991:80).
Internal validity is defined by Mouton & Marais (1988:50) as "the fact that a study has generated accurate and valid findings of the specific phenomena which have been studied". The questionnaire is a product of the literature study, conceptual framework and the contributions of professionals. The implementation was done by the researcher himself, who maintained a controlled environment.

- Value of controlled environment: validity and reliability was created by the researcher in virtue of the fact that the participants of the study were at work, their time was extremely limited; there was therefore little opportunity for participants to find literature and read up on the subject of IABP therapy. The researcher ensured that each participant had a small private space in which to fill out the questionnaire and thus prevent persons from sharing knowledge or comparing answers. Persons participating in the research were either all tested at once or in small groups. The researcher kept both the "tested" and those undergoing "testing" apart by keeping himself between the two groups and requested that they not discuss the questionnaire until all the participants had handed their filled in questionnaires to the researcher.

- During the implementation of the research, the questionnaires were held by the researcher and at no time, other than the actual filling in under controlled environment mentioned above, were the questionnaires in possession of any other person. The researcher only removed the questionnaires from a folder when implementation took place, collecting them immediately afterwards.
- The researcher presented the questionnaire to each participant in the unit himself: in this way, he ensured that each participant was given the same explanation pertaining to the research and as far as possible the same steps of implementation were undertaken for every participant tested. In this way, the researcher aimed at implementing the questionnaire in a uniform manner to promote validity and reliability to provide each participant with as far as possible, the *identical conditions* with which to answer the questionnaire.
- The results were processed with the help of a consultant statistician: validity and reliability were hereby strengthened by the involvement of a source external to the study. The data gained in this way was considered by the researcher to be objective and not biased.
- The pilot study was considered to rule out the possibility of ambiguously worded questions and to elicit flaws previously unnoticed by the researcher. The pilot study was implemented in order to gain an objective view of the questionnaire.
- Content-related validity evidence examines the extent to which the method of measurement includes all the major elements relevant to the construct being measured (Burns & Grove, 1993:343). This evidence is obtained from three sources: the literature, representatives of the relevant population and content experts. Face validity gives the appearance of measuring the content (Burns & Grove, 1993:343). For face and content validity of the questionnaire used in this study, professionals with expertise within the field of IABP therapy were identified. They were

approached and agreed to be of assistance in reviewing the questionnaire. The questionnaire was considered reliable after being reviewed, as all of the experts' interpretation of the questions concurred.

3.2.2.4 OPERATIONALISATION OF DATA COLLECTION

- ***Data collection***

After written permission was obtained from the relevant authority (see Annexure III), the cardiothoracic unit manager was approached by the researcher. The researcher explained the purpose of the research and presented the questionnaire (see Annexure I). Anonymity and confidentiality of each participant were assured, as information collected would not be linked in any way to their names. A date and time convenient to the unit was discussed, and the researcher implemented the questionnaire accordingly.

Thirty registered nurses working in the cardiothoracic unit were approached to participate in the study. Twenty four out of this group volunteered willingly to complete the questionnaire. Six persons declined to participate in the study.

The tea room was used for participants to complete the questionnaire. The researcher handed out questionnaires to participants only when the research study was being conducted (not beforehand) and collected the questionnaires as soon as they were completed.

- ***Control of external variables***

The questionnaire was developed by the researcher through deductive logic based on the literature study. Deductive reasoning is the process of deriving logical answers or conclusions from reliable premises (Uys & Basson, 1991:2).
Nursing experts were in no way directly involved with the unit participating in the research study or the nursing staff thereof. The researcher ensured that no group discussions or sharing of knowledge took place and that no textbooks were consulted during completion of the questionnaire. The researcher was available for answering any queries. A standardised answer sheet was used for retrospective evaluation of the questionnaire.

♦ ***Indicator of adequate competency***

The researcher assumes a standard norm of knowledge level that the critical care nurse should have in order to give competent and safe nursing care to the patient receiving IABP therapy. The literature review (see chapter 2) confirms the notion that correct management of IABP therapy is potentially life-saving, whilst the converse is true; mismanagement of counterpulsation therapy is potentially fatal. The critical care nurses involved in the study all work in the cardiothoracic intensive care unit involved in the study, where all cardiothoracic patients are potential candidates for IABP therapy. As an independent nurse practitioner, the critical care nurse has to make decisions in emergency or crisis situations, based on her knowledge, for which she is responsible. "When a nurse accepts a prescription, request or direction for the treatment of a patient from a doctor, she does so as an independent practitioner, as a shared responsibility with the doctor on behalf of her patient, but she remains accountable for her actions in the collaborative situation" (Searle, 1986:89).

Van der Merwe (1991:50) proposes a standardised indicator of erroneous judgement and knowledge deficit for nurses dealing with prescriptions from doctors in an intensive care unit. Her reasoning is that all prescriptions for the critically ill patient may mean the difference between life and death, and mismanagement is potentially life threatening. The critical care nurse for this reason, should be thoroughly familiar with prescriptions routinely prescribed in the intensive care unit setting he/she finds him/herself in. In her similar study, van der Merwe (1991:50) assumed a knowledge deficit of more than 10% to be a potential threat.

As IABP therapy management is in effect emergency management, the researcher assumes a figure of 80% to be an indicator of adequate competency. A knowledge deficit of more than 20% is *assumed* to be a potential threat to raise mortality figures of the critically ill patient found in cardiothoracic intensive care units.

3.2.2.5 DATA ANALYSIS

Data analysis was done by means of descriptive statistics. This branch of statistics covers methods for:

- organising and presenting data by means of frequency tables, graphs, diagrams and statistical pies, and
- summarising or describing data by determining one or more representative characteristics or values, such as an average and percentage (Brink, 1990:23).

The statistics were facilitated by a consultant statistician expert; the statistics included frequency distributions and central tendency.

3.3 SUMMARY

This contextual research study is concemed with describing the knowledge of critical care nurses regarding the safe usage of IABP therapy. The research tool is a questionnaire developed with the aid of a literature study, input from professionals with IABP therapy expertise and a pilot study. The questionnaire is designed in such a way as to separate the critical knowledge points into nine sections, with the number of questions asked in each section a reflection of its importance. The degree of difficulty of the questions and a competency indicator, that is, an acceptable knowledge level expected of critical care nurses participating in the research study are discussed. The data was collected by the researcher in person. The questionnaires were implemented by the researcher who ensured that external variables were held to a minimum and that the conditions under which the questionnaire was answered were controlled. The researcher has limited the research study to a private cardiothoracic intensive care unit in the West Rand area. Data analysis was facilitated by the consultant statistician expert.

---o0o---

CHAPTER 4

RESULTS AND CONCLUSION OF THE STUDY

4.1 INTRODUCTION

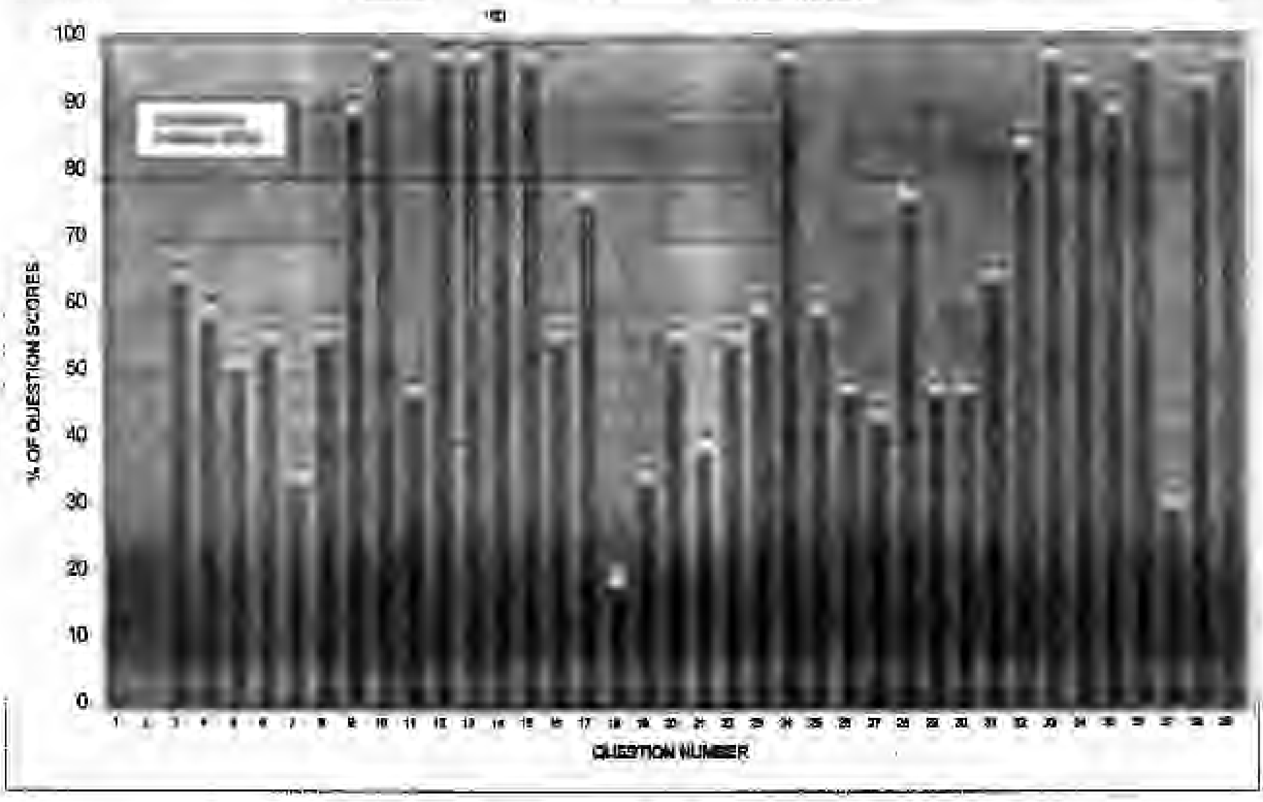
The results of the research study are presented and discussed in this chapter. Where possible, the data has been presented in graphs or tables to facilitate the significance of the results. The chapter is organised in the following manner:

- Two aspects of the competency levels of the participants are discussed: that of the participants regarding the various essential knowledge sections and that of the participants' individual performances.
- The sample of participants is analysed to ascertain if appointment and qualification have a bearing on results scored by the various groups.
- The overall performance in the knowledge base is assessed.

4.2 COMPETENCY INDICATOR

As discussed in chapter 3, the researcher assumes a standard norm of knowledge level that the critical care nurse should have in order to be a competent and safe user of intra-aortic balloonpump (IABP) therapy. The researcher assumes a figure of 80% to be an indicator of adequate competency. As stated in chapter 3, a knowledge deficit of more than 20% is assumed to increase mortality of the critically ill patients found in cardiothoracic intensive care units.

Figure 4.1 shows the score level attained for each question by the total number of participants; figure 4.2 shows the competency level for the entire questionnaire by each participant.



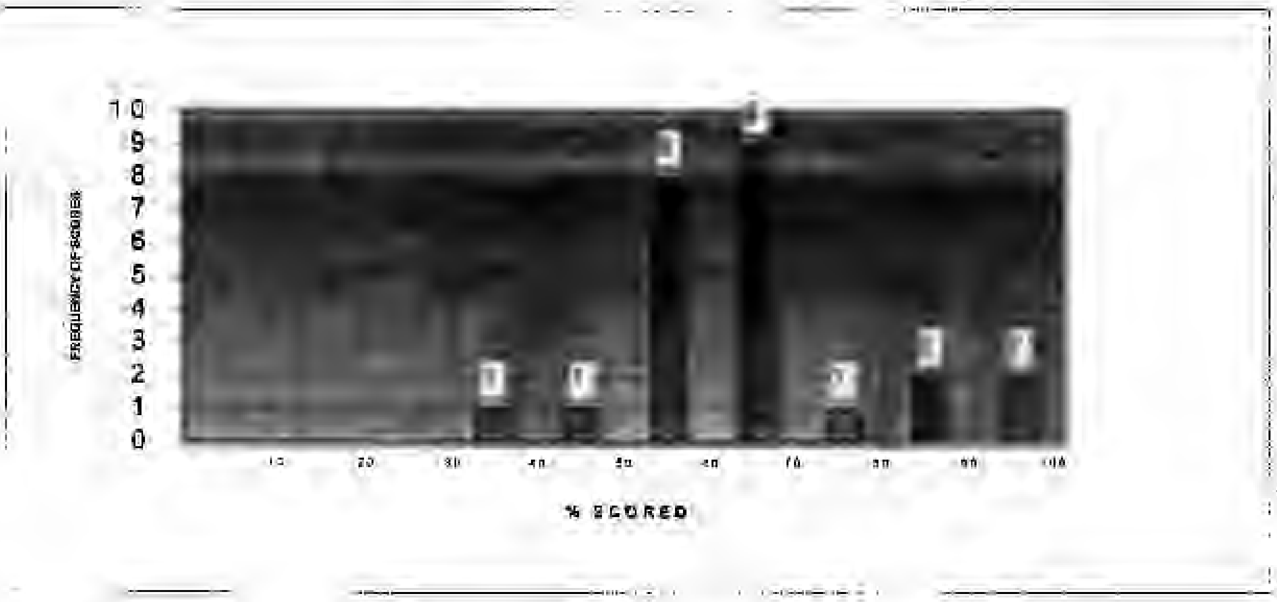
COMPETENCY LEVEL OF PARTICIPANTS OF RESEARCH STUDY

Figure 4.1 Score level of each question of research study

Figure 4.1 describes the results of the study with regard to the competency indicator. As the figure shows, fourteen questions met the competency level of eighty percent. The questions that the participants were judged competent in were questions 12 and 13, concerning the principles of the IABP; questions 14, 15 and 32 concerning the IABP settings; questions 24 and 36 indicating the alarm system of the IABP; question 9 concerning the indications of IABP therapy; questions 10 and 35 indicating possible complications of counterpulsation therapy; questions 34 and 38 were the only questions under the section heading: 'evaluation of IABP therapy'; and questions 33 and 39 were the questions for the section headed 'removal of intra-aortic balloon catheter' and deals with nursing action taken when the balloon catheter are to be removed.

Based on the above results, one can assume that the participants are able to remove the IABP catheter, and have the necessary knowledge regarding principles of the IABP, the alarm system and the settings concerning the most commonly used tracing for triggering the balloonpump, and the arterial waveform as tracing representing the mechanical events in the heart used to accurately time balloon inflation and deflation. The participants also show competence with the setting of the ECG for triggering the balloonpump. Indications for IABP therapy with possible complications were also completely answered by most participants. Only two questions (34 and 38), regarding the evaluation of IABP therapy were competently answered by the participants, which concerns the level of the bed and flexing of the leg.

Based on the above results, one can assume that the participants are able to remove balloon catheters and have sufficient knowledge regarding fundamental principles, indications, and complications of IABP therapy. However, the participants have an incompetent knowledge level regarding the management and evaluation of IABP therapy.



COMPETENCY LEVEL OF INDIVIDUALS

Figure 4.2 Competency of individuals

The figure shows that the number of competent individuals is four. (One person scored 78%, it may be reasonable to include this person in the competent category, which brings the total competent persons to five). From a total of 24 (100%) participants, 21% were found to be competent in their knowledge level of managing intra-aortic balloonpump therapy. This finding suggests that 79% of the staff tested would benefit from an education programme to upgrade their knowledge level.

4.3 PARTICIPANTS OF THE RESEARCH STUDY

4.3.1 SAMPLE

The participants of the research study were selected on a convenience sampling basis. All staff present in the cardiothoracic intensive care unit were approached by the researcher. All critical care nurses on duty in the selected intensive care unit were considered eligible for the study: this included permanent staff, temporary or session workers, part-time staff and intensive care students. Figure 4.3 summarises the sample data:

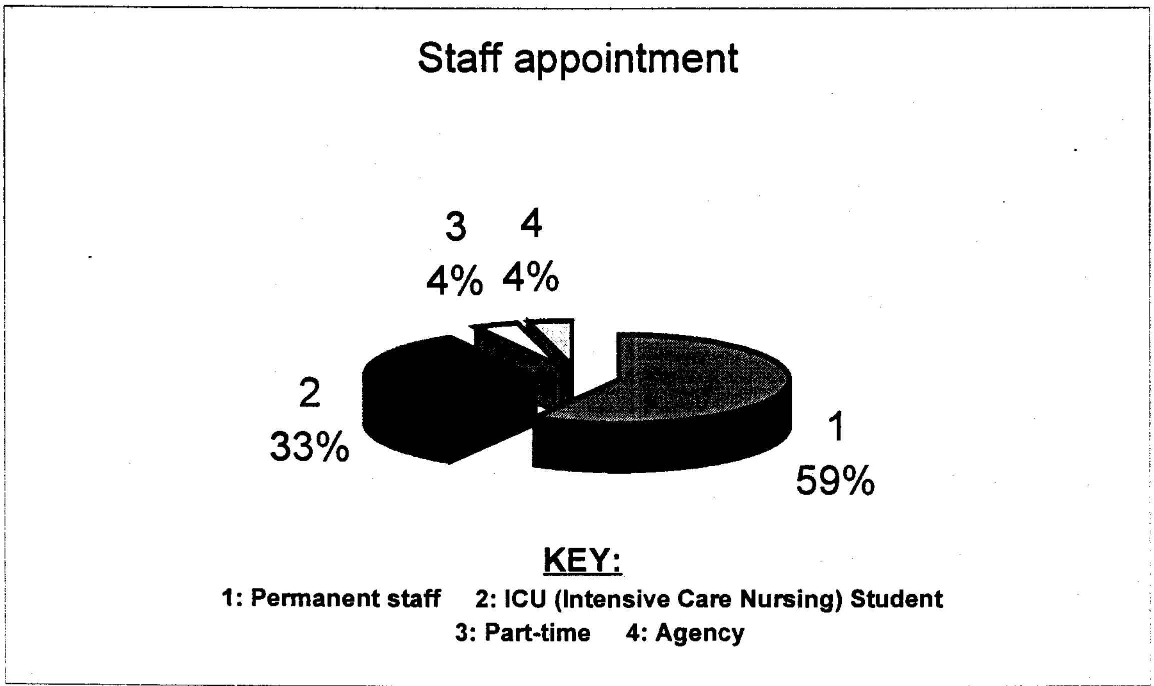


Figure 4.3 *Sample data* (n = 24)

The largest group were permanent staff, 14 (59%) – who work in the cardiothoracic intensive care unit on a full-time basis. The two smallest groups were the agency or session workers – 1 (4%), and part-time staff – 1 (4%), who are those workers that are least likely of all staff to work in the same area on a long-term basis. A number of 8 (33%) of ICU students tend to be transient workers as they rotate through units whilst studying. Part-time workers are more stable staff: they tend to work infrequently, but are usually in the same unit every time they work.

4.3.2 KNOWLEDGE RELATED TO SAMPLE

The scores are summarised in table 4.1.

Table 4.1 Knowledge level related to staff appointment

STAFF APPOINTMENT		KNOWLEDGE LEVEL		
		Mx	**Me**	**Mo**
Permanent	(14)	67	65	62; 65; 67
Part-time	(1)	78		
Agency (session)	(1)	54		
ICU student (Intensive Care Nursing)	(8)	59	58	57

Key:

Mx = mean score – average total correct answers in questionnaire, converted to a percentage;

Me = median total correct answers in questionnaire, converted to a percentage;

Mo = mode total correct answers in questionnaire, converted to a percentage.

The table shows that the highest scoring group (14 members – 58%) were the permanent staff members. The total agency and part-time staff tested were respectively one (each 4%), and their scores therefore, are *assumed not to be a true reflection of reality*. The scores of the permanent staff would appear to reflect that experience and increased exposure (by virtue of time spent at work) improve knowledge of intra-aortic balloonpump therapy, and thus scores obtained in the questionnaire were higher.

The intensive care student group's score is interpreted as being a reflection of their position of being under supervised instruction, and therefore, their level of knowledge is high.

The conclusion is drawn that the permanent staff group has an adequate level of knowledge with which to compare findings and scores. This inference is made on the assumption, that, if the questionnaire was simply too difficult in terms of the knowledge sought and the technical details, then the permanent staff members would have been unable to respond in the manner they did.

It is assumed that they are functioning at an increased knowledge level due to the fact that they are exposed to intra-aortic balloonpump therapy more often than the intensive care students. It is perhaps to this level that the other staff members should be motivated to achieve. The permanent staff group's average score was 67%, with a central tendency of 65% and a tri-modal score of 62%, 65% and 67%. This group therefore was the nearest to the competency indication score of 80% (as discussed in chapter 3). The average score reflects that more training or instruction for the members of the group who scored below the central tendency of 65% is needed to uplift their knowledge level.

4.3.3 DEMOGRAPHIC DATA

All levels of intensive care 'qualifications' were eligible to take part in the study. There was no master's degree qualification amongst the participants. The levels of 'qualifications' were represented by the following participants:

- Diploma in ICU (Intensive Care Nursing), and
- ICU (Intensive Care Nursing) experienced critical care nurses (with no formal intensive care qualification).

A total of 24 participants volunteered to participate in the study. Figure 4.4 summarises the demographic data.

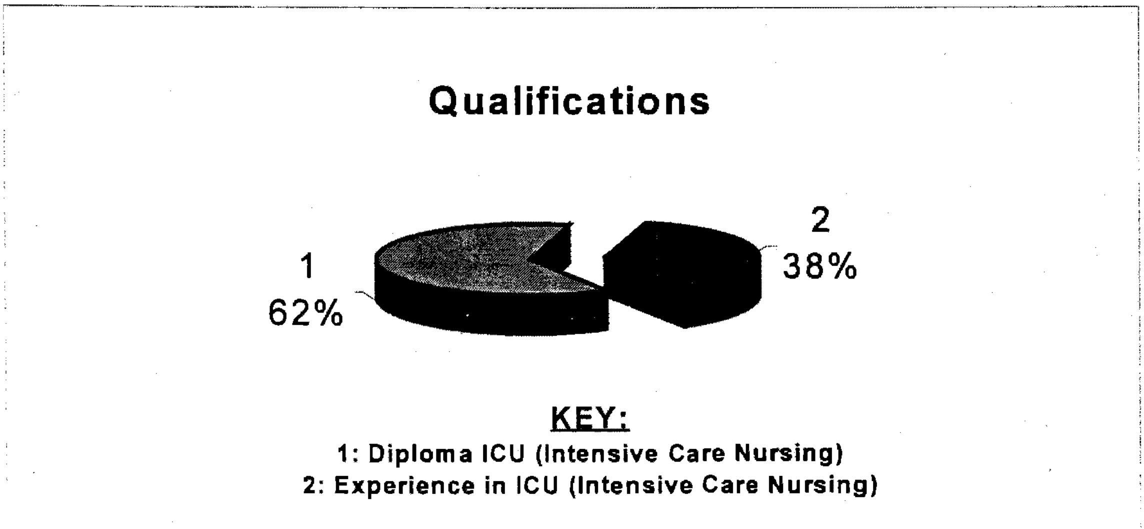


Figure 4.4 Demographic data (n = 24)

The researcher assumed that the majority of staff tested would have a post-basic qualification (for example, an ICU (Intensive Care Nursing) diploma). This expectation was based on the perception that there would be greater incentives in the private sector for those with post-basic qualifications, in view of the fact that the private sector is presently undertaking to provide that post-basic training. The study showed the majority of participants to have both ICU (Intensive Care Nursing) experience and intensive care training.

Table 4.2 describes their scores:

Table 4.2 Knowledge level related to demographic data

QUALIFICATIONS		KNOWLEDGE LEVEL		
		Mx	**Me**	**Mo**
Diploma (ICU) (Intensive Care Nursing)	(15)	68	65	62; 65; 67
Experience (ICU) (Intensive Care Nursing)	(9)	59	57	57

Key:

Mx = mean score – average total correct answers in questionnaire, converted to a percentage;

Me = median total correct answers in questionnaire, converted to a percentage;

Mo = mode total correct answers in questionnaire, converted to a percentage.

Table 4.2 indicates that higher qualifications do have a bearing on knowledge level. The ICU (Intensive Care Nursing) student group's scores (second highest scoring group) were included in the 'experienced' category (as they have not yet graduated), which indicates that the vast majority of ICU (Intensive Care Nursing) experienced staff have a knowledge level closer to the mode and median shown, rather than the average score. The average score of the diploma qualified staff was approximately 10% higher than that of the experienced staff. Both the median and mode of the diploma graduates were higher than those of the experienced staff. Obviously, exposure to intra-aortic balloonpump therapy, self-motivation and interest must play a role in the knowledge level of the individual participant, a point proved by the highest-scoring candidate (100%) who held the distinction of being diploma qualified in intensive care nursing.

4.4 KNOWLEDGE BASE

The information is tabled reflecting *only* the questions correctly answered with the corresponding percentage, and the average scored percentages.

4.4.1 ALARM SYSTEM OF IABP

The following results were obtained as summarised in table 4.3:

Table 4.3 Alarm system of IABP results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (24) concerned aspects most likely to cause a high pressure alarm.	23	96%
Question (36) referred to the balloon inflating and deflating with high pressure alarming.	23	96%
Average score	96%	

Both questions 24 and 36 referred to causations of alarms with high pressures. Of the total number of participants, 23 (96%) answered both questions correctly. This percentage, when considered in the light of the competency indicator (80%), is above competency level.

4.4.2 IABP SETTINGS

There were 7 questions: questions 14, 15, 16, 26, 30, 32 and 37. The following results were obtained, summarised in table 4.4:

Table 4.4 IABP setting results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (14) concerned tracing for triggering the IABP to inflate and deflate.	24	100%
Question (15) concerned the tracing to accurately time inflation and deflation.	23	96%
Question (16) concerned the timing interval of inflation and deflation.	13	54%
Question (26) concerned the difference between peak and pattern trigger modes.	10	42%
Question (30) deals with the most commonly used trigger mode.	11	46%
Question (32) deals with the ECG triggering IABP inflation and deflation.	20	83%
Question (37) concerns the changing of helium volume while on standby mode.	7	29%
Average score	64%	

The average score for this knowledge section was 64%. This percentage is well below competency level. Questions 14, 15 and 32 in this section had a competency level score, that is, 80% or above.

4.4.3 REMOVAL OF IABP CATHETER

Two questions were asked: questions 33 and 39. The following results were obtained and summarised in table 4.5:

Table 4.5 Removal of IABP catheter results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (33) referred to digital pressure applied to the femoral artery after percutaneous balloon removal.	23	96%
Question (39) concerned the removal of the intra-aortic balloon catheter.	23	96%
Average score	96%	

Both questions 33 and 39 concerned nursing care actions when removing the IABP catheter. Of the participants, 23 (96%) answered correctly. This question's scores are well above the competency level, and it can be conducted that the participants are proficient in removing IABP catheters.

4.4.4 IDENTIFICATION OF ARTERIAL AND IABP WAVEFORMS

Two questions were asked: questions 19 and 22. Question 19 concerned the arterial pressure tracing, and participants had to identify the descriptions of the tracing. Question 22 concerned the balloon pressure waveform, and participants had to identify the descriptions of the tracing. The findings are summarised in table 4.6.

Table 4.6 Identification of arterial and IABP waveform results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (19) referred to the arterial pressure tracing waveform.	8	33%
Question (22) referred to the balloon pressure waveform.	13	54%
Average score	43%	

The average score for this section was 43%. The score is below competency level; it appears that the identification of the balloon pressure waveform was more identifiable than the arterial pressure tracing waveform, as more participants, 13 (54%) recognised the balloon pressure waveform tracings correctly.

The implication of participants not being able to recognise the arterial and IABP waveforms is a serious matter, as setting the correct inflation / deflation of the IABP depends on the correct readings of the said waveforms. If the critical care nurse is unable to recognise these waveforms correctly, the patient receiving IABP therapy may suffer serious complications.

4.4.5 EVALUATION OF IABP THERAPY

Eleven questions were asked: questions 18, 20, 21, 23, 25, 27, 28, 29, 31, 34 and 38. The results were as follows, summarised in the following table 4.7:

Table 4.7 Evaluation of IABP therapy results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (18) referred to the effects of proper timing with inflation and deflation.	4	17%
Question (20) referred to the results of late inflation.	13	54%
Question (21) referred to the results of late deflation.	8	33%
Question (23) referred to the effects of a rounded balloon pressure waveform.	6	25%
Question (25) referred to the width of the balloon pressure waveform.	5	21%
Question (27) referred to the evaluation of the dicrotic notch on the arterial pressure waveform.	10	42%
Question (28) referred to the evaluation of isovolumetric contraction.	15	62%

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (29) referred to the evaluation of balloon augmentation.	11	46%
Question (31) referred to the evaluation of pacing spikes in peak and pattern modes.	15	62%
Question (34) referred to the evaluation of patient position in bed whilst receiving IABP therapy.	21	87%
Question (38) referred to the position of the leg after insertion of balloon catheter.	22	92%
Average score	49%	

The average score for this knowledge section was 49%. The poor performance in this section is reflected in the inability of the participants to achieve competency (80%) in the majority of questions asked. A significant number of participants, 21 (87%), and 22 (92%) were in the competent level with regard to questions 34 and 38, of which both referred to the position of patient and limbs in bed whilst receiving IABP therapy. It can be concluded that the participants are not proficient in IABP evaluation. The maintenance and evaluation of IABP therapy is the crux of nursing the IABP patient (see metatheoretical assumptions, chapter 1).

Poor left ventricular function, resulting in poor cardiac output, is often the reason for IABP therapy and only constant, intelligent monitoring and evaluation of IABP therapy will detect malfunctioning of the balloonpump and subsequent life-threatening complications.

4.4.6 COMPLICATIONS ASSOCIATED WITH IABP THERAPY

Three questions were asked: questions 10, 11 and 35. The results were as follows in table 4.8:

Table 4.8 Complications associated with IABP therapy results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (10) referred to the listing of two possible complications of IABP therapy.	20	83%
Question (11) referred to complications with insertion of balloon catheter.	10	42%
Question (35) referred to complication with balloon rupture.	20	83%
Average score	69%	

The average score for this section was 69%, indicating an inadequate knowledge level, based on the 80% competency level. Two questions, 10 and 35 were significantly well answered by 20 (83%) of respondents. Although the average score for this section was 69%, one can conclude that most participants will be able to take proper immediate action, should complications occur, and in so doing, prevent possible fatality of a patient.

4.4.7 PRINCIPLES OF CORONARY CIRCULATION AND PHYSIOLOGY OF THE CARDIAC CYCLE

There were five questions asked: questions 3, 4, 6, 7 and 17. The results were as follows in table 4.9:

Table 4.9 Principles of coronary circulation and physiology of the cardiac cycle results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (3) referred to the definition of preload.	15	62%
Question (4) referred to the definition of afterload.	14	58%
Question (6) referred to coronary artery perfusion.	13	54%
Question (7) referred to isovolumetric perfusion.	8	33%
Question (17) referred to the dicrotic notch on the arterial waveform.	18	75%
Average score	56%	

The average score for this section was 56%, indicating an inadequate knowledge level, based on the 80% competency level. The critical care nurse caring for the patient receiving IABP counterpulsation therapy must possess a thorough understanding of the principles of coronary circulation and the physiology of the cardiac cycle, to enable them to assess the hemodynamic effects achieved through IABP therapy and remain alert to the need for adjustments in IABP timing sequences. The critical care nurse requires the competent knowledge to recognise significant trends in the patient's condition.

4.4.8 PHYSIOLOGICAL EFFECTS OF IABP THERAPY

There was one question asked: question 5. The results were as follows in table 4.10:

Table 4.10 Physiological effects of IABP therapy results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (5) referred to the major physiological effects of counterpulsation therapy.	12	50%
Average score	50%	

Question 5 deals with the major effects of IABP counterpulsation therapy. There were a total of 12 correct answers, giving a percentage of 50%. Complex physiological concepts are crucial to patient management. An understanding of the physiological effects of IABP therapy permits the critical care nurse to increase the hemodynamic benefits of IABP therapy, potentially improving patient outcome.

4.4.9 INDICATIONS AND CONTRA-INDICATIONS OF IABP THERAPY

Two questions were asked: questions 8 and 9. The results were as follows in table 4.11:

Table 4.11 Indications and contra-indications of IABP therapy results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (8) referred to contra-indications to IABP therapy.	20	83%
Question (9) concerned the listing of four possible medical or surgical indications for IABP therapy.	21	87%
Average score	85%	

Question 8 deals with contra-indications to balloon pumping. There were a total of 20 correct answers, giving a percentage of 83%. Question 9 deals with indications for IABP therapy. There were a total of 21 correct answers, giving a percentage of 87%; the average score for both questions being 85%. Both questions achieved competent scores in the questionnaire, indicating that all participants have the necessary knowledge regarding indications and contra-indications to IABP therapy.

4.4.10 FUNDAMENTAL PRINCIPLES OF IABP THERAPY

Two questions were asked: questions 12 and 13. The results were as follows in table 4.12:

Table 4.12 Fundamental principles of IABP therapy results

QUESTION	QUESTIONS CORRECTLY ANSWERED	% CORRECT
Question (12) referred to inflating / deflating of the IABP at the onset of diastole.	23	96%
Question (13) referred to inflating / deflating of the IABP at the onset of systole.	23	96%
Average score	96%	

Question 12 deals with inflation at the onset of diastole, and question 13 deals with deflation at the onset of systole. There were a total of 23 correct answers for both questions, giving an average percentage of 96%. Both questions achieved high scores in the questionnaire, indicating that all the participants (except for one) understood the fundamental principles of IABP therapy.

By understanding the principles of IABP therapy, critical care nurses will be able to incorporate timing adjustments, hemodynamic effects, and trouble-shooting in the evaluation of their patient's clinical response (Shoulders – Odom, 1991:60).

4.5 CONCLUSION

The conclusions drawn from this study are detailed in chapter 5.

4.6 SUMMARY

The results of the study show that:

- Only 21% of the participants were found to be competent in their knowledge of IABP therapy. The knowledge deficit included the following:
  - IABP settings;
  - identification of arterial and IABP waveforms;
  - evaluation of IABP therapy;
  - complications associated with IABP therapy;
  - principles of coronary circulation and physiology of the cardiac cycle, and
  - physiological effects of IABP therapy.

- The abovementioned premises will be used in formulating guidelines through deductive reasoning for improving knowledge regarding IABP therapy. Deductive reasoning moves from the general to the specific or from a general premise to a particular situation or conclusion (Burns & Grove, 1993:9).

---o0o---

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS (GUIDELINES)

5.1 INTRODUCTION

The research study idea was conceived, a literature study completed and a research tool developed: a questionnaire, which was examined by experts in intra-aortic balloonpump (IABP) therapy.

The implementation of the questionnaire was done by the researcher, and the data processed and presented in the previous chapter. The goal of the study at the onset was two-fold: to explore and delineate the knowledge of critical care nurses regarding IABP therapy, and to formulate guidelines to improve knowledge regarding IABP therapy. This chapter is concerned with recommendations and fulfilling the final goal, that of formulating guidelines based on the findings of the study.

5.2 CONCLUSIONS

The conclusions are divided into demographic data and knowledge base.

5.2.1 DEMOGRAPHIC DATA

- The majority of the participants were permanent staff members of the cardiothoracic unit, the smallest groups being agency and part-time staff.
- A large proportion of the participants were only intensive care experienced, and did not receive formal training in intensive care nursing.
- Intensive care diploma staff were the highest scoring group of participants: their knowledge level is assumed to be the highest due to their state of being trained.
- The intensive care qualification had a bearing on the score: the more advanced the training, the better the average knowledge level, as indicated in table 4.2 where the average score of the intensive care diploma participants was approximately 10% higher than that of the intensive care experienced participants. Formal education in critical care nursing enhances the knowledge and skills of nurses working in the critical care environment (Sole, 1997:58).

5.2.2 KNOWLEDGE BASE

- The questionnaire was set at a level in keeping with the knowledge level of the participants.
- The competency of the participants was confined to the alarm system of IABP therapy, indications and contra-indications of IABP therapy, and fundamental principles of IABP therapy.
- The participants of the study were able to remove intra-aortic balloon catheters in a safe manner.
- The knowledge level of participants regarding evaluation of IABP therapy, IABP settings, identification of arterial and IABP waveforms, complications associated with IABP therapy, principles of coronary circulation and physiology of the cardiac cycle and physiological effects of IABP therapy was below the competency indicator, that is, below 80%.
- As stated in chapter 4, only 21% of the participants were found to be competent in their knowledge of IABP therapy. The area deemed most important by the researcher, by virtue of the literature study, is that of evaluation of IABP therapy, which had a very low overall score of 49%. It appears that the areas of knowledge vital to the well-being of the patient are those least known by the participants.

5.3 GUIDELINES TO IMPROVE KNOWLEDGE REGARDING IABP THERAPY

The guidelines evolve, through a process of deductive reasoning, from the results of the study.

Deductive reasoning moves from the general to the specific or from a general premise to a particular situation or conclusion (Burns & Grove, 1993:9).

The guidelines are described in table 5.1.

Table 5.1 Guidelines derived from research study results to improve knowledge regarding IABP therapy

RESULTS OF RESEARCH STUDY: KNOWLEDGE DEFICIT	**GUIDELINES**
1. IABP settings.	In-service training with demonstrations showing the functions of the different settings.
2. Identification of arterial and IABP waveforms.	In-service training with the use of arterial and IABP waveform strips; demonstration / illustration on identification of the descriptions and their different meanings.
3. Evaluation of IABP therapy.	The critical care nurse in charge of the unit is made aware of the fact that this section was poorly answered by the participants of the research study. In the light of this, in-service education programmes should be made available to all categories of staff with demonstrations on observations related to IABP therapy.
4. Complications associated with IABP therapy.	The implications of complications should be made clear to all staff members involved with IABP therapy, that is, they are potentially fatal. Urgent in-service training should be conducted utilising examples of possible complications and the course of action to be initiated to prevent and arrest the complications of IABP therapy.
5. Principles of coronary circulation and physiology of the cardiac cycle.	In-service training and emphasis in ICU training courses on the definitions of concepts such as: ♦ Preload; ♦ Afterload; ♦ Coronary artery perfusion; ♦ Isovolumetric contraction; ♦ Dicrotic notch, and ♦ Myocardial oxygen consumption.

RESULTS OF RESEARCH STUDY: KNOWLEDGE DEFICIT	GUIDELINES
6. Physiological effects of IABP therapy.	Emphasis in ICU training courses and in-service training on the physiological effects of IABP therapy.

5.4 LIMITATIONS OF STUDY

- The concept of IABP therapy covers an extensive area of knowledge, which is difficult to confine to a questionnaire requiring approximately twenty minutes to complete. This unfortunately limits the field covered in the questionnaire, since the participants may have a much broader knowledge of IABP therapy as a subject.
- The available literature on IABP therapy is limited: valuable evaluation criteria for the research study may be omitted due to this fact.
- The research study is contextual, limited to a cardiothoracic intensive care unit on the West Rand; therefore generalisations and implications are confined to this limited area only.

5.5 RECOMMENDATIONS

The following recommendations are made:

5.5.1 NURSING PRACTICE

- The target group for the improvement of knowledge is registered nurses who are working permanently in the cardiothoracic unit (the largest group of the study), with the instructions made available in such a way as to benefit their part-time and agency counterparts as well.
- The availability of guidelines to improve the knowledge regarding IABP therapy would probably be of benefit to all as they can be referred to at any time in the cardiothoracic intensive care unit.
- The development of an educational programme for critical care nurses working in the cardiothoracic intensive care unit responsible for the care of patients needing IABP therapy. This educational programme can consist of several in-service training sessions in which the following are reviewed:

- evaluation of patient response to counterpulsation in terms of hemodynamic status, control of arrhythmias, systemic perfusion and relief of symptoms of cardiac ischemia;
- observation of early signs of complications from IABP therapy such as limb ischemia, bleeding, infection, thrombus formation, malpositioning of balloon catheter and arterial damage;
- ensuring proper functioning of the IABP itself including correct timing, consistent triggering, appropriate trouble-shooting of all alarm situations and safe operation;
- nursing management plans for the patient with IABP therapy. Standard principles and techniques will guide the nurse in the care of the patient undergoing IABP therapy (Woods, 1995:584).

- ♦ An intra-aortic balloonpump course can be designed as a review for experienced critical care nurses directly responsible for the care of patients needing IABP therapy. Knowledge obtained from these courses can provide increased autonomy for the nurses and can benefit the patients undergoing IABP therapy.
- ♦ Orientation programmes to be offered to critical care nurses should be designed to suit the specific needs of a particular critical care unit.

5.5.2 NURSING EDUCATION

- ♦ As IABP therapy in the cardiothoracic critical care setting is a potentially life-saving procedure, it is recommended that refresher courses, preferably with demonstrators and preceptors, be part of an in-service teaching programme. For the same reason, more emphasis should be placed on IABP therapy in the intensive care training courses.
- ♦ Such a programme should focus on the evaluation and maintenance of IABP therapy and the possible complications associated with IABP therapy.
- ♦ Those with experience in intensive care nursing and with no post-basic training should be encouraged to undergo a formal course in critical care nursing.

5.5.3 NURSING RESEARCH

- ♦ This study can be replicated in other cardiothoracic units to note finding correlation's with the present study.

- Research regarding IABP therapy should be undertaken in the same unit to note improvement of knowledge once the recommendations regarding education have been instituted. An in-service programme can be designed based on the findings and recommendations of this study and effectively tested.
- Insufficient scientific research by nurses in this field has left a gap in the available information. The need to continue nursing research in this field is therefore imperative.

5.6 SUMMARY

The purpose of this research study was to explore and describe the knowledge of the critical care nurse regarding the safe usage of IABP therapy, and to formulate guidelines for its safe usage.

The research tool was a questionnaire, implemented under controlled conditions in a private cardiothoracic intensive care unit in the West Rand area.

The knowledge of the majority of critical care nurses tested was found to be insufficient, particularly in those areas considered important by the researcher (based on the literature study). In figure 2.1, Bergman (1982:8) illustrates that the basic precondition for accountability is to have the *ability* (knowledge, skill, values) to decide and act on a specific issue. Thus, the critical care nurse in the cardiothoracic unit should have the ability (knowledge) to manage IABP therapy in a safe and therapeutic manner. All too often nurses are given responsibility (and expected to be accountable for same) when they are lacking the ability (knowledge) base (Bergman, 1982:8).

Safe usage guidelines have been proposed to improve the current situation. There remains, however, a need for continued in-service education regarding IABP therapy.

Critical care nurses play a vital role in the management of patients undergoing IABP therapy. As technology evolves in the treatment of cardiovascular disease, critical care nurses must continually examine and revise clinical practice standards (Holmes & Hollabaugh, 1997:65).

Critical care nurses should be skilled in providing effective IABP therapy (Osborn & Quaal, 1998:25). The nurse's role requires the operation of the IABP, while at the same time, the ability to deliver quality nursing care. Knowledge of physiology, co-ordination of the principles of timing with hemodynamic effects and skilful problem-solving assure critical care nurses 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 and should be so regarded by everybody involved.

The identified guidelines could improve the quality of nursing care and standards if they could be mastered by the critical care nurses in the cardiothoracic unit affected by this research.

---o0o---

BIBLIOGRAPHY

ANDREOLI, KG 1987: Comprehensive cardiac care. Study. Louis: Mosby.

ANELLA, J; Mc CLOSKEY, A & VIEWEG, C 1987: Nursing dynamics of pâediatric intra-aortic balloon pumping. Critical Care Nurse, 10(4): 24-37.

ARROW 1996: IABP operator's manual: KAAT II PLUS IABP system. Massachusetts: Arrow International.

BAUE, AE; GEHA, AS: HAMMOND, GL; LAKS, H & NAUNHEIM, KS 1991: Glen's thoracic and cardiovascular surgery. East Norwalk: Appleton & Lange.

BAVIN, TK & SELF, MA 1991: Weaning from intra-aortic balloonpump support. American Journal of Nursing, 91(10): 54-59.

BERGMAN, R 1982: The role of the unit sister: emphasis on quality of care and accountability. Curationis, 5(4): 4-9.

BOTES, AC 1989: 'n Model vir wetenskapsbeoefening in die verpleegkunde. Johannesburg: Randse Afrikaanse Universiteit. (Doktorale tesis).

BOTES, AC 1991: 'n Funksionele denkbenadering in die verpleegkunde. Curationis, 14(1): 19-23.

BOTES, AC 1992: A research model in nursing. Johannesburg: Rand Afrikaans University.

BRINK, HIL 1990: Statistics for nurses. Pretoria: Academia.

BURNS, N & GROVE, SK 1993: The practice of nursing research: conduct, critique and utilisation; second edition. Philadelphia: W B Saunders.

CLOCHESY, JM; BREU, C; CARDIN, S; WHITTAKER, AA & RUDY, EB 1993: Critical care nursing. Philadelphia: W B Saunders.

DANTZKER, DR & SCHARF, SM 1998: Cardiopulmonary critical care. Philadelphia: W B Saunders.

DORLAND, W 1988: Dorland's illustrated medical dictionary. Philadelphia: W B Saunders.

GEIGER, J; HALL, T; BREEZE, E; DAVEY, C; JONES, A & STACKHOUSE, D 1997: Intra-aortic balloonpumps in children: a small-nursing-team approach. Critical Care Nurse, 17(3): 79-86.

GORAN, SF 1996: From counterpulsation to paralysis: a case presentation. Critical Care Nurse, 16(2): 54-57.

GUZETTA, CE & DOSSEY, BM 1992: Cardiovascular nursing: holistic practice. St. Louis: Mosby.

HOLLOWAY, NM 1993: Nursing the critically ill adult. California: Addison-Wesley.

HOMES, L & HOLLABAUGH, SK 1997: Using the continuous quality improvement process to improve the care of patients after angioplasty. Critical Care Nurse, 17(6): 56-65.

HUDAK, CM & GALLO, BM 1994: Critical care nursing: a holistic approach. Philadelphia: JB Lippencott.

JOHANSON, BC; DUNGCA, CU; HOFFMEISTER, D & WELLS, SJ 1981: Standards for critical care. Toronto: Mosby.

JOSEPH, DL & BATES, S 1990: Intra-aortic balloonpumping: how to stay on course. American Journal of Nursing, 90(9): 42-47.

JULIAN, DG & BRAUNWALD, E 1994: Management of acute myocardial infarction. London: W B Saunders.

KENNER, CV; GUZZETA, CE & DOSSEY, BM 1985: Critical care nursing: body-mind-spirit. Boston: Little, Brown and Company.

KLOPPER, HC 1994: 'n Model vir begeleide selfstudie in verpleegkunde. Johannesburg: Randse Afrikaanse Universiteit. (Doktorale tesis).

KOZIER, B; ERB, G & BLAIS, K 1992: Concepts and issues in nursing practice; second edition. California: Addison-Wesley.

LEWIS, SM & COLLIER, IC 1987: Medical-surgical nursing: assessment and management of clinical problems. New York: McGraw-Hill.

MASON, CB & DAVIS, JE 1987: Cardiovascular critical care. New York: Van Nostrand Reinhold Company.

MELEIS, AI 1991: Theoretical nursing development and progress; second edition. Philadelphia: J B Lippencott.

MOGHISSI, K 1986: Essentials of thoracic and cardiac surgery. London: William Heinmann Medical Books.

MOUTON, J & MARAIS, HC 1988: Basic concepts in the methodology of the social sciences. Pretoria: Human Sciences Research Council.

OH, TE 1991: Intensive care manual. Sydney: Butterworths.

ORAL ROBERTS UNIVERSITY: ANNA VAUGHN SCHOOL OF NURSING 1990: Nursing for the whole person theory: 136-142.

OSBORN, C & QUAAL, SJ 1998: Maximising cardiopulmonary resuscitation in patients with intra-aortic balloonpumps. <u>Critical Care Nurse</u>, 18(2): 25-27.

POLIT, DF & HUNGLER, BP 1995: Nursing research: principles and methods. Philadelphia: Lippencott.

POLIT, DF & HUNGLER, BP 1997: Essentials of nursing research. Methods and utilisation. Philadelphia: Lippencott.

QUAAL, SJ 1984: Comprehensive intra-aortic balloonpumping. St. Louis: Mosby.

RAND AFRIKAANS UNIVERSITY NURSING DEPARTMENT 1992: Nursing for the whole person theory. Johannesburg: Rand Afrikaans University.

ROUTIER, RJ 1999: Cardiologist and specialist physician in an interview with the researcher regarding the questionnaire, held on 17 May 1999 in Johannesburg.

SADLER, D 1984: Nursing for cardiovascular health. Connecticut: Appletton.

SEARLE, C 1986: Professional practice: a South African nursing perspective. Durban: Butterworths.

SEARLE, C 1987: Ethos of nursing and midwifery: a general perspective. Durban: Butterworths.

SEARLE, C 1991: Towards excellence: the centenary of state registration for nurses and midwifes in South Africa, 1891-1991. Durban: Butterworths.

SEARLE, C & PERA, S 1993: Professional practice: a South African nursing perspective. Durban: Butterworths.

SHOULDERS-ODOM, B 1991: Managing the challenge of IABP therapy. Critical Care Nurse, 11(2): 60-76.

SOLE, ML 1997: Academic education. Offering choices in a critical care elective. Critical Care Nurse, 17(4): 55-61.

SOUTH AFRICA (Republic). South African Nursing Act (Act No 50 of 1978 as amended). Pretoria: Government Gazette.

SOUTH AFRICAN NURSING COUNCIL REGULATION No R2598 of 1984. Pretoria: South African Nursing Council.

SOUTH AFRICAN NURSING COUNCIL REGULATION No R387 of 1985. Pretoria: South African Nursing Council.

STRAUS, A & CORBIN, J 1990: Basics of qualitative research. Grounded theory procedures & techniques. London: Sage.

SOUHAMI, RL & MAXHAM, J 1990: Textbook of medicine. London: Churchill Livingstone.

TALBOT, LT 1994: Principles and practice of nursing research. St. Louis: Mosby.

THELAN, LA; DAVIE, JK & URDEN, ID 1998: Textbook of critical care nursing: diagnosis and management. Toronto: Mosby.

THE OPEN BIBLE, 1985: New York: Thomas Nelson Publishers.

UYS, HHM & BASSON, AA 1991: Research methodology in nursing. Pretoria: Haum.

VAN DER MERWE, D 1991: Medikasie-hantering deur die verpleegkundige in 'n intensiewe sorgeenheid. Johannesburg: Randse Afrikaanse Universiteit.

WATSON, R 1995: Accountability in nursing practice. London: Chapman & Hall.

WOJNER, AW 1994: Assessing the five points of the intra-aortic balloonpump waveform. Critical Care Nurse, 14(3): 48-52.

WOODS, SL; SIVARAJAN FROELICHER, ES; HALPENNY, CJ & UNDERHILL MOTZER, S 1995: Cardiac nursing. Philadelphia: J B Lippencott.

---o0o---

ANNEXURE I

P J Oosthuizen
P.O. Box 7324
WELTEVREDEN PARK
1715
☎: 082 850 8745

Dear Respondent

Research: The knowledge of critical care nurses regarding intra-aortic balloonpump counterpulsation therapy

I am in the process of completing the MA(Cur) degree (Cardiothoracic Intensive Care Nursing) at UNISA.

The purpose of my study is to explore and describe the knowledge of the critical care nurse regarding the safe nursing management of intra-aortic balloonpump counterpulsation therapy, and to describe **guidelines** for the safe nursing management of the patient receiving counterpulsation therapy.

It would be greatly appreciated if you would complete the attached questionnaire. All information will be kept strictly confidential. The information will be grouped and processed and therefore cannot be associated with you as an individual.

Please fill in the questionnaire by circling (O) the correct answer in the appropriate box. More than one response may be correct, e.g.:

1	Your level of qualification / experience in intensive care nursing is:	
●	masters degree in intensive care nursing;	A
●	diploma in intensive care nursing;	B
●	intensive care nursing experience.	C

Permission for undertaking the research has been granted by the relevant authorities. This should take approximately 20 minutes to complete.

Thank you for your participation. As a result of your co-operation, guidelines focusing on essential information will be formulated to ensure and improve quality nursing care.

FOR OFFICIAL USE

INTRA-AORTIC BALLOONPUMP COUNTERPULSATION THERAPY QUESTIONNAIRE

(1-3)

SECTION A - BIOGRAPHICAL DATA

Read each item below, and circle the letter of the correct response/s. More than one response may be correct.

1	Your level of qualification / experience in intensive care nursing is:		
●	masters degree in intensive care nursing ;	A	(4)
●	diploma in intensive care nursing;	B	(5)
●	intensive care nursing experience.	C -	(6)

2	As a staff member, you are:		
●	a permanent staff member;	A	
●	a part-time staff member;	B	
●	an agency (or session) worker;	C	(7)
●	an intensive care student.	D	

SECTION B - KNOWLEDGE BASE

Multiple choice questions.

3	Preload is the:		
●	impedence against which the left ventricle must pump;	A	
●	pressure of volume in the left ventricle at the end of diastole;	B	
●	aortic root pressure;	C	(8)
●	peripheral vascular resistance.	D	

4	Afterload is the:		
●	impedence against which the left ventricle must pump;	A	
●	pressure or volume in the ventricle at the end of diastole;	B	
●	ability of the myocardial fibres to stretch;	C	(9)
●	same as the pulmonary artery wedge pressure.	D	

FOR OFFICIAL USE

5	The major physiological effects of counter-pulsation include the following:	
●	increased coronary artery perfusion, increased preload, decreased afterload, and decreased myocardial oxygen consumption;	A
●	increased coronary artery perfusion, increased preload, increased afterload, and decreased myocardial oxygen consumption;	B
●	increased coronary artery perfusion, decreased preload, decreased afterload, and increased myocardial oxygen consumption;	C
●	increased coronary artery perfusion, decreased preload, decreased afterload, and decreased myocardial oxygen consumption.	D

(10)

6	Coronary artery perfusion occurs predominantly during:	
●	ventricular systole;	A
●	isovolumetric ventricular contraction;	B
●	reduced ventricular ejection;	C
●	ventricular diastole.	D

(11)

7	During isovolumetric contraction:	
●	the mitral valve is open;	A
●	coronary artery perfusion occurs;	B
●	90% of myocardial oxygen consumption occurs;	C
●	the aortic valve is open.	D

(12)

8	Contra-indications to balloon pumping include:	
●	aortic valve insufficiency;	A
●	mitral valve incompetence;	B
●	dissecting aortic aneurysm;	C
●	dissecting thoracic aneurysm;	D
●	pre-infarction angina;	E
●	coronary artery disease.	F

(13)

FOR OFFICIAL USE

Questions 9 and 10 are to be completed by writing the correct answer in the space provided:

9	**List** four medical or surgical indications for using the balloonpump:	
●		
●		
●		
●		

(14-17)

10	**List** two possible complications of intra-aortic balloon insertion or pumping:	
●		
●		

(18-19)

11	Insertion of the intra-aortic balloonpump should be halted immediately if the patient complains of:	
●	numbness in the affected leg;	A
●	back pain;	B
●	pressure at the insertion site;	C
●	chest pain.	D

(20)

12	The intra-aortic balloonpump .... at the onset of diastole:	
●	inflates;	A
●	deflates.	B

(21)

13	The intra-aortic balloonpump .... at the onset of systole:	
●	inflates;	A
●	deflates.	B

(22)

FOR OFFICIAL USE

14	The most commonly used tracing for triggering the balloonpump to inflate and deflate is the ....tracing:	
●	cvp wave;	A
●	ecg or r wave.	B

(23)

15	The only tracing representing the mechanical events in the heart used to accurately time balloon inflation and deflation is the .... waveform:	
●	arterial waveform;	A
●	pulmonary artery waveform.	B

(24)

16	When timing the intra-aortic balloonpump, the assist interval to use is:	
●	1:1;	A
●	1:2;	B
●	1:3;	C
●	1:4.	D

(25)

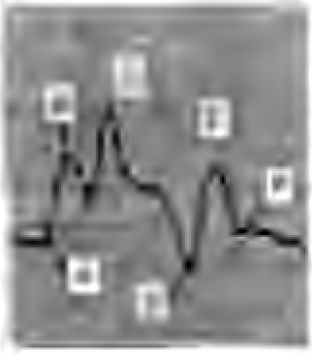
17	The dicrotic notch on the arterial waveform reflects:	
●	systolic ejection;	A
●	isovolumetric contraction;	B
●	aortic valve opening;	C
●	aortic valve closure.	D

(26)

18	Some of the desirable effects that can be expected from proper timing are:	
●	decrease in afterload;	A
●	decrease in PCWP;	B
●	increase in preload;	C
●	increase in LV size;	D
●	increase in CO;	E
●	increase in heart rate;	F

(27-29)

FOR OFFICIAL USE

19	**Place the letter** from the diagram below next to their correct descriptions at the right:		
		• peak systole (patient);	
		• patient aortic end diastole;	
		• balloon aortic end diastole;	
		• dicrotic notch;	
		• peak diastole;	
		• assisted systole.	
	Arterial pressure tracing		

(30–35)

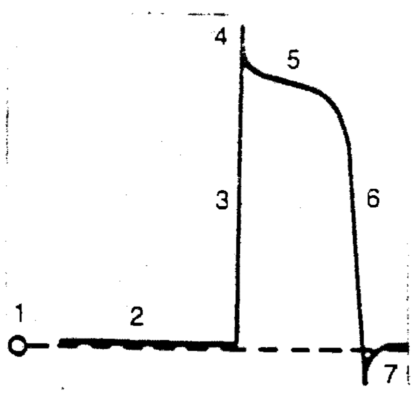
20	Late inflation of the balloon can result in:	
•	premature augmentation;	A
•	increased augmentation;	B
•	decreased augmentation;	C
•	increased coronary perfusion.	D

(36)

21	Late deflation of the balloon can result in:	
•	increased myocardial oxygen consumption;	A
•	premature closure of the aortic valve;	B
•	decreased afterload;	C
•	increased afterload.	D

(37)

FOR OFFICIAL USE

22	**Place the letter** from the diagram below next to their correct descriptions at the right:	
	● peak deflation (patient);	☐
	● zero baseline on the screen;	☐
	● peak inflation artifact;	☐
	● rapid deflation;	☐
	● rapid inflation;	☐
	● balloon plateau pressure;	☐
	● balloon pressure baseline.	☐
Balloon pressure waveform		

(38–44)

23	A rounded balloon pressure waveform can indicate:	
●	helium leak;	A
●	high pressure in the balloon;	B
●	balloon occluding the aorta;	C
●	hypovolemia.	D

(45–46)

24	One of the following is most likely to cause a high pressure alarm:	
●	hypertension;	A
●	increased ectopy;	B
●	kinked balloon catheter;	C
●	hypotension.	D

(47)

25	The width of the balloon pressure waveform should correspond to:	
●	heart rate;	A
●	length of diastole;	B
●	length of systole;	C
●	arterial pressure.	D

(48–49)

FOR OFFICIAL USE

26	The major difference between peak and pattern trigger modes is that the pattern mode of recognition:	
●	measures the width of the QRS complex;	A
●	does not screen muscle artifact as well as peak;	B
●	recognises only positively deflected QRS complexes;	C
●	is not as discriminating as peak.	D

(50)

TRUE OR FALSE QUESTIONS:

27	The dicrotic notch is the landmark used to set balloon deflation:	
●	true;	A
●	false.	B

(51)

28	Deflation is timed to occur during the period of isovolumetric contraction:	
●	true;	A
●	false.	B

(52)

29	The balloon should be large enough to occlude the aorta, when fully inflated:	
●	true;	A
●	false.	B

(53)

30	The most commonly used trigger mode is the arterial pressure mode:	
●	true;	A
●	false.	B

(54)

31	Pacing spikes are automatically rejected in peak and pattern modes:	
●	true;	A
●	false.	B

(55)

FOR OFFICIAL USE

32	If the ECG used for triggering the IABP is lost, the pump will continue to work:	
●	true;	A
●	false.	B

(56)

33	After percutaneous balloon removal, firm pressure is applied to the femoral artery immediately above the puncture area:	
●	true;	A
●	false.	B

(57)

34	The patient on the IABP is allowed to have the head of the bed up no more than 90°:	
●	true;	A
●	false.	B

(58)

35	Blood in the clear plastic tubing of the balloon catheter indicates a hole in the balloon itself:	
●	true;	A
●	false.	B

(59)

36	When the console alarms for “high pressure”, the balloon continues to inflate and deflate:	
●	true;	A
●	false.	B

(60)

37	You may change the volume of helium going into the balloon while in the standby mode:	
●	true;	A
●	false.	B

(61)

38	The patient on the IABP is allowed to flex the leg of insertion:	
●	true;	A
●	false.	B

(62)

FOR
OFFICIAL USE

39	When the balloon catheter is to be removed, you:	
●	call for the doctor to remove the catheter;	A
●	remove catheter immediately to prevent infection at the insertion site;	B
●	disconnect the balloon from the console, and withdraw the balloon back through the sheath;	C
●	disconnect the balloon from the console, and remove the balloon and sheath simultaneously.	D

(63-64)

THANK YOU FOR YOUR PARTICIPATION.

Phillip Oosthuizen.

ANNEXURE II

P.J. Oosthuizen
Student number 426 9365
c/o Department of Advanced
Nursing Science
UNISA
Tel: 082 850 8745

Attention: Mrs. F Oates

The Management
Cardiothoracic ICU
Olivedale Clinic
RANDBURG

Dear Nursing Services Manager / CT-ICU Manager / Critical Care Nurses

REQUEST PERMISSION FOR RESEARCH STUDY IN THE CARDIOTHORACIC ICU

I am a Master's degree student in cardiothoracic intensive care nursing at the University of South Africa. It is required of me to conduct a research study as partial requirement for obtaining a MA (CUR) degree. It is for this reason that I request your permission to undertake a research study in the cardiothoracic ICU.

The title of the research is: *THE KNOWLEDGE OF CRITICAL CARE NURSES REGARDING INTRA-AORTIC BALLOONPUMP COUNTER-PULSATION THERAPY.*

The aim of this research study is to explore and describe the knowledge of the critical care nurse regarding the maintenance of intra-aortic balloonpump therapy, and to describe guidelines to advocate safe management of intra-aortic balloonpumps.

Participants are voluntary critical care nurses working in the cardiothoracic ICU, of all qualifications, regardless of staff appointment. A structured questionnaire is used for data gathering.

Ethical standards will be adhered to at all times. Anonymity and confidentiality will be ensured. Informed consent forms are signed by all respondents.

The approximate duration for completion of the questionnaire is 20 minutes. The date and times for completion of the questionnaire will be scheduled with management.

A copy of the printed research dissertation will be made available to Olivedale Clinic.

Thanking you

Phillip Oosthuizen

P.J. Oosthuizen
P.O. Box 7324
WELTEVREDEN PARK
1715

July 1999

The Management
Olivedale Clinic
RANDBURG

REQUEST PERMISSION FOR RESEARCH STUDY IN THE CARDIOTHORACIC ICU

I hereby request your permission to conduct a research study in the cardiothoracic intensive care unit.

Attached please find information in this regard.

Thanking you in advance

Phillip Oosthuizen
MA (CUR) Student

ANNEXURE III

OLIVEDALE
KLINIEK CLINIC

Olivedale Kliniek/Clinic
Mpy Reg Nr/Co Reg No: 72/09256/07
Private Bag X10029,
Randburg 2125
Tel: (011) 462-5588
Fax: (011) 462-5611

1999-07-22

PJ OOSTHUIZEN
PO BOX 7324
WELTEVREDEN PARK
1715

RE: REQUEST PERMISSION FOR RESEARCH STUDY IN THE CARDIO THORACIC ICU

Thank you for your letter dated July 1999 requesting permission to do research in the CTICU regarding intra-aortic balloon pump and nursing knowledge.

Permission is hereby granted and we wish you well.

MRS FA OATES
NURSING SERVICE MANAGER