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A Descriptive Study to Assess the Knowledge Regarding Robotic Surgery Among BSc Nursing Students at Allahabad Institute of Medical Sciences, Fatehpur

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Abstract: ***Background**: Robot-assisted surgery (RAS) has transformed minimally invasive surgical care, requiring perioperative nurses to possess specialized technological knowledge. However, undergraduate nursing students often receive limited formal exposure to robotic surgical modalities during their academic training. **Objectives**: To assess the level of knowledge regarding robotic surgery and determine awareness of its advantages and limitations among BSc Nursing 3rd and 4th Semester students. **Materials and Methods**: A quantitative non-experimental descriptive cross-sectional study was conducted among 76 BSc Nursing 3rd and 4th Semester students at Allahabad Institute of Medical Sciences, Fatehpur, selected via a non-probability convenience sampling technique. Data were collected at 10:00 AM using a validated 25-item structured self-administered knowledge questionnaire reviewed by five nursing and public health experts, and analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation). **Results**: Among the 76 participants, the overall mean knowledge score was 15.00 ± 2.72 (out of 25). Specifically, 43.4% (f = 33) demonstrated poor knowledge (score 0–8), 31.6% (f = 24) demonstrated excellent knowledge (score 17–25), and 25.0% (f = 19) exhibited average knowledge (score 9–16) regarding robotic surgery. **Conclusion**: Nearly half of the surveyed undergraduate nursing students lacked adequate knowledge of robotic surgery. Incorporating structured educational modules, simulation demonstrations, and clinical workshops into the undergraduate BSc Nursing curriculum is essential to strengthen perioperative competency.*

Keywords: Robotic surgery, robot-assisted surgery, knowledge, nursing students, perioperative nursing

1. Introduction

Surgery is a core discipline of medical science involving manual and instrumental operative techniques to investigate, diagnose, and treat diseases, injuries, and anatomical deformities. Comprehensive surgical care spans preoperative preparation, intraoperative management, and postoperative rehabilitation to minimize morbidity and restore quality of life. Over recent decades, innovations in anesthesia, sterilization protocols, and minimally invasive technologies—including laparoscopy, endoscopic and laser procedures, image-guided navigation, and three-dimensional (3D) organ modeling—have substantially enhanced surgical precision and patient recovery.

Among these advancements, robot-assisted surgery (RAS) represents an advanced form of minimally invasive surgery in which a surgeon operates robotic arms and high-definition endoscopic instruments from an ergonomic console. Conceptualized in the late 1980s through collaborative research involving the National Aeronautics and Space Administration (NASA) and early prototypes such as PUMA 560 (1985), PROBOT (1989), ROBODOC (1992), and AESOP (1993), robotic surgery gained widespread clinical adoption following U.S. Food and Drug Administration (FDA) approval of the da Vinci Surgical System in 2000. By providing magnified 3D visualization, superior wristed dexterity, elimination of physiological hand tremors, and improved surgeon ergonomics, RAS reduces intraoperative blood loss, postoperative pain, surgical site infections, and length of hospital stay compared with conventional open procedures. Nevertheless, challenges such as high capital and maintenance costs, bulky equipment footprints, lack of direct tactile feedback, and specialized operating room setup persist.

In the perioperative environment, nurses serve as the primary point of patient contact and play an indispensable role in preoperative education, robotic system docking and troubleshooting, intraoperative patient safety, and postoperative complication monitoring. As highlighted by Redondo-Sáenz et al. (2023), working within a robot-assisted surgical modality represents an expanded clinical role that demands specialized knowledge and structured competency training. Because nursing students represent the future perioperative workforce, assessing their foundational knowledge regarding robotic surgery is vital for identifying educational gaps and integrating modern surgical technologies into undergraduate nursing curricula.

2. Objectives of the Study

1) To assess the level of knowledge regarding robotic surgery among BSc Nursing 3rd and 4th Semester students.
2) To determine the awareness of BSc Nursing students regarding the advantages and limitations of robotic surgery.

3. Materials and Methods

1) **Research Approach and Design:** A quantitative non-experimental descriptive cross-sectional research design was adopted to assess the knowledge regarding robotic surgery among undergraduate nursing students at a single point in time without manipulating any variables.
2) **Setting and Population:** The study was conducted at Allahabad Institute of Medical Sciences, Fatehpur, Uttar Pradesh. The accessible population comprised undergraduate students enrolled in the BSc Nursing 3rd and 4th Semesters.
3) **Sample Size and Sampling Technique:** A total of 76 BSc Nursing 3rd and 4th Semester students (N = 76) were enrolled using a non-probability convenience sampling technique. Students who were present at the time of data collection (10:00 AM), willing to participate, and physically and mentally fit were included, whereas students who were absent or unwilling to provide consent were excluded.
4) **Data Collection Instrument and Validity:** Data were collected using a structured self-administered questionnaire consisting of two sections:
   - *Section A (Socio-Demographic Proforma):* Comprised 5 items capturing age, gender, previous educational qualification, current course of study, and source of previous knowledge regarding robotic surgery.
   - *Section B (Structured Knowledge Questionnaire):* Comprised 25 multiple-choice items assessing knowledge of robotic surgical concepts, historical evolution, clinical applications, advantages, limitations, and perioperative nursing roles. Each correct answer was awarded 1 mark and each incorrect answer 0 marks (maximum score = 25).
   - *Content Validity:* Content validity was established by a panel of five nursing and public health experts: Prof. Mrs. Renuka Bahadur (Jhpiego NGO, Fatehpur), Mr. Virendra Moond (Associate Professor, Sai College of Nursing, Deoria), Mr. Naresh Chandra Meena (Allahabad Institute of Medical Sciences, Fatehpur), Mr. Amjad Ali Khan (Jaipur Nursing College, Sikar, Rajasthan), and Mr. Pradeep Tyagi (Associate Professor, Allahabad Institute of Medical Sciences, Fatehpur). All expert recommendations were incorporated into the final tool.
5) **Ethical Considerations and Statistical Analysis:** Formal administrative permission was obtained from the authorities of Allahabad Institute of Medical Sciences, Fatehpur, and written informed consent was secured from all participants with assurance of anonymity and confidentiality. Data were collected at 10:00 AM and analyzed using descriptive statistics (frequency, percentage, mean, and standard deviation).

4. Results

Section I: Socio-Demographic Characteristics of Participants (N = 76)

Table 1 illustrates the baseline socio-demographic characteristics of the 76 BSc Nursing 3rd and 4th Semester students enrolled in the study. With respect to age, the majority of the participants (63.2%, f = 48) belonged to the 21–23 years age group, followed by 19.7% (f = 15) aged 18–20 years, 15.8% (f = 12) aged 23–24 years, and 1.3% (f = 1) aged above 24 years. Regarding gender distribution, 76.3% (f = 58) of the students were female, while 23.7% (f = 18) were male (comprising 11 male students from the 3rd Semester and 7 male students from the 4th Semester). In terms of previous educational qualification, the vast majority (92.1%, f = 70) held an undergraduate-level qualification, whereas 6.6% (f = 5) had completed intermediate (10+2) education and 1.3% (f = 1) held a diploma. All participants (100.0%, f = 76) were enrolled in the BSc Nursing programme. Furthermore, books (48.7%, f = 37) and media/internet (43.4%, f = 33) served as the primary sources of previous knowledge regarding robotic surgery, followed by other sources (5.3%, f = 4) and seminars/conferences (2.6%, f = 2).

Table 1: Frequency and Percentage Distribution of Socio-Demographic Variables (N = 76)

Demographic Variable	Category	Frequency (f)	Percentage (%)
Age (in years)	18–20 years	15	19.7%
	21–23 years	48	63.2%
	23–24 years	12	15.8%
	Above 24 years	1	1.3%
Gender	Female	58	76.3%
	Male (11 in 3rd Sem; 7 in 4th Sem)	18	23.7%
Previous Level of Education	Intermediate (10+2)	5	6.6%
	Diploma	1	1.3%
	Undergraduate	70	92.1%
Current Course of Study	BSc Nursing (3rd & 4th Semester)	76	100.0%
Source of Previous Knowledge	Books	37	48.7%
	Media / Internet	33	43.4%
	Seminar / Conference	2	2.6%
	Others	4	5.3%

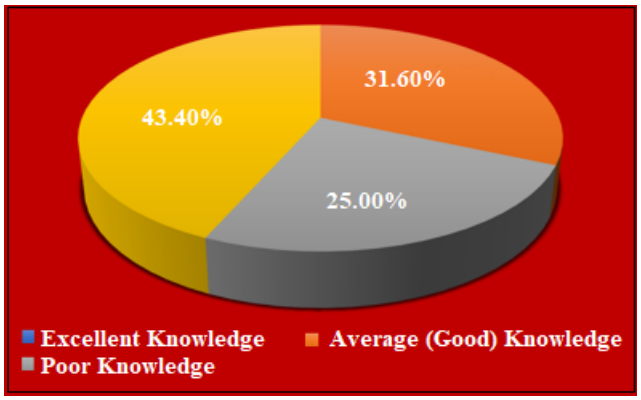
Section II: Level of Knowledge Regarding Robotic Surgery (N = 76)

Table 2A outlines the scoring criteria (maximum score = 25) used to classify participants' knowledge levels, and Table 2B presents the overall knowledge distribution among the 76 BSc Nursing students. The overall Mean ± Standard Deviation (SD) knowledge score was 15.00 ± 2.72. The findings revealed that the largest proportion of students (43.4%, f = 33) had poor knowledge (score 0–8), followed by 31.6% (f = 24) who demonstrated excellent knowledge (score 17–25), and 25.0% (f = 19) who exhibited average knowledge (score 9–16) regarding robot-assisted surgery. Overall, while 56.6% (f = 43) of the participants possessed average-to-excellent foundational awareness, more than two-fifths (43.4%) lacked

adequate knowledge of robotic surgical systems, clinical benefits, and perioperative nursing responsibilities.

Table 2A: Scoring Criteria for Assessing Level of Knowledge (Maximum Score = 25)

Level of Knowledge	Score Range (Out of 25)	Percentage Criteria
Poor Knowledge	0 – 8	≤ 32.0%
Average (Good) Knowledge	9 – 16	36.0% – 64.0%
Excellent Knowledge	17 – 25	≥ 68.0%



5. Discussion

The present descriptive cross-sectional study assessed the level of knowledge regarding robotic surgery among 76 BSc Nursing 3rd and 4th Semester students at Allahabad Institute of Medical Sciences, Fatehpur. In this study, the mean knowledge score was 15.00 ± 2.72 (out of 25). While 31.6% (f = 24) demonstrated excellent knowledge and 25.0% (f = 19) possessed average knowledge- meaning 56.6% had average-to-excellent foundational awareness—a substantial proportion (43.4%, f = 33) still exhibited poor knowledge regarding robotic surgical principles, clinical advantages, limitations, and perioperative nursing roles. Furthermore, only 2.6% of students had learned about robotic surgery through formal seminars or conferences, relying predominantly on books (48.7%) and media/internet (43.4%).

These findings align closely with national and international literature. Uslu et al. (2023) investigated robotic surgery knowledge among 478 undergraduate nursing students and reported that although 79.3% had heard of robotic surgery- primarily via the internet (77.8%)- 73.0% possessed only partially sufficient knowledge, underscoring the absence of structured academic instruction. Similarly, Turan et al. (2025) found that while 62.4% of university nursing students reported general familiarity with robotic surgery, 56.7% were unaware of its specific clinical benefits and limitations compared with traditional open surgery. Likewise, Alarishi et al. (2024) observed that 51.0% of respondents acquired awareness of robot-assisted surgery mainly through digital and social media, while Boys et al. (2016) and Brar et al. (2023) noted persistent misconceptions regarding how surgeons control robotic systems despite broad public awareness. Additionally, Chand et al. (2024) concluded in their systematic review and meta-analysis that only 24.0% of Indian healthcare students demonstrated comprehensive readiness toward robot-assisted surgery. Together, these comparisons confirm that structured curricular integration is urgently needed to bridge the knowledge gap among undergraduate nursing students as global surgical adoption continues to rise.

6. Conclusion, Nursing Implications, and Limitations

6.1 Conclusion

Although 56.6% of BSc Nursing 3rd and 4th Semester students at Allahabad Institute of Medical Sciences, Fatehpur demonstrated average-to-excellent knowledge (Mean ± SD: 15.00 ± 2.72), 43.4% possessed poor knowledge regarding robotic surgery and its advantages and limitations. Incorporating dedicated educational modules, simulation demonstrations, and clinical workshops on robot-assisted surgery into the undergraduate BSc Nursing curriculum is essential to prepare future nurses for modern technology-driven operating rooms.

6.2 Nursing Implications

- **Nursing Practice:** Perioperative and clinical nurses must possess sound foundational knowledge of robot-assisted surgery to educate patients preoperatively, assist safely with robotic system docking and intraoperative protocols, and monitor postoperative recovery.
- **Nursing Education:** Nurse educators and curriculum planners can utilize these findings to integrate structured topics, simulation demonstrations, and clinical orientations on robotic surgery into the undergraduate BSc Nursing syllabus.
- **Nursing Administration:** Hospital nursing administrators should organize regular in-service education programmes, continuing nursing education (CNE) workshops, and hands-on training on robotic surgical systems to keep nursing staff and trainees updated with emerging surgical advancements.
- **Nursing Research:** This study provides baseline empirical data and a validated 25-item questionnaire that future researchers can use to conduct experimental or multi-center studies evaluating the effectiveness of structured teaching programmes on robotic surgery.

6.3 Limitations and Recommendations

Generalizability of the study findings is limited because data were collected from a single nursing institution (Allahabad Institute of Medical Sciences, Fatehpur) using a non-probability convenience sample of 76 BSc Nursing students. Future studies should replicate this investigation across multiple institutions with larger sample sizes and evaluate the effectiveness of structured teaching programmes on robotic surgery among nursing students and perioperative staff.

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