World Cancer Research Journal

WCRJ 2023; 10: e2624
DOI: 10.32113/wcrj_20237_2624

ROBOTIC URO-ONCOLOGICAL SURGERY: NURSING SKILLS AND FUTURE PERSPECTIVES

C. GIAMMARIA[1], A. SPANO[2], E. DI SIMONE[3], N. PANATTONI[2], A.C. PIGNATELLI[1], F. SCERBO[4], F. PETRONE[1]

[1]Nursing, Technical, Rehabilitation, Assistance and Research Direction-IRCCS Istituti Fisioterapici Ospitalieri - IFO, Rome, Italy

[2]Nursing Research Unit IFO – IRCCS Istituti Fisioterapici Ospitalieri – IFO, Rome, Italy

[3]Department of Clinical and Molecular Medicine, Sapienza University of Rome, Rome, Italy

[4]Department of Biomedicine and Prevention, University of Rome Tor Vergata, Rome, Italy

Corresponding Author
Nicolò Panattoni, RN, MSN, PhD student; e-mail: nicolo.panattoni@ifo.it

ABSTRACT – The robotic nurse has an essential role in the robotics surgical team to successful robotic surgery. The operating room nurse takes on essential and specific roles, based on advanced skills. The studies published on this topic show that the nursing role positively impacts surgery outcomes; reduced mortality, reduced recovery time, reduced costs, lower complications, and greater patient satisfaction. This paper aims to describe the principal nursing skills and role in the robotic surgical contest, especially in the uro-oncological one. Moreover, in the last section, offers possible future research ideas on this topic to reach and maintain safe and high-quality care.

KEYWORDS: Robotic surgery, Uro-oncological surgery, Nursing.

INTRODUCTION

Robotic surgery is today applied in different surgical contexts, such as in oncological settings, thanks to its modern operating system and the revolutionary advancements in surgery outcomes [1]. In this paper, our considerations will be relative to a specific robot in use in Europe and Italy, particularly the 3D Da Vinci Surgical System®. The oncology robotic surgical approach is constantly growing thanks to its multiple benefits in the patient's surgery outcomes, including a decrease in recovery time, less perioperative bleeding, and lower postoperative complications [2]. Only in the year 2017, Italy registered 18,000 robotic surgical procedures in the urological setting, becoming the first surgery type chosen in the Italian context [3]. The IRCCS Regina Elena - Istituti Fisioterapici Ospitalieri of Rome (IRCCS IFO), uro-oncological robotic surgery could be considered one of the Italian surgical centres of excellence. Considering the year 2021, overall, 545 uro-oncological surgeries were realized through Da Vinci robotic technology. The improved surgical team's excellent expertise and advanced nursing skills enabled 687 uro-oncological robotic surgeries in the last year 2022. In the robotics surgical team, the operating room (OR) nurse takes on essential and specific roles, based on advanced skills [4-6]. Sure enough, due to the introduction of this new operating system, different and advanced peri-operative nursing skills are needed to ensure better and safer clinical practice [7]. Robotic surgical techniques' continuous improvement and development make OR assistance dynamic and stimulating for the nurses involved. The studies published on this topic show that the nursing role positively impacts surgery outcomes; reduced mortality, reduced recovery time, reduced costs, lower complications, and greater patient satisfaction [8]. Specifically, the skills required of the nurse in robotic surgery are listed below:

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License

- Robotic Surgical Technology: familiarity with the robotic surgical system being used in urological procedures, such as the da Vinci Surgical System, is crucial. Nurses should understand its components, functions, and how to operate and troubleshoot it;
- Surgical Instrumentation and Equipment: proficiency in handling and maintaining the robotic surgical instruments and equipment specific to urology, including robotic arms, endoscopes, trocars, and other specialized instruments used during procedures;
- Sterile Technique: strict adherence to sterile technique is essential to prevent infections and ensure patient safety during surgery. Nurses must be well-versed in sterile preparation, including gowning, gloving, and maintaining a sterile field.
- Surgical Assistance: nurses in robotic urological surgery play a vital role in assisting the surgeon during procedures. This includes providing instruments, manipulating robotic arms, passing sutures, and ensuring visualization with the endoscope.
- Patient Monitoring and Assessment: nurses should possess excellent assessment skills to monitor patients' vital signs, fluid status, and overall well-being during and after surgery. They should recognize potential complications and be prepared to intervene when necessary.
- Anatomical Knowledge: a strong understanding of urological anatomy is essential for nurses in robotic surgery. This knowledge helps them anticipate the surgeon's needs, accurately position robotic arms, and assist in achieving optimal surgical outcomes.
- Communication and Teamwork: effective communication and teamwork are crucial in the operating room. Nurses need to collaborate with the surgeon, anesthesiologist, and other team members to ensure a smooth workflow, anticipate needs, and address any issues promptly.
- Critical Thinking and Problem-Solving: nurses should be able to think critically and make quick decisions in high-pressure situations. They may encounter unexpected challenges during surgery and must be able to troubleshoot problems effectively.
- Documentation and Record-Keeping: accurate and detailed documentation is essential in healthcare. Nurses should be proficient in documenting patient information, surgical procedures, intraoperative events, and any postoperative care provided.
- Continuous Learning: the field of robotic surgery is rapidly evolving. Nurses must stay updated with the latest advancements, attend relevant training programs, and engage in continuous learning to enhance their skills and provide the best care to patients.

Nursing role and skills in uro-oncologic robotic surgery

In international literature, the robotic operating room nurse has been defined as a "robotic nurse" (RN) [9,10] and must possess specific skills. Generally, the circulating RN's own skills such as preparation of the robotic system (connections and accidental prevention of disconnections); patient trolley's sterile dressing in collaboration with the scrub nurse (SN); robotic draping and docking with the surgical team; patient safety positioning; timely system error handling or surgical conversion [11-15]. Instead, the scrub nurse guarantees: sterility throughout the surgical process; checks the integrity of robotic instruments before, during, and after each surgery; finds the surgical procedure instrumentation; timely management of system errors or surgical conversion [11,12]. The literature identifies three nursing roles in the robotic uro-oncological surgery team: circulating robotic nurse, scrub robotic nurse, and chief robotic nurse [10]. They will now be analyzed further. Specific roles and skills will be described in detail below (Figure 1).

Circulating robotic nurse

The circulating RN is responsible for preparing the robotic system with its connections (robot-console-system) [12-15]. The numerous recommendations for the correct and safe use of the robotic system have identified this specific figure [11]: the cables of the system must not hinder the passage of the room staff; these should be positioned carefully to avoid accidental disconnections and should be inspected regularly to reduce electrical accidents. In addition, the nurse will ensure that the system is switched on and that the robotic arms are positioned in a neutral position to allow the instrument nurse to proceed with the sterile dressing [11]. The circulating RN ensures that the necessary robotic tools and additional accessory tools are present [10]. The nurse will take all pautions to ensure the patient's safety while docking and unhooking the robotic system to the patient's bed. During the surgery time, he prevents compression damage to the nerves, circulating RN prevents and acts promptly in emergency anesthetic situa-

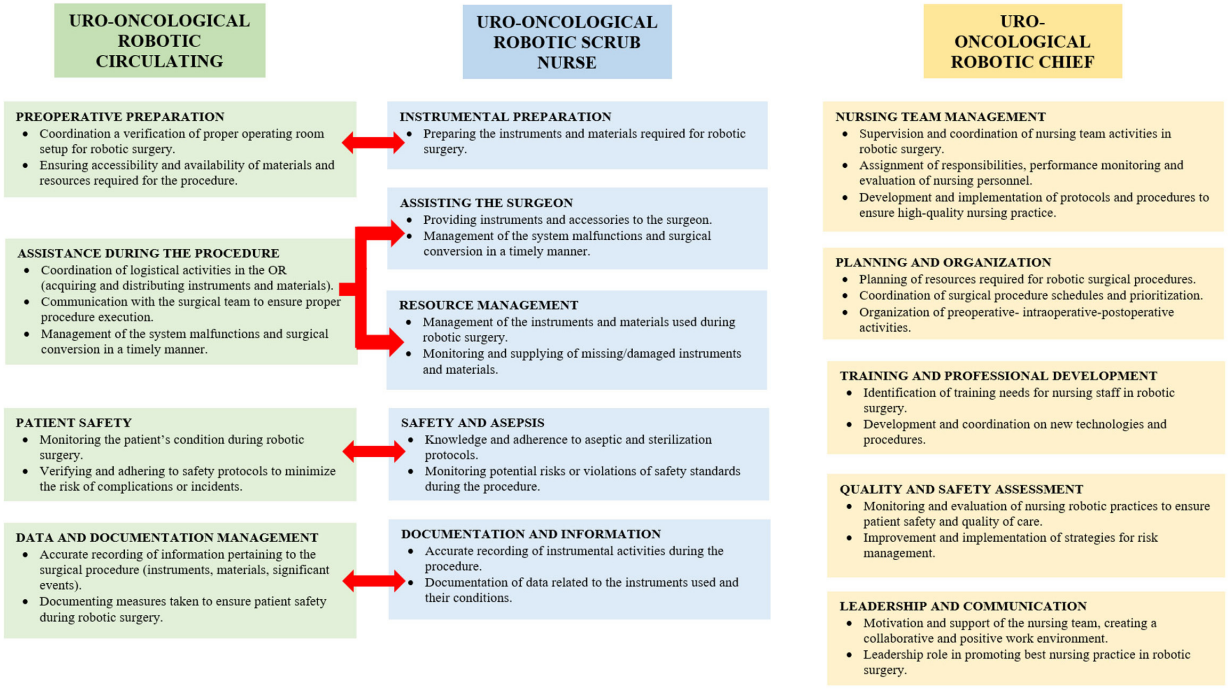

Figure 1. Algorithm for representation of uro-oncological robotic nursing skills.

tions related to the possible location of Trendelemburg, he also interprets timely messages displayed on the robotic monitor [10]. This nursing figure will also be responsible for the tracking and number of uses of the robotic instrument and its reintegration if necessary [10,11]. The literature demonstrates that documentation of practices of perioperative nurses in the operating room is important for the continuity of patient care and patient safety [16]. For this reason, the circulating room nurse and the entire robotic team must ensure that the information relating to the surgical procedure (instruments, materials, significant events) and the measures obtained to ensure patient safety during robotic surgery are documented.

Scrub robotic nurse

The scrub nurse proceeds with the sterile dressing of the robotic arms and ensures the maintenance of asepsis and sterility according to the protocols [10,17], making sure that the necessary instruments are present in the room during the surgical operations; he/she inspects the integrity of the instruments before, during, and after each surgery; he/she can recognize any system errors and manage them together with the robotic team [11]. Several studies show that system malfunctions, if not timely managed, can induce referral or conversion to open or laparoscopic surgery, rarely causing injury to the patient [10,13,18]. Applying a standardized setup of surgical instruments on the mother and servant tables can help reduce the room's preparation time and improve the robotic program's efficiency [19]. The scrub nurse and the circulating RN collaborate for an accurate recording of the instrumental activities during the procedure and the documentation of the data relating to the instruments used [10].

Chief robotic nurse

The chief robotic nurse, interpreted as a nursing coordinator in this specific context, is represented as the most experienced of the nursing team that develops and maintains clinical and professional skills in this area [10]. Identifying the chief RN is essential for the optimal planning of the OR; procuring instruments; training staff and collaboration between the nursing and robotics teams [19]. The chief robotic nurse, jointly with the robotic team nurses, should engages in proactive communication to support the team and discovers what help is needed to improve the quality of performance [20]. Therefore, the chief RN should monitor and evaluate robotic nursing practices to ensure patient safety and quality of care, and to imple-

ment risk management strategies [21]. Working with a reference surgeon allows the chief RN to establish and implement the actions to develop a standardized room layout for each surgical case (positions of the robotic, the console, the mother table, etc…) [19]. An important aspect that chief RNs should pay attention to is the assignment of a "coherent team" to the robotic procedure to be performed [19]. A "coherent team" is a group of nurses who are experienced in the procedure and who are aware of the specific additional protocols. It is recommended that the team be assigned to the surgery the day before the procedure [19]. Other responsibilities are management of the daily program of robotic interventions to coordinate the operating time and instrumental availability; robotic inventory management; supervision; support and advice. Furthermore, the chief RN is guidance of new staff and the training of the team through the creation of educational programs with the aim of keeping the team up to date and enabled for their practice [22].

Tools for OR nurse's assessing the competencies

In the context of the OR, the competence concept has been defined in relation to technical (practical and situational knowledge, knowledge of clinical protocols and standards) and non-technical (holistic and empathic care, coordination, communication, and teamwork) skills [23]. Before the design of the PPCS-R scale by Gillespie et al [23], some researchers developed generic tools to assess perceived competency in nursing practice. The domains identified by these measurements were represented by caring skills and general areas of self-perception; assessment, planning, decision-making, cognition, research and social participation [24,25], job role, helper, teaching-coaching, quality assurance, and situation management [26], knowledge base, management, professionalism, nursing process, problem-solving [27]. The major limitation encountered when using generic tools is the impossibility of grasping the contextual aspects characteristic of certain specialized fields. Specifically, the surgical setting of operating theaters is characterized by a high level of competence and knowledge on the part of the professionals who work there, being also considered a high-risk environment [28].

Before the devising of the Perceived Perioperative Competence Scale-Revised (PPCS-R) by Gillespie et al [23], researchers developed generic tools to assess perceived competence in nursing practice. The major limitation encountered when using generic tools is the impossibility of grasping the contextual aspects characteristic of certain specialized fields. Perioperative competence was assessed by the PPCS-R through 40 items investigating six domains: basic knowledge and skills, leadership, collaboration, competence, empathy, and professional development. The PPCS-R scale, therefore, focuses on the assessment of the skills perceived by operating room nurses, emphasizing how the perception of one's own competence, being an integral part of the professional self-image, directly and indirectly, influences one's role, care performance, job satisfaction, maintenance of one's skills [29]. Currently, the scale has been applied in perioperative nursing settings in Australia [23], China [30], Sweden [31], Turkey [32], and Iran [33]. but not yet in Italy.

The tool used in the following study is the Revised Perioperative Competence Scale (PPCS-R) developed and validated by Gillespie BM, Polit DF, Hamlin L, and Chaboyer W in 2012.

The Perceived Perioperative Competence Scale (PPCS) is a tool used to assess the perceived competence of healthcare professionals in performing perioperative tasks in a specific domain, such as robotic surgery. The scale aims to measure the self-perception of competence and confidence in performing various aspects of the perioperative process. Assessments can be conducted through a variety of methods, including self-assessment questionnaires, peer evaluations, objective structured assessments of technical skills (OSATS), and virtual reality simulators. These assessments may cover various aspects of robotic surgery, including console operation, instrument manipulation, camera control, procedural knowledge, teamwork, and communication skills. The purpose of such assessments is to identify areas of strength and areas for improvement in a surgeon's robotic surgical skills, which can help guide training and professional development. Additionally, these assessments can be used to monitor the progress of surgeons over time and ensure that they meet the necessary competency standards for performing robotic surgical procedures.

The PPCS self-reported scale consists of 40 items characterized by questions relating to the eight areas of competence identified by the authors; technical and procedural knowledge, practical knowledge, aesthetic knowledge, communication, teamwork, coordination, and leadership. Each item is represented by a question (self-assessment) that can be answered using a 5-point Likert scale (1, never / 5, always). Various socio-demographic variables of the sample will also be investigated. Therefore, in this context of the growing use of robotic surgical techniques, investigating peri-operative nursing skills, in the Italian context, is essential to identify critical issues and strengths on which to base interventions aimed at the development of best clinical practice. It's worth noting that the development and validation of specific competence assessment tools, including the PPCS for robotic surgery, would typically involve a rigorous research process to establish reliability and validity.

Although this editorial has described how the RN's role and skills are defined in the literature, it is important to underline how poor and heterogeneous literature on this topic is still. Moreover, there is a compelling need to evaluate the impact of the RN's role on the surgical outcome in the uro-oncological setting surgery [10].

In addition, the assessment of the skills acquired or missing in the nursing team of this specific area may reveal training or management needs. There are currently no validated Italian tools for a correct assessment of nursing skills in the perioperative and robotic context. Instead, advanced nursing skills require an adequate and specific training program. In the context of robotic training, the success of robotic surgery procedures is correlated and dependent on the motivation of surgeons, anesthetists, and nurses [34]. So, to have a successful nursing team, it must be adequately trained and compliant with a well-structured training program [34].

Another future research topic should be the patient's positioning. For the correct positioning of the patient, there are several recommendations [14,35]. The most frequent wrong positioning complications are stretching and compression of tissues, resulting in reduced blood flow and the risk of ischemia with temporary or permanent damage, cutting injuries or prolonged pressure [36]. The positioning guidelines of the Registered Nurses Association of Perioperative [37,38] provide some key points, such as: performing a pre-operative assessment for early identification of the risk of positioning injuries; identifying, selecting, and using equipment and positioning devices for the prevention of pressure injuries; identify/implement safe practices for the correct positioning of patients; take special precautions for obese or pregnant patients; conduct a post-operative evaluation to identify surgical positioning injuries. Unfortunately, there is no consistent literature on the specific management of uro-oncological patients in robotic surgery. It would be interesting to produce more nursing studies of complications' incidence and management related to the positioning of patients in uro-oncological robotic surgery.

CONCLUSIONS

In conclusion, knowing the robotic nurse's new responsibilities will help nurses act with awareness and competence, structuring specific training program; remembering that excellent surgery outcome depends on the nursing and surgical team acting collaboratively.

Financial support:
This research received no financial support.

Ethics approval and consent to participate:
Not applicable.

Consent for publication:
Not applicable.

Availability of data and material:
Not applicable.

Conflict of interests:
The authors declare no conflict of interest.

Funding:
This research received no external funding.

Authors Contributions:
Conceptualization, Chiara Giammaria and Alessandro Spano; methodology, Emanuele Di Simone, and Nicolò Panattoni; writing—original draft preparation, Chiara Giammaria and Nicolò Panattoni; writing—review and editing, Emanuele Di Simone, Adriana Pignatelli and Francesco Scerbo; supervision, Fabrizio Petrone. All authors have read and agreed to the published version of the manuscript.

ORCID ID:
Chiara Giammaria: 0009-0005-4556-6985; Alessandro Spano: 0000-0002-5097-4693; Emanuele Di Simone: 0000-0002-6373-8163; Nicolò Panattoni: 0000-0002-4162-937X.

REFERENCES

1. Madureira FAV, Varela JLS, Madureira D Filho, D'Almeida LAV, Madureira FAV, Duarte AM, Vaz OP, Ramos JR. Model of a training program in robotic surgery and its initial results. Revista Do Colegio Brasileiro De Cirurgioes 2017; 44: 302-307.
2. Müller S, Grønning LE, Nilsen FS, Mygland V, Patel HRH. Robotic and minimal access surgery: technology and surgical outcomes of radical prostatectomy for prostate cancer. Expert Rev Anticancer Ther 2014; 14: 1317-1321.
3. Perrone M. Chirurgia. 100 robot nelle sale operatorie italiane. Primi in Europa insieme alla Francia. Quotidiano Sanità 2018.
4. Pograjec A, Hubert J. Le rôle de l'IBODE en chirurgie robotique urologique. Progrès en Urologie 2019; 29: 899-903.
5. Aslaner A, Çakır T, Eyvaz K, Kazan MK, Çakır RC, Doğan U, Gündüz UR. Comparison of robotic-assisted resection alone and with natural orifice specimen extraction for rectal cancer by using Da Vinci Xi. Eur Rev Med Pharmacol Sci 2022; 26: 6665-6670.
6. Perutelli A, Domenici L, Garibaldi S, Albanesi G, Baroni C, Salvati L, Salvati N, Cecchi E, Bottone P, Salerno MG. Efficacy and safety of robotic-assisted surgery in challenging hysterectomies–a single institutional experience. Eur Rev Med Pharmacol Sci 2022; 26: 1235-1240.
7. Gillespie BM, Harbeck EB, Falk-Brynhildsen K, Nilsson U, Jaensson M. Perceptions of perioperative nursing competence: a cross-country comparison. BMC Nurs 2018; 17: 12.
8. McKenna HP. Nursing skill mix substitutions and quality of care: an exploration of assumptions from the research literature. J Adv Nurs 1995; 21: 452-459.
9. Uslu Y, Altınbaş Y, Özercan T, van Giersbergen MY. The process of nurse adaptation to robotic surgery: A qualitative study. The international journal of medical robotics + computer assisted surgery: MRCAS 2019; 15: e1996.
10. Abdel Raheem A, Song HJ, Chang KD, Choi YD, Rha KH. Robotic nurse duties in the urology operative room: 11 years of experience. As J Urol 2017; 4: 116-123.
11. Tabor W. On the cutting edge of robotic surgery. Nursing 2007; 37: 48-50.
12. Lichosik D, Arnaboldi C, Astolfi D, Caruso R, Granata M. Nurses' role in robotic surgery. eonsmagazine 2014; 1: 22-24.
13. Borden LS, Kozlowski PM, Porter CR, Corman JM. Mechanical failure rate of da Vinci robotic system. Can J Urol 2007; 14: 3499-3501.
14. Sutton S, Link T, Makic MBF. A quality improvement project for safe and effective patient positioning during robot-assisted surgery. AORN J 2013; 97: 448-456.
15. Martins RC, Trevilato DD, Jost MT, Caregnato RCA. Nursing performance in robotic surgeries: integrative review. Rev Bras Enferm 2019; 72: 795-800.
16. Søndergaard SF, Lorentzen V, Sørensen EE, Frederiksen K. The documentation practice of perioperative nurses: a literature review. J Clin Nurs 2017; 26: 1757-1769.
17. Gaines S, Luo JN, Gilbert J, Zaborina O, Alverdy JC. Optimum operating room environment for the prevention of surgical site infections. Surg Infect 2017; 18: 503-507.
18. Lucas SM, Pattison EA, Sundaram CP. Global robotic experience and the type of surgical system impact the types of robotic malfunctions and their clinical consequences: an FDA MAUDE review. BJU Int 2012; 109: 1222-1227.
19. Van Brenk CM. Setting Up a Robotic Surgery Program: A Nurse's Perspective. Sem Colon Rectal Surg 2009; 20: 162-165.
20. Poston RS. The Indispensable Role of the Circulating Nurse in Robotic Cardiac Surgery – Robert S Poston, MD. 2018; .
21. Korb W, Kornfeld M, Birkfellner W, Boesecke R, Figl M, Fuerst M, Kettenbach J, Vogler A, Hassfeld S, Kornreif G. Risk analysis and safety assessment in surgical robotics: A case study on a biopsy robot. Minim Invasive Ther Allied Technol 2005;14: 23-31.
22. Pinto EV, Lunardi LS, Trevisso P, Botene D. Nurse role in robotic surgery: challenges and prospects. Rev SOBECC 2018; 23: 43-51.
23. Gillespie BM, Polit DF, Hamlin L, Chaboyer W. Developing a model of competence in the operating theatre: psychometric validation of the perceived perioperative competence scale-revised. Int J Nurs Stud 2012; 49: 90-101.
24. Clinton M, Murrells T, Robinson S. Assessing competency in nursing: a comparison of nurses prepared through degree and diploma programmes. J Clin Nurs 2005; 14: 82-94.
25. Cowin LS, Hengstberger-Sims C, Eagar SC, Gregory L, Andrew S, Rolley J. Competency measurements: testing convergent validity for two measures. J Adv Nurs 2008; 64: 272-277.
26. Meretoja R, Isoaho H, Leino-Kilpi H. Nurse competence scale: development and psychometric testing. J Adv Nurs 2004; 47: 124-133.
27. Safadi R, Jaradeh M, Bandak A, Froelicher E. Competence assessment of nursing graduates of Jordanian universities. Nurs Health Sci 2010; 12: 147-154.
28. Greenberg CC, Roth EM, Sheridan TB, Gandhi TK, Gustafson ML, Zinner MJ, Dierks MM. Making the operating room of the future safer. Am Surg 2006; 72: 1102-1148.
29. Gillespie BM, Harbeck EB, Falk-Brynhildsen K, Nilsson U, Jaensson M. Perceptions of perioperative nursing competence: a cross-country comparison. BMC Nurs 2018; 17: 12.
30. Yu Q, Wei R, Wei Y, Wu X, Liang T. Psychometric evaluation of the perceived perioperative competence scale-revised among the Chinese operating room nurses: a methodological research. BMC Nurs 2022; 21: 79.
31. Jaensson M, Falk-Brynhildsen K, Gillespie BM, Wallentin FY, Nilsson U. Psychometric Validation of the Perceived Perioperative Competence Scale-Revised in the Swedish Context. J Perianesth Nurs 2018; 33: 499-511.
32. Sönmez B, Ayoğlu T. Validity and reliability of the Perceived Perioperative Competence Scale-Revised. Nurs Health Sci 2019; 21: 428-435.
33. Ajorpaz NM, Tafreshi MZ, Mohtashami J, Zayeri F, Rahemi Z. Psychometric Testing of the Persian Version of the Perceived Perioperative Competence Scale-Revised. J Nurs Meas 2017; 25: 162-172.
34. Sicotte D. Implementation of a Staff Education Project for a Robotics Education Program in the Operating Room. Walden Dissertations and Doctoral Studies 2019.
35. Ministero della Salute,. Governo clinico e sicurezza delle cure. Manuale per la sicurezza in sala operatoria. salute.gov.it 2022.
36. Johnson RL, Warner ME, Staff NP, Warner MA. Neuropathies after surgery: Anatomical considerations of pathologic mechanisms. Clin Anat 2015; 28: 678-682.
37. Burlingame BL. Guideline Implementation: Positioning the Patient. AORN J 2017; 106: 227-237.
38. Aorn. Guideline Summary: Positioning the Patient. AORN J 2017; 106: 238-247.