

CHAPTER 8

Use of Technology in Surgical Nursing

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Introduction

Nursing is an applied health discipline that deals with the health status of the individual, family, and society, which has managed to renew itself with social, cultural, and technological changes from the past to the present. Surgical Nursing, on the other hand, is a branch of nursing in which nursing activities based on scientific knowledge are coordinated, and personalized care is applied by determining the physical, psychological, and social needs of the patient to regain and maintain the patient's health and well-being.

It is known that surgery, which started in the cave period with the existence of human history, has shown static and rapid developments from time to time (Arpag et al., 2022). Today, advances in health sciences have necessitated the development of health professionals, and physicians, nurses, and other health professionals have tried to maintain their development by resorting to various ways to keep up with the development of the age (Eti Aslan, 2009).

In the dictionary of the Turkish Language Association, technology is defined as "application knowledge, application science, which covers the production methods related to an industry branch, the tools, equipment, and instruments used, and the ways of using them" and "all of the tools and equipment developed by human beings to control and change their material environment and the information related to them" (TDK Dictionary). Today, the use of technology has entered all areas of life, and it has become a necessity rather than a privilege for people to benefit from technology (Şentürk Erenel et al., 2011). In recent years, the increase in technological developments in health systems has contributed to improvements in diagnosis, treatment, and care in hospitals (Price, 2013; Bagherian et al., 2017). Some researchers believe that technology can facilitate and improve nursing care. According to these researchers, technology provides benefits such as increasing the safety of care provided to patients, reducing the workload of nurses, spending more time with their patients, alleviating their anxiety, and relieving their concerns (Price, 2013, Tunlind et al., 2015). The World Health Organization (WHO) defines technology used in health services as the use of skills and organized information developed by methods, systems, medicines, vaccines, and devices that improve the quality of life and are developed to solve health problems (WHO, Health technology assessment).

The historical development of surgery is considered in three periods, and the first

period starts with the first injured person and is limited to wound care. The second period started in the mid-19th century and developed rapidly with the discovery of anesthesia, asepsis, and disinfection procedures. The third period is considered a period that has reached from the 1960s to the present day, starting with endoscopic surgical interventions and leaving its place towards robotic surgical interventions using high-level technological facilities (Arpag et al., 2022). Technology has continuously influenced and shaped nursing practices from the past to the present. As a result, technological developments reflected in the surgical field have gained momentum. This situation causes surgical nurses to work with continuously more complex machinery and equipment, and their roles and responsibilities to differentiate and increase. The introduction of technology into the surgical field through robotic surgery, artificial intelligence-based/supported applications, virtual reality applications, information systems, and similar means is largely beyond the control of the nursing discipline. Although this phenomenon does not alleviate nurses' care responsibilities towards the patient and their obligations to fulfill other differentiated duties in the team, surgical nurses are expected to always make the right decisions regarding their areas of responsibility and roles. For this, they need to understand technology and have up-to-date and comprehensive knowledge about technological developments and applications. Nurses must first have a positive perception to understand technology. Many factors such as the nurse's age, level of education, interest, and experience in technology, and whether they are open to innovation shape their current perceptions. In general, it can be said that nurses have a positive attitude toward technology and try to adapt to technological developments (Barnard & Gerber, 1999; Huang & Lee, 2011; Cakir Umar et al., 2016; Konukbay et al., 2020).

In addition to the safety risks of surgery, patient-related changes and complications can develop very rapidly in the perioperative period. Operating rooms and surgical clinics are challenging environments where ensuring patient safety is complex. The nurse's focus on the technological environment and applications can sometimes jeopardize patient safety, and technology, which is one of the risk factors related to patient safety in this challenging environment, can also be a tool to reduce this risk. In this part of our book, methods of using technology in surgical nursing will be examined under different headings.

Technological approaches in surgical nursing

It is possible to benefit from technological applications in coping with the complexity of the perioperative environment and in planning and implementing nursing care. For example, the documentation of patient information to be used in patient identification, treatment, and care planning can be done reliably and quickly with appropriate software. Physicians, nurses, dieticians, and other health professionals can save time by using a common documentation program and can obtain much more information about the patient beyond their efforts. In this way, more time and effort is saved to obtain previously questioned information. Unnecessary contact with the patient with the risk of contamination of surgical incisions is avoided, and patient delivery and evaluation are reliable and fast with the documentation system. Moreover, with artificial intelligence-supported software, patient data can be analyzed together with the information pool compiled from a large number of patients and used in patient/staff decision support systems. Data that the nurse overlooks or has difficulty associating can be analyzed with AI-supported systems, and care recommendations or checklists can be created (Jacques & Minear, 2008).

The presence and intensity of advanced technological applications such as robotic surgery, endoscopic surgery, and simulation put operating room nursing ahead of the technological development trend. In this context, knowing the perception of nurses about whether robotic nurses and artificial intelligence applications can replace nurses can give an idea about the adaptation of surgical nurses to technology. In a study conducted with operating room nurses, the knowledge level about robotic nurses and artificial intelligence was found to be medium level, and it was concluded that training on the use of technology will reduce the level of anxiety in nurses and contribute to the increase in the quality of care (Ergin et al. 2023).

Continuous technological development will continue to be a part of the healthcare system in any case. Artificial intelligence and robotic applications are increasingly involved in the perioperative process. In particular, artificial intelligence technology may lead to a redefinition of the roles of nurses along with other healthcare professionals, unlike previous development processes. Although it seems unlikely for the near future that robots will replace human nurses and provide care with empathic and emotional aspects, it is a crucial issue whether nurses will be able to keep up with technological change with the concern of losing their roles to robots. Perioperative nurses can be passive members of the changing healthcare system or a shaper of the new working order. The nurse can strengthen the bond that technology weakens between the health professional and the patient with her continuous relationship with the patient. To remain an effective component of the system, the nursing discipline should start planning today (Francis & Winfield, 2006; Needleman, 2013; Duff, 2020). Technological developments in the field of health do not push nurses out of the system but only require the definition of different roles and jobs (Kartal & Yazici, 2017). The number of studies investigating the emotions created by the use of technology in nurses is strikingly low. According to a limited number of studies, the use of information technology in the work environment can lead to both positive and negative emotions (Cakir Umar et al., 2016; Konukbay et al., 2020; Golay et al., 2022-a; Golay et al., 2022-b).

Wearable Technology

The wishes of individuals and the developing and changing trends in health services have made it necessary to collect more data on the health status of individuals. Some of these data include the individual's habits, hospitalization and departure times, medication usage hours, previous disease history and diagnostic tests, diagnosed diseases, individual measurement applications, diet, number of steps per day, anxiety level, body weight, blood glucose level, body temperature, blood pressure, pulse/respiratory rate, and oxygen saturation. Wearable technologies include tools that can be a precursor to collecting these desired data. Thanks to wearable technologies, patients/individuals can obtain information about their general health status without going to a health institution (Demirci, 2018; Dursun & Yilmaz, 2021). Wearable devices are electronic special monitoring tools synchronized to a smartphone or computer to provide wireless and long-term data tracking, they have storage areas, and data can be input and output at any time (Demirci, 2018). Wearable technology products are defined as all electronic devices (jewelry such as watches, wristbands, glasses, lenses, e-textiles, smart fabrics, headbands, rings, and hearing aids) that can be glued to the body, placed in clothes or accessories, and carried. These wearable devices can perform many tasks that computers and smart cell phones can do (Demirci, 2018; Dursun & Yilmaz, 2021). In surgery, WT is utilized in many different surgical fields for the diagnosis of diseases, postoperative evaluation, and follow-up of patients. In addition, this technology is also used in comparing different

applications, measuring physical activity, and as a part of surgical training. WT is also utilized in the operating room in line with the needs of surgeons and nurses working in a sterile environment (Dursun & Yilmaz, 2021).

Measurement of physical activity in patients after surgery is an example of the use of wearable technologies in surgical patients. A decrease in physical activity is often observed in cancer patients after surgery. This leads to poor postoperative outcomes and early recurrence of cancer (Dursun & Yilmaz, 2021). In a study conducted on gastric cancer surgery patients, it was reported that wearable devices and cell phone applications were useful in objectively assessing physical activity in postoperative patients (Wu et al., 2019). Wearable technologies are used in surgery not only after surgery but also in the preoperative period (Dursun & Yilmaz, 2021). In the study of Hedrick et al. (2020), the patients were educated about the use of wearable activity monitoring devices, they were told to wear the device for 30 days before the surgery, and the step counts of the patients were recorded with the wearable devices. As a result of the study, the data recorded on the devices were examined, and it was observed that a significant decrease in the rate of postoperative complications was achieved in patients who mobilized more by following the given program.

Telesurgical nursing

In tele-nursing, communication between the patient and the nurse is provided by using telephone, computer, and interactive television (Ay, 2008). Tele-surgical nursing is the provision of preoperative and postoperative surgical preparation and care of surgical patients with telecommunication tools (Akyolcu, 2017). In surgery, telenursing practices can be carried out by telephone and video conferencing before and after surgery and after the patient is discharged to enable patients to cope with physiological, psychological, and sociocultural problems that may develop before and after surgery, to support early recovery and to improve quality of life (Ozkan & Salik Asar, 2022). Studies have shown that remote surgical care applications provide a reduction in health costs (Rowell et al., 2014), reduce perioperative mortality and morbidity rates (Barnason et al., 2009), and telecommunication services used in the preoperative process help to reduce patients' food, transportation, and hotel costs (Leshera & Shah, 2018), however, it has been observed that there are problems in telesurgical nursing practices in our country since patients live in rural areas, care is provided to elderly patients and patients' inability to use technological devices, and not enough studies have been conducted (Ozkan & Salik Asar, 2022).

Virtual Reality

Virtual reality (VR) is the projection of computer-animated three-dimensional images to people as a "real world" with the help of some devices. These devices that enable the experience of virtual reality are a combination of a computer, glasses, headphones, and motion sensors (Dayan & Ince, 2021). Virtual reality technologies are used in healthcare services in many areas, such as surgery, to relieve symptoms by offering the opportunity to create therapeutic environments in the evaluation, diagnosis, and treatment of health problems, in the rehabilitation of patients and exercise applications, and the training of professional groups in medicine and healthcare (Yilmaz, 2021).

If we look at its use in surgical nursing, it is often seen that it is used in applications such as relieving preoperative anxiety, relieving postoperative pain, and relieving pain during wound/burn dressing. Results show that preoperative preparation using virtual reality goggles and postoperative video watching are effective on anxiety

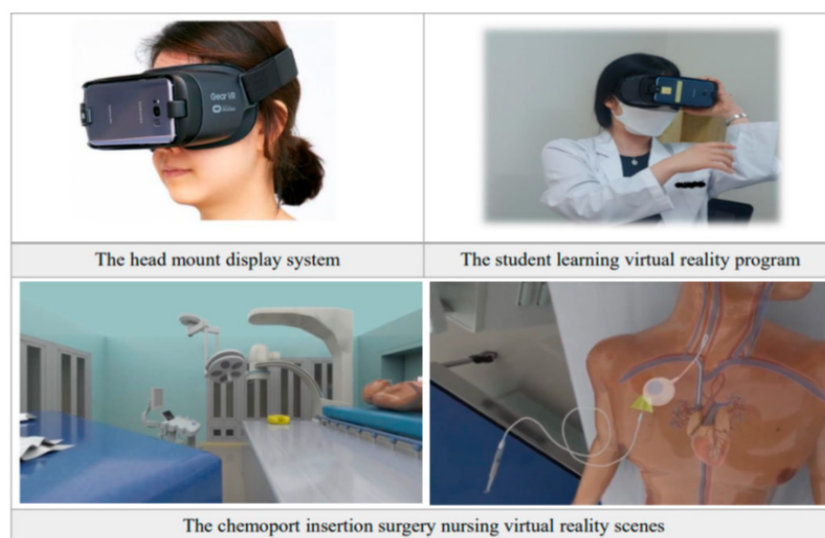
and parental satisfaction and a useful method to reduce postoperative pain in children who will undergo surgery (Turgut, 2021). Similarly, it was determined that virtual reality application before total knee replacement surgery reduced pain, anxiety and had a positive effect on vital signs (Gunes, 2021). It has been reported that the use of VR in relieving the pain observed in patients with dressing changes during burn care (Guo et al., 2014) and anxiety levels decreased with the use of VR goggles, and patients felt more comfortable (Kipping et al., 2012; Scapin et al., 2018). In a systematic review and meta-analysis study examining the effects of virtual reality in reducing postoperative pain, eight randomized controlled studies were examined, and it was observed that patients who received virtual reality experienced lower levels of postoperative pain than patients receiving routine care (Ding et al., 2020).

Use of technology in surgical nursing education

Nursing education includes the process of learning intensive and diverse theoretical knowledge. This information is mainly aimed at improving the student's patient care and problem-solving skills. The higher the quality of nursing education, the higher the quality of patient care (Sherwood & Drenkard, 2007). To improve the quality of education, theoretical knowledge should be used in the clinic. Students should be provided with sufficient opportunities to do this. However, nursing students have limited time in the clinic. This limitation leads to a gap between theory and practice. The use of technology contributes to filling this gap between theory and practice. With the use of technology in nursing education, the clinical environment can be simulated for students. In this way, it has been proven that the quality of nursing education increases (Cant & Cooper, 2010; Yuan et al., 2012). Similarly, virtual reality application, which allows interaction with the course subject in a virtual environment, contributes positively to the professional education of students. For example, as represented in Figure 1, interactive learning of the operating room environment and procedures can be provided for operating rooms where student access and stay time are limited (Jung & Park, 2022).

Figure 1

The virtual reality based nursing education



With the use of technology in nursing education, students can be better prepared for clinical practice. In the clinic, they can make numerous applications in educational subjects where risks related to the patient are in question, and they can see the detailed

evaluation of their actions. In addition, in today's conditions, nurses work with technological devices and take responsibility for technological applications. Therefore, it has become an inevitable necessity for nursing students to benefit from technology at the highest level in their learning. Computerized simulation applications, online and offline distance education methods, virtual reality, augmented reality, and artificial intelligence are used in nursing education today. The use of technology in education is not only effective but also fun for students. The achievements show that these technologies will penetrate education even more over time (Ulupinar & Toygar, 2020). A study conducted in Turkey revealed that about a quarter of the publications in the field of nursing and technology were on nursing education. According to this research, the number of studies conducted tends to increase over the years. This increase shows the constructive effort to integrate technology into nursing education. In addition, it can be concluded that nurses have the potential to produce technology for nursing care (Aytur & Kantek, 2020).

vSim® (Figure 2), which aims to improve clinical nursing practice and patient care skills, improves students' reasoning skills (Foronda, 2015). Contrary to the examples given in this section, rare findings are showing that the use of technology does not make a positive difference in education. Various variables such as students' learning styles, approaches to technology, access opportunities, and instructors' attitudes may be determinants in the effect of technology use on education (Johnston et al., 2010). Academic nurses who train the nurses of the future should reflect on technological developments in education and pay attention to students' utilization of technology (Sendir et al., 2019).

Figure 2

vSim® for nursing



Robotic surgery and nursing

Robotic surgery is the performance of surgical procedures using robotic arms with various functions. It is one of the fastest-developing fields in medicine (Maza & Sharma, 2020). Since the 1980s, minimally invasive surgery has become widespread due to its various advantages. Laparoscopic surgery promised less pain, shorter hospital stays, fewer complications, and lower costs compared to open surgery. However, laparoscopic

surgery also had its limitations. Robotic surgery has overcome these limitations of laparoscopic surgery and offered a more successful surgical process. While moving from laparoscopic surgery to robotic surgery, the da Vinci® robotic system, which is perhaps the most well-known and consists of 3 components, was developed by utilizing previous experiences (Fig.3, Fig.4, Fig.5). The da Vinci® surgical system, the first version of which was used in 1999, can now be used in dozens of different surgeries ranging from cardiac surgery to colorectal and bariatric surgery (Pugin et al., 2011).

Robotic surgical platforms have developed technologically over time. This ongoing development takes the surgical technique one step further and eliminates the need for the surgeon's physical presence in the operating room. In 2001, the first transatlantic surgical operation was performed between the USA and France (Diana & Marescaux, 2015).

Figure 3

The surgeon console of the da Vinci Si® robot



Figure 4

The da Vinci Si® imaging system



Figure 5. *Articulating arms of the da Vinci Si® robotic surgery system (The robot)*



One of the most striking effects of technological development on the surgical field is undoubtedly the introduction of robotic arms. The minimization of invasive interventions by robotic surgery provides various advantages ranging from shorter clinical hospitalization to reduced surgical complications and faster recovery. The use of this technology is becoming more and more popular for both patients and surgeons, offering ergonomics for the surgeon and technical possibilities that increase the success of surgery (Lanfranco et al., 2004; Moawad, 2020).

For robotic surgery to be successful, the entire surgical team, including the nurse, should have knowledge, skills, and active participation in this field. However, it is known that the knowledge and training of nurses in robotic surgery are insufficient. There should be certified training programs for nurses covering the aims, advantages, and disadvantages of robotic surgery and nursing care (Konateke & Güner, 2022). In a study, the rate of nurses who declared that they had sufficient knowledge about robotic surgery was found to be 34.6%. The same study showed that the main source of information about robotic surgery was the Internet (Okgün Alcan et al., 2019). In a similar study conducted with nursing students, the rate of those who declared that their knowledge about robotic surgery was partially sufficient was 73%, and the rate of those who declared that they obtained the information from the Internet was 77.8% (Oztepe Yesilyurt & Ozsoy Durmaz, 2023). In a study conducted with nurses with robotic surgery experience, it was found that there were concerns about the risks that may develop in patient safety due to robotic system failure and unexpected problems (Kang et al., 2016). It may be possible to increase the level of qualified knowledge on robotic surgery and nursing, integrate this information into the formal education curriculum, and thus reduce the various concerns of nurses about the subject.

In robotic surgery, the nurse should focus on the patient, not the technological environment and the robot. Patient safety and behavioral and physiological responses should be prioritized. Preoperative and postoperative patient needs and care in robotic surgery are similar to those in the classical method. In the preoperative period, the nurse should additionally inform the patient about how robotic surgery is performed and deal with their concerns and fears. However, especially intraoperative care differs. In the intraoperative period, the nurse takes responsibility for preparing the robotic arms, giving the patient the appropriate surgical position for the arms, and preventing contamination associated with these instruments. In addition, according to unit protocols, nurses may also take responsibility for the control of robotic arms in the preoperative period and operating room preparation (Raheem et al., 2017, Redondo-Sáenz et al., 2023). As a result, the nurse has a critical role in the preparation of the robotic surgical system and other necessary surgical equipment before and during surgery. In addition to scrubbing and circulating nurses for the operating room, the definition of a robotic surgery nurse has started to be made (Okgun Alcan et al., 2019; Martins et al., 2019). The duties, authorities, and responsibilities of robotic surgery nurses can be determined by regulations and necessary arrangements can be provided.

The Association of Perioperative Registered Nurses (AORN) draws particular attention to complications and patient safety concerning robotic surgery. Failure to adjust the patient's position on the operating table according to the robotic arms may increase the risk of physical trauma and falls. interventions to prevent nerve damage in the operating room are recommended. In addition, the use of a second surgical safety checklist is recommended for robotic surgeries lasting longer than 3-4 hours (Song et al., 2013; KilicAkman et al., 2022).

Conclusion

In professional nursing care practices, it is necessary to develop these technological tools and include them in the implementation process in health promotion and maintenance. However, shifting the focus from the patient to technological applications may increase the risks related to patient safety. The fact that different technological devices in the surgical field are not compatible and integrated, whereas most of them need to be used together at the same time, may create a complex and risky treatment environment for the patient. Although the cost of high-end technological applications such as robotic surgery is relatively high and accessibility is low, it is still a new technology. More evidentiary research is needed to demonstrate its clinical advantages and superiorities, disadvantages, and weaknesses. All technological advances should provide everyone involved in the care of individuals with the opportunity to continuously monitor and record the individual's findings. Thus, it will be possible to reduce morbidity and mortality in patients and improve their quality of life.

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