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REVIEW

Nursing in robotic surgery: adapting skills and new roles

Enfermería en cirugía robótica: adaptación de competencias y nuevos roles

Evelyn Lisbeth Zambrano Moreira[1], Paola Cecibel Angulo Vera[1], Silvia Gabriela Villaprado Vélez[1,2], Landy María Carreño Navia[1,2], Franklin Antonio Vite Solorzano[1], Daniel Fabricio Alarcón Cano[2]

[1]Universidad San Gregorio de Portoviejo, Programa de Especialidad en Gestión de Centros Quirúrgicos e Instrumentación. Portoviejo, Ecuador.
[2]Hospital Oncológico Dr. Julio Villacreses Colmont, SOLCA Núcleo Portoviejo. Portoviejo, Ecuador.

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Corresponding author: Evelyn Lisbeth Zambrano Moreira

ABSTRACT

Introduction: robotic surgery has experienced exponential growth in recent decades, with the Da Vinci surgical system being the most widely used. Therefore, we sought to analyze the functions of the surgical nurse in robotic surgery, as well as the competencies and roles required for its application.
Method: a literature review study analyzed articles obtained from indexed sources such as SCOPUS, PUBMED, SCIELO, CINAHL, and LATINDEX. Using keywords with Boolean operators, these were recorded in Excel for analysis using the CASPe method.
Development: the effective incorporation of nursing programs in robotic surgery has shown a positive impact on various healthcare quality indicators. The specialized literature points to a decrease of nearly 30 % in intraoperative complications when interventions are assisted by nursing teams with specific training in robotic technology.
Conclusion: the coordination of nursing in Da Vinci robotic surgery highlights the importance of transforming traditional roles into highly specialized profiles. These new roles, such as the specialized circulating nurse and the robotic scrub nurse, require not only advanced technical knowledge but also communication and coordination skills within a complex surgical environment.

Keywords: Surgical Center; Robotic Surgery; Nursing.

RESUMEN

Introducción: la cirugía robótica ha experimentado un crecimiento exponencial en las últimas décadas, siendo el sistema quirúrgico Da Vinci el más ampliamente utilizado; por lo que, se buscó analizar las funciones de la enfermera quirúrgica en la cirugía robótica, así como las competencias y roles para su aplicación.
Método: estudio de revisión bibliográfica que analizó artículos obtenidos de fuentes indexadas como SCOPUS, PUBMED, SCIELO, CINAHL y LATINDEX; mediante la aplicación de palabras clave con operadores booleanos, estos se registraron en Excel para su análisis mediante el método CASPe.
Desarrollo: la incorporación efectiva de programas de enfermería en cirugía robótica ha evidenciado un impacto positivo en diversos indicadores de calidad asistencial. La literatura especializada señala una disminución cercana al 30 % en las complicaciones intraoperatorias cuando las intervenciones son asistidas por equipos de enfermería con formación específica en tecnología robótica.
Conclusión: la articulación de la enfermería en la cirugía robótica Da Vinci pone en evidencia la importancia de transformar los roles tradicionales hacia perfiles altamente especializados. Estos nuevos roles, como la enfermera circulante especializada y la instrumentista robótica, requieren no solo conocimientos técnicos

avanzados, sino también habilidades en comunicación y coordinación dentro de un entorno quirúrgico complejo.

Palabras clave: Centro Quirúrgico; Cirugía Robótica; Enfermería.

INTRODUCTION

Robotic surgery has experienced exponential growth in recent decades, with the Da Vinci surgical system being the most widely used worldwide.[1,2] This revolutionary technology has transformed not only surgical practice but also the roles and responsibilities of the multi- and interdisciplinary team in surgical centers, considering that the implementation of robotic systems in surgery presents unique challenges that require significant adaptation of traditional surgical nursing skills.[3]

It should be noted that the Da Vinci system, developed by Intuitive Surgical, has transformed operating rooms, allowing surgeons to perform minimally invasive procedures with improved precision, three-dimensional visualization, and greater dexterity.[4,5] However, this advanced technology requires staff to develop new technical skills, specialized communication competencies, and a deep understanding of how robotic equipment works, with a focus on quality and patient safety.[6]

Therefore, the transition to robotic surgery involves not only technical changes but also transformations in the dynamics of the surgical team.[7] Nurses must take on expanded roles that include managing complex technology, coordinating multidisciplinary teams, and ensuring patient safety in a technologically advanced environment.[8,9] For this reason, we sought to analyze the functions of the surgical nurse in robotic surgery, as well as the competencies and roles required for its application.

METHOD

A qualitative literature review was conducted to examine the existing literature on robotic surgery and nursing functions; it also facilitated the organization and detailing of relevant findings on this topic.

The population consisted of scientific articles, with a sample of 18 studies, which met previously established inclusion and exclusion criteria, as well as the time frame and availability of complete information.

Inclusion criteria

- Quantitative, qualitative, or mixed articles.
- Studies in Spanish, English, or Portuguese.
- Articles examining nursing roles in robotic surgery.
- Studies published between January 2021 and June 2025.

Exclusion criteria

- Grey literature works.
- Studies of repositories such as these.
- Clinical trials.

Search equations were created in indexed data sources such as SCOPUS, PUBMED, SCIELO, CINAHL, and LATINDEX, using a combination of Boolean operators (AND and OR) with keywords in Spanish, English, and Portuguese related to robotic surgery, nursing, competencies, roles, and surgical centers.

It should be noted that the selection of studies was carried out independently by three researchers, supervised by an additional team responsible for validating compliance with the criteria and resolving conflicts. In addition, the information was compiled in a Microsoft Excel matrix, with data such as: a) article details (year, URL, database); b) evolution; c) skills required for application; and d) nursing in robotic surgery. It was analyzed using the CASPe method.

DEVELOPMENT

Evolution of Robotic Surgery

The Da Vinci surgical system represents the culmination of decades of development in robotic technology applied to medicine.[10] Since its approval by the FDA (U.S. Food and Drug Administration) in 2000, the system has been adopted in more than 6 000 hospitals worldwide, transforming specialties such as urology, gynecology, general surgery, and cardiothoracic surgery.[11,12]

It should be noted that Da Vinci technology consists of three main components: the surgeon's console, the patient cart with robotic arms, and the vision system. This configuration allows procedures to be performed with minimal incisions, reducing surgical trauma and speeding up patient recovery. This interface also facilitates

the provision of different types of information to the robotic system, including images from imaging studies and data derived from preoperative simulations for surgical planning, which reduces the incidence of complications and adverse events in the postoperative period.[13,14] However, the complexity of the system requires precise coordination of the nursing team to ensure its optimal functioning.[15]

Nursing competencies in robotic surgery

Nursing staff involved in robotic surgery procedures must possess advanced technical skills that exceed conventional surgical nursing skills. Among these skills, detailed knowledge of the Da Vinci robotic surgical system is essential, as is the ability to perform basic troubleshooting maneuvers and operate robotic surgical instruments with dexterity.[16]

Patient positioning in this type of surgery requires millimeter precision, since once the robot is attached, physical access to the patient is limited. Therefore, nurses must develop specialized skills in positioning techniques according to the type of surgical procedure, ensuring adequate vascular access, prevention of pressure injuries, and optimal exposure of the surgical field.[17]

The dynamics of communication in the robotic operating room also pose unique challenges. The physical separation between the surgeon (located at the console) and the operating table requires nursing staff to master effective forms of verbal and nonverbal communication, including the use of intercom systems and the correct interpretation of visual signals emitted by the robotic system.[18]

Furthermore, the complexity of robotic surgery demands highly efficient coordination of the multidisciplinary team. In this regard, nurses must play a central role as facilitators of communication between the surgeon, the table assistants, and the technical staff, thus ensuring the continuity of the procedure and patient safety.

Furthermore, the circulating nurse in a robotic environment assumes expanded roles, including supervising the system's proper functioning, coordinating the layout and configuration of surgical equipment, and promptly managing technical emergencies specific to this modality. This professional must be trained to identify and resolve minor equipment malfunctions, as well as to coordinate with biomedical engineering staff in more complex situations.[19,20]

For this reason, they must also constantly monitor the system's visual and audible indicators to detect any anomalies promptly. In critical situations, they must be prepared to assist in a rapid conversion to open surgery, preserving patient safety at all times.[21]

It should be noted that the role of the scrub nurse requires specific technical knowledge of robotic devices, their safe handling, maintenance, and replacement during the procedure. They must understand both the capabilities and limitations of each instrument to anticipate the surgeon's demands and ensure a smooth flow during surgery.[22]

In addition, the handling of these devices requires specific techniques to ensure both the integrity of the expensive equipment and the maintenance of a sterile environment. Therefore, this professional must develop fine motor skills and be familiar with the cleaning, disinfection, and sterilization protocols applicable to this type of surgical technology.[23]

Nursing in the context of robotic surgery.

The effective incorporation of nursing programs in robotic surgery has shown a positive impact on various healthcare quality indicators. The specialized literature points to a decrease of nearly 30 % in intraoperative complications when interventions are assisted by nursing teams with specific training in robotic technology, compared to those without such specialization.[24]

These results highlight that the adaptation of nursing staff to robotic surgery cannot be addressed in a fragmented manner, but requires a comprehensive training strategy. This must combine specialized technical training, the strengthening of communication skills in complex surgical environments, and the rigorous application of safety protocols geared toward robotic contexts.[25]

Consequently, the evolution of nursing in this field does not simply involve the acquisition of new technical skills, but a profound transformation of professional practice. Nursing profiles must move towards highly specialized roles, where clinical knowledge, biomedical engineering fundamentals, and skills in the management of advanced surgical systems converge.[26]

It should be noted that, although there are challenges in implementation, such as a long learning curve and high initial training costs, international evidence supports that the long-term benefits in both the quality of care and the professional development of nursing staff fully justify this investment.[27]

In this context, the need to establish standardized certification programs in robotic nursing is evident. The current disparity in training between institutions can affect the quality and safety of procedures, so it is recommended to move toward uniform regulatory frameworks, whether national or international, that guarantee safe and excellent care.[28]

CONCLUSIONS

The role of nursing in Da Vinci robotic surgery highlights the importance of transforming traditional roles into highly specialized profiles. These new roles, such as the specialized circulating nurse and the robotic instrument technician, require not only advanced technical knowledge but also communication and coordination skills within a complex surgical environment. This evolution responds to current technological demands and contributes directly to patient safety, operational efficiency, and the quality of surgical care.

Therefore, the effective implementation of these roles requires a strong institutional commitment to continuing education, investment in educational resources, and the development of specific safety protocols. Evidence shows that these efforts generate tangible benefits in the quality of care and patient satisfaction. In this context, nursing must continue to adapt to technological advances through competency frameworks that ensure safe and effective integration, without losing its central focus on humanized and patient-centered care.

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CONFLICT OF INTEREST

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AUTHOR CONTRIBUTION

Conceptualization: Evelyn Zambrano, Paola Angulo.
Data curation: Silvia Villaprado, Landy Carreño, Daniel Alarcón.
Formal analysis: Evelyn Zambrano, Paola Angulo.
Research: Evelyn Zambrano, Paola Angulo.
Methodology: Evelyn Zambrano, Paola Angulo.
Project management: Evelyn Zambrano, Paola Angulo.
Software: Evelyn Zambrano, Paola Angulo, Daniel Alarcón.
Supervision: Evelyn Zambrano, Paola Angulo.
Validation: Silvia Villaprado, Landy Carreño; Franklin Vite.
Visualization: Evelyn Zambrano, Paola Angulo. Franklin Vite.
Writing – original draft: Evelyn Zambrano, Paola Angulo, Daniel Alarcón.
Writing – revision and editing: Evelyn Zambrano, Paola Angulo.

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