

## Tasks of an Operating Nurse in Patient Care during Robotic Procedures

### Zadania pielęgniarki operacyjnej w opiece nad pacjentem w trakcie zabiegów robotycznych

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#### Abstract

Operating nursing is a unique field because it requires specific physical and mental characteristics from nursing staff. The specificity and difference of work between operational nursing staff and nursing staff employed in hospital wards differs significantly. Care for the operated on involved performing standard procedures but also providing individual care for the patient's needs before and after surgery. The range of requirements is also expanded to include assisting and providing professional care for a patient operated on with the assistance of the da Vinci surgical robot. The aim of the study is to present the specifics of the work of an operating nurse during operations performed using surgical robots. To fully use robotic techniques, full cooperation between the operator and the instrumental team is necessary. The tasks are divided into preoperative, intraoperative and postoperative. Indication of the advantages of the modern da Vinci system and presentation of the operating theatre with modern organizational and epidemiological infrastructure were discussed on the example of robotic surgeries performed on patients with bladder cancer. (JNNN 2023;12(4):183–187)

**Key Words:** care, integrated operating theatre, nurse, robot, teleoperation

#### Streszczenie

Pielęgniarstwo operacyjne jest wyjątkową dziedziną, ponieważ wymaga od personelu pielęgniarskiego określonych cech fizycznych i psychicznych. Specyfika i różnica pracy między personelem pielęgniarstwa operacyjnego od personelu pielęgniarskiego zatrudnionego na oddziałach szpitalnych różni się znacząco. Opieka nad operowanym polega na wykonywaniu standardowych procedur ale również na indywidualnym zabezpieczeniu potrzeb chorego przed, w trakcie i po zabiegu operacyjnym. Wachlarz wymagań poszerza się również o asystowanie i zapewnienie profesjonalnej opieki nad pacjentem operowanym z asystą robota chirurgicznego da Vinci. Celem pracy jest przedstawienie specyfiki pracy pielęgniarki operacyjnej podczas operacji wykonywanych przy użyciu robotów chirurgicznych. Do pełnego wykorzystania technik robotowych niezbędna jest pełna współpraca operatora z zespołem instrumentalnym. Zadania dzielą się na przedoperacyjne, śródoperacyjne oraz pooperacyjne. Wskazanie zalet nowoczesnego systemu da Vinci oraz przedstawienie bloku operacyjnego z nowoczesną infrastrukturą organizacyjną i epidemiologiczną, omówiono na przykładzie operacji robotycznych wykonanych u pacjentów z rakiem pęcherza moczowego. (PNN 2023;12(4):183–187)

**Słowa kluczowe:** opieka, zintegrowany blok operacyjny, pielęgniarka, robot, teleoperacja

#### Introduction

The operating theatre is an operating tract — a separate part of the hospital used to perform surgical procedures in conditions of the greatest possible isolation from sources of infection, similar to aseptic conditions.

Typically, the operating theatre is located next to the surgical ward, enabling easy transportation of a patient requiring surgery [1]. Currently created designs of operating blocks are based on the division into “clean” and “dirty” zones with non-crossing communication paths. The organizational and architectural separation

of such zones prevents accidental contact of the block staff and patients with other hospital employees and outsiders, as well as contact of prepared instruments and material with potentially infectious medical waste [1–4].

The operating theatre is usually treated as one of the most important organizational units in a hospital. This is due, among other things, to the fact that procedures performed there cannot be performed elsewhere. Moreover, it employs highly specialized staff that no one else can replace [5].

The most appropriate solution is to build an operating theatre in a good location, a new building or a new addition. This is usually the optimal solution from the point of view of modern functional requirements. Nowadays, convenient communication with the hospital Emergency Department (ER), the Intensive Care Unit (ICU), the Central Sterilization Centre, the Diagnostic Imaging Team, the emergency room and the diagnostic laboratory are extremely important for the operating theatre and the operating team. Connection with departments is ensured through general hospital communication and a set of elevators. If we are talking about a modern construction and a convenient location, we should also take into account quick access even from a helicopter landing pad located on or near the hospital. These assumptions result in the separation of the so-called “wide food” in the architectural structure, i.e. a rectangular building housing the above-mentioned functions as well as laboratories and diagnostic rooms. Observing the existing solutions, it seems that a compact operating theatre located centrally in relations to the communication system is the most appropriate and economical solution. Modern solutions also include the integration of operating rooms through a multimedia IT system that enables integration with the hospital RIS (Radiological Information System), allows the entire examination process to be handled from the moment of planning and registration through the execution process, integration and management of patient information into one comprehensive system, HIS, i.e. Hospital Integration System, is intended to archive, process and share data related to the implementation of the diagnostic and therapeutic process [6]. A digital negatoscope, equipped with a touch screen with an image diagonal of, e.g. 40, ensures control of the operating theatre. Additionally equipped with a keyboard with touchpad. The third option of controlling the system is the so-called hand movement control. To start working with the system, the user must log in to the system, connect a camera to record images from the operating field and an endoscope camera to record operations from the room. Another integration function is the ability to conduct a video conference with the doctor performing the procedure. It is also possible to conduct a consultation during the procedure. Thanks to two-way voice

connection combined with video transmission, the operator can contact the medical team outside the operating room. The consultation module is perfect for training and workshops, and serves as a tool for educating medical staff. Any device in the operating room can be connected to the integration system, such as air conditioning, operating lamps, diathermy, operating table [7].

The operating theatre consists not only of equipment but also of specialists who perform teamwork. A group of people in the operating room forms a team whose task is to perform a complex medical procedure, such as surgery, as best and as quickly as possible. The operating theatre is a separate, closed section of the hospital available only to people directly involved in the performance of the surgical procedure [8]. The permanent staff of the theatre consists of a team of employees: instrument nurses and anaesthetic nurses, as well as support, medical and transport staff. The team and the theatre are managed by an appointed doctor or nurse with a master's degree. The permanent team of employees should not be rotated with other hospital departments. The number of staff should be constant, of course, adapted to the needs, but not less than two nurses/instrumentalists per room (per shift), per one active operating table. The person responsible for the organization of work and safety of the operating theatre is the ward nurse of the operating theatre, the nurse of the anaesthesiology department, and the anaesthesiologist on duty — during duty hours after scheduled work. However, all permanent staff are administratively subordinated to the head of the operating theatre.

Today, the operating theatre with its spatial infrastructure and organization is a comfortable workplace for robotic surgery teams. The da Vinci system is a robot that is an invention that meets the needs of today's medicine. The da Vinci surgical system is a platform for robot-assisted minimally invasive surgery (RAMIS). Currently, over 4,400 da Vinci systems are installed in over 60 countries around the world. Surgeons have performed over 5 million procedures using da Vinci surgical systems. Despite these numbers, the field of robotic-assisted surgery is still relatively young in its evolution. Many exciting technologies are having a positive impact on surgical practice, and robot-assisted platforms such as da Vinci will certainly play an important role [8–10].

Due to the rapid increase in cancerous diseases, the da Vinci system is a tool to fight cancer in various fields of medicine. The da Vinci surgical robot, used mainly in the fields of urology, surgery, gynaecology, and ENT, is also used in neurosurgery [11].

The aim of the study is to present the specifics of the work of an operating nurse during operations performed using surgical robots.

### Preoperative Period — Nurse's Tasks

The tasks of the operating nurse in the block are closely related to the operating plan prepared the previous day. A proper work plan includes “teamwork, where tasks are clear to every nurse providing instruments and helping”. The entire team works for common success. Tasks before the surgery include primarily [10]:

1. Preparation — containers with surgical instruments, unpacking surgical instruments and additional sterile dressing materials. It is important that the preparation of tools is based on information about a specific procedure. That is, dedicated tools, e.g. implants for a given procedure, or information that, for example, the patient has a stimulator. What surgeries has the patient undergone? Deviations from standard procedures, e.g. due to the patient's height. Names of people included in the operational team. Surgical hand washing, putting on sterile surgical gowns. Preparing the table with surgical instruments and unpacking the container. When preparing a tool table, pay attention to: sterility, i.e. distances from the walls, and count the tools. Check sterility indicators in surgical instrument containers. When removing sterile materials, avoid contamination (dirt) of the instrument table, containers and surgical gloves. A proven method is to remove sterile materials from a sterile package opened by the support staff or to throw sterile materials onto a separate table (not onto the table with surgical instruments).
2. Inspection of the prepared equipment, both quantitative and qualitative. Quantitative one will concern the counting of prepared materials, e.g. tools, surgical drapes, needles, disposable materials and ready-made company-packaged packaging, which will need to be counted again. Qualitative one is a macroscopic inspection of instruments, paying attention to blood stains, as well as an assessment of the efficiency of instruments and a macroscopic inspection of sterile materials. Assistance in draping the surgical field. Connection and fastening of high-frequency devices, drains, etc.

### Intraoperative Period — Nurse's Tasks

Adaptation to the situation, instrumentation during the procedure. The operating room nurse must know the course of the surgical procedure. Necessary insight into

the surgical field. Professionalism and competence are expressed through self-control and calm, especially in life-threatening situations. Absorbent textile materials are removed to a separate container in order to: facilitate their counting, facilitate the anaesthesiologist's assessment of the patient's blood loss. Labelling slides before handing them over to support staff. Accurately dictating dosages of agents administered to support staff for entry into documentation. Informing the anaesthesiologist about important medications. Communication with support staff, anaesthesiologist and surgical team. Providing support staff with data relevant to documentation. Checking the completeness of the tool kit after surgery. Quantitative and qualitative control of surgical instruments and other materials. After applying skin sutures, remove remaining blood and other dirt from the patient, disinfect the skin, and apply a sterile dressing [9,12].

### Postoperative Period — Tasks for Nurses

Postoperative tasks include activities such as: removal of drains, wires, suction, and high-frequency cables from the lining. Checking the completeness of the layout, removing lamp holders. Counting needles and sharp materials and removing sharp objects to appropriate containers. In the case of notifiable diseases or septic conditions, containers should be marked accordingly. After organizing the tools, it is necessary to pack them into containers and send them to the sterilization department [9,13].

### Da Vinci Robot — the Role of an Operating Nurse in Urological Surgeries

Operative nursing requires both high professional qualifications and appropriate psychophysical predispositions from the nurse. The specificity of the work of an operating nurse consists in making decisions independently in the shortest possible time and implementing them during the surgical procedure so as to ensure the highest level of safety for the patient and the entire surgical team [14]. The nurse assisting in the procedure with the da Vinci surgical robot is trained in a company that distributes robots on the market. The course covers tools, preparatory procedures before surgery, how to use them during surgery, supply of tools and the endoscope, and handling tools after surgery. It is important that the tools after the procedure are subjected to a macroscopic assessment for damage, dents, damage to the cables, possible cracks in the housing, etc. The tools should be placed only in containers intended for this purpose, filled only with an approved liquid and placed in a horizontal position. Only port number 2 is

used to fill the tool. Port number 1 is used to fill the tool housing. Similarly, the endoscope is placed by the assisting nurse only in the indicated original basket. The endoscope cable is placed loosely on the frame and the tip is secured with a wet, clean gauze. The elements, tools, cannulas and cables prepared in this way are sent for sterilization in order to carry out the washing, rinsing, sterilization and maintenance process according to the guidelines. Preparation of the operating room includes, among others, standard equipment with an anaesthesia machine, a tower with a diathermy machine, suction and rinsing systems, a vision system, an operating table, operating lamps, tables for surgical instruments, a Mayo table, trolleys with bags for contaminated material, general waste. Cabinets with handy sterile tools (individually packed laparoscopic tools and for “open” procedures), sutures, catheters, drains, spare bipolar and monopolar forceps, cups, thermoses, clips, haemostatic material.

In addition to the standard equipment on the day of surgery with the assistance of a surgical robot, the operating room is additionally equipped with basic elements such as a vision tower, a tool platform or a console. Tools specific to the system, dedicated to the robot [15]. These tools mimic the skilful hands and wrists of a surgeon. It’s like an extension of the operator’s hand. The tools can bend at right angles, clamp and can do sutures. There is a system for reducing hand tremor and compensating the surgeon’s hand tremor. Three-four movable arms equipped with operating tools (8 mm trocars), 3D camera control arm (10 mm trocar). The surgical console is a kind of “command centre” that ensures comfort, ergonomics and precise control of the surgical tips, which have 7 degrees of freedom. The console remains outside the sterile operating field, yet the surgeon is in constant contact with the entire team through a system of microphones and loudspeakers [15].

The key aspects thanks to which the robot can also be used in neurosurgery include [11,15]:

1. Precision and stability: the da Vinci robot allows neurosurgeons to perform very precise movements with great stability. This is especially important in the case of surgery on delicate areas of the brain, where even the smallest mistake can have serious consequences.
2. Scalability of movements: The da Vinci surgical system enables surgeons to transform their movements into more precise ones, which is especially important for neurosurgical operations. This allows for precise manipulation of surgical instruments in hard-to-reach areas.
3. Three-dimensional imaging: This system provides surgeons with three-dimensional, high-resolution images, which allows the surgeon to better see the surgical area. This increases the effectiveness of

the operation and minimizes the risk of damage to surrounding tissues.

4. Minimally invasive approach: Da Vinci robot surgery offers a minimally invasive approach to neurosurgical surgery. Smaller skin incisions mean faster healing, lower risk of infection and shorter recovery time for the patient.
5. Reducing hand tremor: For many neurosurgical procedures, it is important to minimize the surgeon’s hand tremor. The da Vinci system allows for stabilization of the surgeon’s movements, which is crucial for operations in areas requiring the greatest precision.
6. Education and training: The da Vinci surgical robot can also be used for educational and training purposes. Young surgeons can use the system to learn complex surgical techniques in a safe and controlled environment.

## Conclusions

1. Nurses specializing in surgical nursing have experience and qualifications to perform highly specialized procedures. Based on the experience in laparoscopy, it was easier to develop skills for assistance in robotic procedures. Nursing staff has the opportunity to acquire knowledge and experience in reference centres abroad or through coordinators and representatives of specific companies in Poland who participate in surgical procedures in centres that are starting to work with a surgical robot.
2. The benefits of using the da Vinci system include great precision, stability of the robot’s tools, 10× optical magnification, 3D imaging in HD quality with the ability to modulate the image depth, the tools have greater efficiency and precision than the human wrist, and reduction of the surgeon’s hand tremors. Possibility of penetrating structures such as the brain, heart, kidneys, urinary bladder.
3. Benefits for the patient include: minimally invasive procedures, quick return to life and professional fitness. Less pain, less risk of infection, reduction of complications, aesthetic aspect (small scars).
4. Benefits for the health care unit: lower costs, lower costs of treating complications, lower consumption of blood and drugs, short hospitalization time. Increasing the hospital’s competitiveness (unique service), ability to acquire new patients, prestige.

## Implications for Nursing Practice

Preparation for robotic procedures is based on training in reference centres. The nurse acquires professional assisting skills through the repetition of a specific procedure. It is worth acquiring knowledge in the field of robotics, because these procedures are already in everyday operational plans. Artificial intelligence, a modern integrated operating theatre, and robotics contribute to the high quality of the procedure, which translates into the patient's quality of life after surgery.

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