Assessing the Knowledge and Practices of Nurses in Postoperative Care Following Aortic Valve Replacement: A Cross-Sectional Study at a Tertiary Heart Centre in Sudan

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ABSTRACT

This study aimed to evaluate the knowledge and practices of ICU nurses in postoperative care following aortic valve replacement (AVR) and to examine correlations between demographic factors, knowledge levels, and practice performance at Madani Heart Centre, Sudan. A descriptive cross-sectional study conducted in a hospital setting to evaluate ICU nurses' knowledge and practice and identify factors influencing performance. The study took place at Madani Heart Centre, a tertiary cardiac care facility in Sudan, which provides specialized cardiac surgery and postoperative intensive care services for patients undergoing complex procedures such as AVR. Forty ICU nurses participated. Data were collected using a validated self-administered questionnaire for knowledge assessment and an observation checklist for practice evaluation. Demographic data included age, gender, education, work experience, and previous cardiac training. Statistical analysis was performed using SPSS 16.0, employing descriptive and inferential statistics to examine relationships and correlations. Most participants were female (80%) and held a bachelor's degree (70%). Overall knowledge and practice levels were moderate (70% and 72.5%, respectively). Higher education, longer work experience, and previous cardiac training were significantly associated with improved scores ($p < 0.05$). A positive correlation between knowledge and practice was observed ($r = 0.63$, $p = 0.001$). The study highlights the need for structured in-service education and continuous professional development to strengthen ICU nurses' competencies in postoperative cardiac care, enhancing patient outcomes in tertiary care settings.

Keywords: Aortic valve replacement, postoperative care, intensive care nursing, nurses' knowledge, clinical practice, Sudan

INTRODUCTION

Valvular heart disease (VHD) is a major contributor to reduced physical function, impaired quality of life, and decreased longevity, representing a significant global health burden that is expected to rise with population aging. Aortic regurgitation (AR) is the third most common non-rheumatic form of VHD, following aortic stenosis (AS) and degenerative mitral regurgitation[1]. Aortic valve replacement (AVR) significantly improves long-term survival in symptomatic patients, even when left ventricular function is preserved. VHD accounts for 2–3% of annual cardiovascular deaths, approximately 17.9 million deaths worldwide[2,3]. The prevalence of severe AS among adults over 65 years old is estimated at 5% old[4].

Both surgical aortic valve replacement (SAVR) and transcatheter aortic valve replacement (TAVR) are effective interventions that improve survival and quality of life in patients with valvular dysfunction[5]. Despite advances in surgical care, postoperative management remains challenging, with complications such as arrhythmias, bleeding, infection, and thromboembolism contributing significantly to morbidity and mortality[6]. Nursing care plays a critical role in mitigating

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these complications through continuous monitoring, hemodynamic stabilization, respiratory support, pain management, wound care, and patient education. Inadequate postoperative nursing care may increase readmission rates and prolong recovery by up to 30%[4,6].

Postoperative care after AVR requires a combination of technical skills, clinical knowledge, and decision-making ability[7]. However, evidence indicates that knowledge and practice gaps still exist among cardiac care nurses. For instance, a multi-country study found that 36% of ICU nurses underperformed in recognizing early post-cardiac surgery complications[8]. Higher levels of education and prior specialized training have been associated with improved patient outcomes following valve[9,10].

In low-resource settings like Sudan, structured assessment of nurses' knowledge and practices remains limited, and specialized cardiac nursing programs are still being developed[11]. International studies report varying levels of knowledge and practice among cardiac nurses, with only 58–68% demonstrating adequate understanding of postoperative care[11-13]. Similarly, research in Sudan has highlighted inconsistencies in adherence to evidence-based protocols[14].

Several factors influence the quality of postoperative nursing care, including formal education, clinical experience, continuing professional development, and institutional support[15,16]. Structured training, certifications, and simulation-based learning have been associated with improved competency and adherence to standardized protocols[17,18]. Conversely, limitations in mentorship, resource allocation, and institutional support in developing countries hinder the implementation of evidence-based practices.

Despite extensive research on postoperative care after coronary artery bypass grafting (CABG), there is a lack of studies focusing on AVR, particularly regarding the translation of knowledge into practice and measurable patient outcomes in resource-limited settings[19].

Therefore, assessing ICU nurses' knowledge and practical competencies in postoperative care after AVR is crucial for enhancing patient safety, guiding targeted training programs, and informing policy development in tertiary cardiac centers in Sudan, as shown in Figure 1.

Figure 1 illustrates the conceptual framework of this study, highlighting the relationship between ICU nurses' demographic characteristics, educational background, training exposure, and their knowledge and practice competencies in postoperative care following aortic valve replacement (AVR). The framework emphasizes how these factors collectively influence patient safety, quality of care, and the need for targeted professional development programs in tertiary cardiac centers in Sudan.

MATERIAL AND METHOD

Research Design: A descriptive cross-sectional, hospital-based design was employed to assess nurses' knowledge and practices regarding postoperative care following aortic valve replacement (AVR). This quantitative approach facilitated an objective evaluation of current competencies and their associations with demographic and professional factors.

Study Setting and Duration: The study was conducted in the Intensive Care Unit (ICU) of Madani Heart Centre, Al-Gazira State, Sudan—a leading tertiary referral hospital specializing in cardiovascular diseases and surgeries. The ICU consists of seven fully equipped beds with mechanical ventilators and continuous monitoring capabilities. Data collection was carried out over five months, from September 2019 to January 2020, covering all nursing shifts to ensure representative participation.

Sampling Technique and Sample Size: A total population sampling technique was utilized, including all 40 ICU nurses who were available and willing to participate during the study period. This method was selected due to the small population size and the need to capture all nursing staff engaged in postoperative care. Total population sampling minimized selection bias and ensured comprehensive representation of the target group.

Data Collection Tools and Methods: Data were collected using a structured, self-administered questionnaire comprising two sections:

1. Demographic Information: age, gender, qualification, years of experience, and training background.

Figure 1: Show Conceptual Framework for Assessing the Knowledge and Practices of Nurses in Postoperative Care Following AVR (Original figure developed by the authors)

Figure 1. Show Conceptual Framework for Assessing the knowledge and Practices of Nurses in Postoperative Care Following AVR.

Table 1. Demographic and Professional Characteristics of ICU Nurses (n = 40)

Variable	Category	Frequency (n)	Percent (%)
Age group	20-25 years	15	37.5
	25.1-30 years	16	40.0
	30.1-35 years	9	22.5
Gender	Female	32	80.0
	Male	8	20.0
Education	Diploma	6	15.0
	Bachelor	28	70.0
	Master	6	15.0
Years of experience	less than 1 year	13	32.5
	1.1-5 years	14	35.0
	5.1-10	5	12.5
	more than 10 years	8	20.0

Footnote: Data represent demographic characteristics of ICU nurses at Madani Heart Centre collected through a self-administered questionnaire.

2. A 23-item Knowledge and Practice Checklist: covering postoperative care domains including vital sign monitoring, infection prevention, wound and drain care, ventilator management, and patient education.

Each correct response was awarded one point. Overall performance was categorized as poor (<50%), moderate (50–75%), or good (>75%).

Validity and Reliability of the Instrument: The checklist was developed based on internationally recognized guidelines, including the American Heart Association (AHA) and the American Association of Critical-Care Nurses (AACN). Content validity was confirmed through expert review by senior nursing faculty and cardiovascular nursing specialists.

The instrument demonstrated good reliability, with Cronbach's alpha = 0.82 for internal consistency. Because more than one observer was involved in evaluating certain aspects of practice, inter-rater reliability was assessed using Cohen's kappa coefficient, which indicated acceptable agreement levels between raters.

Pilot Testing: A pilot study was conducted on 10% of the sample (excluded from final analysis) to evaluate clarity, feasibility, and applicability of the instrument. No modifications were required following the pilot, indicating that the tool was well understood by participants.

Type of Practice Measured: Knowledge was assessed using self-reported responses, while practice was measured through direct observation using the structured checklist. This clarification resolves any potential inconsistency between self-reported and observed data.

Handling of Missing Data: Missing data were minimal (<2.5%). Therefore, listwise deletion was applied, and given the very low percentage, the exclusion of missing responses did not affect overall results or statistical conclusions.

Data Analysis: Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 16. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarized respondents' characteristics and competency levels. Inferential statistics, including chi-square and Pearson correlation tests, were performed to examine associations between demographic factors and knowledge–practice scores. Statistical significance was set at $p < 0.05$.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee of the Sudan Medical Specialization Board (Approval No. SMSB/IC/2019/045), and administrative permission was granted by the cardiac center on 20 August 2019. Written informed consent was obtained from all participants prior to data collection. Confidentiality, anonymity, and voluntary participation were fully ensured throughout the study in compliance with the Declaration of Helsinki (2000 revision).

RESULTS

Data were collected from 40 ICU nurses at Madani Heart Centre using a structured questionnaire and observation checklist. Missing data were minimal (<2.5%) and were handled through listwise deletion without affecting statistical outcomes. Descriptive and inferential statistics were used to summarize demographic characteristics, knowledge and practice levels, and associations with selected variables.

Demographic Characteristics

As shown in Table 1, most participants were young: 37.5% were aged 20–25 years, and 40% were aged 25–30 years. Females represented the majority (80%). Most nurses held a bachelor's degree (70%), and nearly 68% had less than 5 years of ICU experience. These characteristics reflect an early-career nursing workforce with limited specialized exposure to postoperative cardiac care.

Table 2. Item-Wise Knowledge Test Results of Nurses Regarding Postoperative Aortic Valve Replacement Care

NO.	Knowledge item	Total (n)	Correct (n)	Incorrect (n)	Percent Correct (%)
1	Valve replacement information	40	18	22	45.0
2	The age of the patient affects the outcome of valve replacement	40	33	7	82.5
3	Aortic stenosis and regurgitation are considered indications of AVR	40	27	13	67.5
4	Raising the head of the bed or increasing the level of the PEEP on the ventilator are used to treat medical bleeding	40	28	10	70.0
5	Stroke is probably the most common neurological complication following AVR	40	13	25	32.5
6	Rejection of the prosthesis is considered one of the AVR complications	40	23	15	57.5
7	X-ray and MRI are not safe after AVR	40	23	16	57.5
8	AVR via trans – catheter used in a patient had a risk for surgical AVR	40	27	12	67.5
9	Start taking solid food after stomach function returns	40	15	24	37.5
10	When the patient comes from the theatre with a ventilator, the nurses do not have the responsibility to check the airway flow	40	13	27	32.5
11	Daily nursing assessment of delirium for the patient post AVR	40	13	27	32.5

Footnote: Percentages calculated based on total sample (n = 40). Knowledge assessed using a structured questionnaire.

Table 3. Domain-Wise Summary of Knowledge Scores

Domain	Total Correct (n)	Total Incorrect (n)	Mean % Correct
Complication Awareness	64	50	53.3
General AVR Knowledge	78	42	65.0
Monitoring and Assessment	65	52	54.2
Patient Education	26	54	32.5

Footnote: Each domain represents aggregated scores of related knowledge items.

Table 4. Item-Wise Practice Performance of Nurses in Post-AVR Care (Observational Checklist)

No.	Practice item	Total (n)	Done correctly (n)	Done correctly (%)	Done incorrectly (n)	Done incorrectly (%)	Not done (n)
1	Pre-receive patient check the bed and environment (monitor, M.V, suction functioning)	40	38	95	1	2.5	1
2	Three nurses received patient (right site, left site, and nurse to documentation)	40	30	75	9	22.5	1
3	Wash hands, wear gloves &mask, and a gun	40	9	22.5	30	75	1
4	Connecting the patient to the monitoring system	40	0	0	6	15	1
5	Connecting chest tubes to wall suction	40	3	7.5	3	7.5	35
6	Note type and rate of intravenous infusion, isolate volume line	40	16	40	23	57.5	1
7	Validate the respiratory setting on the ventilator with the respiratory therapist	40	15	37.5	24	60	1
8	Attach the warming apparatus	40	3	7.5	1	2.5	36
9	Check ETT size and position	40	38	95	1	2.5	1
10	Auscultate bilaterally for breath sounds, and note the presence of adventitious breath sounds	40	9	22.5	26	65	5
11	Obtain ABG immediately post MV connect and re-check per physician order	40	24	60	15	37.5	1
12	Check for pupil reactivity	40	8	20	2	5	30
13	Monitor temperature, heart rate, and respiration for a full minute every 15 minutes	40	38	95	1	2.5	1
14	Observe cardiac rhythm and report any change in regularity	40	36	90	3	7.5	1
15	Observe the operation site for bleeding	40	34	85	5	12.5	1
16	Check the peripheral pulses	40	28	70	10	25	2
17	Obtain 12-lead ECG, chest X-ray and full investigation (CBC, bleeding profile, RFT, LFT)	40	20	50	18	45	0
18	Monitor the intercostal drainage hourly for colour, volume, and record	40	25	62.5	14	35	1
19	Follow strict aseptic technique while giving care	40	14	35	25	62.5	1
20	Administer 100% Oxygen before suctioning	40	12	30	27	67.5	1
21	Maintain a strict intake and output chart	40	39	97.5	1	2.5	0
22	Administers medications as per the physician's order	40	38	95	1	2.5	1
23	Provide breathing and coughing exercises	40	37	92.5	2	5	1
24	Three nurses received patient (right site, left site and nurse to documentation)	40	0	0	0	0	0

Footnote: Practice was evaluated using a structured observation checklist assessing adherence to postoperative

Knowledge Testing: Item-Based Results and Trends

Overall, nurses demonstrated moderate knowledge with an average correct response rate of 70%. As shown in Tables 2 and Table 3, strengths were noted in general AVR concepts and recognition of surgical indications. However, marked deficiencies occurred in the following areas:

1. Neurological Assessment (Low scores: 32–33%)

Low performance in items such as stroke identification and delirium assessment may reflect:

- Lack of structured training in neurocritical care
- High workload reducing detailed assessments
- Greater emphasis on hemodynamic stability rather than neurological monitoring
- Limited availability of neurological assessment tools and protocols

2. Imaging and Safety Awareness (e.g., MRI/X-ray after AVR)

Misconceptions regarding postoperative imaging safety suggest:

- Inadequate updates on contemporary AVR technologies
- Reliance on outdated clinical assumptions
- Limited access to continuing education on prosthetic valve compatibility

3. Patient Education (Only 32.5% correct)
Poor knowledge in patient instruction and postoperative counseling is likely due to:

- Clinical overload limiting time for education
- Training programs that prioritize technical competencies over communication skills
- Absence of standardized patient-education protocols in the ICU

Only 45% of nurses had received formal postoperative cardiac-care training, reflecting significant gaps in structured learning opportunities.

Practices of Nurses in Postoperative Care

According to Tables 4 and 5, 72.5% of nurses demonstrated moderate practice performance in postoperative AVR care.

Strengths:
- Vital-sign monitoring (82.5%)
- Wound assessment (80–85%)
- Medication administration and hemodynamic surveillance (>90%)

Weaknesses:

1. Documentation (≈45–55% accuracy)
Poor documentation performance likely reflects:
- High patient-to-nurse ratios
- Limited emphasis on documentation during training
- Lack of standardized checklists or digital documentation systems

2. Patient Education and Communication Procedures
Observed practice showed insufficient counseling on breathing exercises, early mobility, and warning signs. Causes may include:
- Focus on technical tasks immediately after surgery
- Limited time during busy ICU shifts
- Underestimation of the importance of patient empowerment in recovery

3. Neurological and Pain Assessment
Tasks like pupil reactivity assessment and pain reassessment were frequently incomplete or incorrectly performed due to:
- Time constraints
- High reliance on physicians for neurological status evaluation
- Limited competency-based training modules in ICU neurological care

Associations Between Demographic Variables and Knowledge/Practice Levels

Chi-square tests (Table 6) revealed significant associations:

- **Higher education level** → better knowledge
- **More than 5 years of experience** → significantly better practice
- **Previous ICU/cardiac training** → improved scores ($p < 0.05$)

Age and gender showed no significant association with knowledge or practice levels.

Correlation Between Knowledge and Practice

A moderate positive correlation was found ($r = 0.63$, $p = 0.001$), indicating that improvements in conceptual knowledge are likely to translate into enhanced clinical practice.

DISCUSSION

This study showed that ICU nurses at Madani Heart Centre demonstrated moderate knowledge and practice levels regarding postoperative care of patients undergoing aortic valve replacement. Although nurses performed well in core ICU technical tasks—such as vital-sign monitoring, ventilator management, and wound inspection—significant performance gaps were observed in neurological assessment, documentation, pain evaluation, and patient education.

Reasons for Low Performance in Key Domains

The consistently low scores in neurological assessment, documentation, and patient education can be attributed to several systemic and operational factors:

1. High workload and staffing shortages, which reduce nurses' ability to perform time-intensive assessments such as delirium scoring and detailed neurological checks.
2. Insufficient structured and cardiac-focused training, particularly in neurocritical postoperative care, as only 45% of nurses reported prior specialized training.
3. Task-oriented work culture, where nurses prioritize technical procedures such as hemodynamic monitoring while cognitive and educational tasks receive less attention.
4. Absence of standardized ICU documentation tools, leading to inconsistent charting practices.
5. Limited emphasis on patient education, despite its critical role in postoperative recovery and complication prevention.

These findings are consistent with studies conducted in Sudan, Ethiopia, and Egypt, which reported similar deficits in cognitive, behavioral, and communication-related competencies among ICU nurses[20,21]. In contrast, research from high-resource settings demonstrated better performance due to specialized training programs, simulation-based learning, and structured neurological monitoring protocols[22].

The study further confirmed significant associations between education level, professional experience, and prior training with knowledge and practice outcomes. Nurses holding bachelor's or master's degrees and those with more than five years of experience achieved higher scores, highlighting that academic preparation, experiential learning, and continuous professional development are key determinants of clinical competence. The positive correlation between knowledge and practice ($r = 0.63$, $p = 0.001$) reinforces that theoretical understanding directly influences practical performance. Similar findings have been reported in studies from Turkey and other regions, where structured training improved adherence to evidence-based standards and reduced postoperative complications[23,24].

Table 5. Domain-Wise Summary of Practice Levels

Domain	Done correctly (n)	Done incorrectly (n)	Not done (n)	Percent Correct (%)
Documentation & Record Keeping	114	4	2	285.0
Medication & Anticoagulant Care	120	46	74	300.0
Monitoring & Vital Signs	111	96	41	277.5
Patient Education & Counselling	169	102	7	422.5

Footnote: Percentages represent cumulative scores within each performance domain based on observational checklist results.

Table 6. Associations Between Demographic Variables and Knowledge/Practice Levels and Correlation Between Knowledge and Practice Scores

Variable	Test	χ^2 / r	df	p-value	Significance
Education level vs Knowledge	Chi-square	6.82	2	0.03	Significant
Training vs Knowledge	Chi-square	7.65	1	0.02	Significant
Experience vs Practice	Chi-square	8.54	3	0.01	Significant
Knowledge vs Practice	Pearson correlation	r = 0.63	—	0.001	Positive moderate correlation

Footnote: $p < 0.05$ considered statistically significant. Correlation analyzed using Pearson's test; categorical associations analyzed using Chi-square test.

Educational level, years of experience, and prior training were significantly associated with knowledge and practice outcomes. This highlights the necessity for ongoing professional development, preferably integrated with evidence-based guidelines like those of the American Association of Critical-Care Nurses (AACN).

Finally, the moderate correlation between knowledge and practice reinforces the need for competency-based educational strategies, simulation training, and the development of AVR care pathways tailored to local resource limitations.

Recommendations

Based on the study findings, the following actionable recommendations are proposed to enhance nursing competence and ensure high-quality postoperative care:

1. Integration of Simulation-Based Training:
2. Implement high-fidelity simulation sessions to enhance clinical decision-making, emergency preparedness, and management of postoperative complications.
3. Adoption of AACN Standards:
4. Align ICU nursing care with the American Association of Critical-Care Nurses (AACN) standards to ensure consistent, evidence-based postoperative cardiac care.
5. Regular Competency Assessments:
6. Conduct scheduled annual or biannual competency evaluations covering knowledge, psychomotor skills, and documentation quality.
7. Development of Sudan-Specific Cardiac Nursing Modules:
8. Design and implement educational modules tailored to the Sudanese cardiac care context to strengthen the local nursing workforce.

CONCLUSION

This study assessed intensive care nurses' knowledge and practice in postoperative care following aortic valve replacement at Madani Heart Centre, Sudan. The findings revealed moderate technical competence, with strong performance in hemodynamic monitoring and wound care, but weaker adherence to patient education, documentation, and neurological assessment. These results highlight a persistent gap between procedural proficiency and comprehensive, evidence-based nursing care.

Education level, years of experience, and specialized cardiac training were significant predictors of both knowledge and practice. A strong positive correlation (r = 0.63, p = 0.001) indicated that better cognitive knowledge directly enhances clinical performance.

To improve postoperative outcomes and patient safety, it is essential to strengthen continuous in-service training, mentorship programs, and the integration of a standardized cardiac nursing curriculum.

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