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Developing Fundamental Perioperative Nursing Educational Program of Robotic Assisted Surgeries

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Introduction

Minimally invasive surgeries started in 1980s'with endoscopic surgeries. In early 20 century, the robotic system was introduced to overcome some limitation of endoscopic surgeries and facilitate a laparoscopic approach to various robotic surgeries. The robotic system, da Vinci, first approved by FDA (Food and Drug Administration) robotic surgical system, provides a 3-dimensional view of the operative field and applied specified instruments that mimic the movements and dexterity of the human hand. It reduces the operating time and the length of hospital stay.

The robotic surgical system consists three main parts: the surgeon console, the patient cart, the vision cart. The surgeon leaves the sterile field to perform surgery in front of surgeon console with three manipulators and 3-dimension view. Manipulators duplicate the fingers' movements of surgeon then transmit signals to robotic arms into the patient's body to conduct the surgery.

At the beginning of surgery, the surgeon creates trocars in proper anatomical location to obtain visualization. The circulating nurse guides docking the patient cart toward the precise position of a patient. The first assistant places instruments into operation field through trocars. The surgeon sits in front of the console during procedures performing. As the robotic system provides a three-dimensional view, ergonomic advantages increase the dexterity and ability to perform microsurgery. The benefits are shorter hospital stays, less post-operation pain and complications.

Literature of nursing care during robotic surgeries related is limited. As the trending of robotic surgeries, we would like to create a mentoring educational program for nursing students during the nursing internship. Based on systemic data collection and built mentoring guidelines of perioperative robotic surgeries. We aimed to improve the knowledge and skills of perioperative nursing care and provide the high quality of perioperative nursing care to patients undergoing the robotic surgery. This program provides an integrated concept of robotic surgeries to perioperative nursing students, improves the effectiveness of clinical practice and better perioperative nursing experience expectantly.

Robotic Surgery System

The surgeon's eyes, the three-dimensional camera, increase the visual depth and perception of the surgeon. The robot mimics movements of human's wrist, hands and fingers plus excludes the essential human hand tremors to obtain the better results than traditional laparoscopic surgeries. The robotic instruments with seven degrees freedom can do a finer dissection and more delicate suturing. Another character of the robotic system is force feedback, function instead of tactile sensation. Furthermore, the feedback augmented by high-solution three-dimensional visions compensates the loss of tactile stimulation.

Robotic surgeries have some similarities with endoscopic surgeries. Some difference between endoscopic surgeries and robotic surgeries are as follow:

Carbon dioxide is necessary for endoscopic surgeries to create the channel for instruments reaching the operating field and space during performing surgeries. The hemodynamic changes cause risks of preload declining, hypotension, central venous pressure raising, pulmonary artery pressure raising, hypercapnia and acidosis.

Nursing Care in Robotic Surgeries

Intra-operation

Based on research, the mean learning curve of robotic surgery team is 20; the operation duration would be less gradually as team member gained experience. Surgeons perform surgeries via surgeon console in the unsterile area but convert to open surgeries when patients' condition out of their control. Surgeons should leave the operation room to repeat preparation procedures for traditional surgeries. The proficiency of these converting systems is necessary for all perioperative professional to reduce the risk [1-3]. The proficiency of robotic surgeries for nurses including conduct the connection of three carts of robotic consoles, covering and ducting patient cart to operating area and handling robotic arms is essential when the surgery is aborted.

Perioperative nurses prevent all complications of long hour surgeries before the robotic surgeries start, especially in the early beginning stage of robotic surgeons.

Positioning is challenging when patients undergo robotic surgeries. Most of the robotic surgeries are under modified lithotomy position or modified Trendelenburg position. Besides, adjustment of positions produces shearing and friction damage on patients' skin. Circulating nurse prevent skin damage from positioning by checking skin integrity, padding and fixating correctly, reassessing skin after every movement of patients' position. Flexuous knee increases the risk of thrombosis of legs, for this reason, pressure legging is needed to increase venous return. Legs up position improve the possibility of peritoneum compressing lung base cause breathing restriction, fluid shifting worsens the effect of this breathing problem.

Another risk of long hour surgeries is hypothermia. All of the robotic surgeries are under general anesthesia; thermoregulation subsided, muscle relaxation, heat creation subsided, cause hypothermia. Hypothermia induces higher incision site infection rate, delayed post-operative recovery and an increased risk of cardiovascular complications. An auto-set-point heating system less incidence of hypothermia.

As the complexity and popularity of robotic –assisted surgeries, organize an integrative program for the surgical team to provide a patient safety healthcare for patients. All members join the holistic training program, familiar with the setting and operating of the robotic system, uploading and downloading robotic arms, cleaning and troubleshooting. Surgeons focus on performing surgeries. The team is capable of converting the robotic surgeries to open surgeries if in need [4].

The intra-operative care of robotic-assisted surgeries needs to match how to properly connect, calibrate and set up the robotic surgical system. Those include properly loading, handling and cleaning the robotic instruments.

The challenge of intra-operative nursing related to the familiarity of robotic technology. Nurses have to know how to connect, calibrate and setup properly and familiar to the instruments of each type of surgeries. The patient-side surgeon assists the non-sterile operative surgeon by exchanging sterile instruments, retracting patient tissues and manipulating non-robotic sterile instruments used to assist the procedure. Therefore, nurses know the messages displayed on the robotic system are crucial for the success of robotic surgeries and familiar to procedures for removing the patient cart from the sterile field if the surgeon decides to abort the robotic surgery [5].

Surgeons perform surgeries via surgeon console in the unsterile area. When converting to traditional surgery is in need. The surgeon should leave the operation room to repeat preparation for traditional surgery. The proficiency of these converting procedures is necessary for all perioperative professional to reduce the risk [1-3].

Pre-operation

The pre-operative care and post-operative care of robotic surgeries are similar to endoscopic surgeries. Both of pre-operative and post-operative instructions are in written form and verbally reviewed with patients. The whole plan includes assessment of patients' anxiety, planning, implementation, evaluation and patient's attitudes and feelings related to the procedure and its outcome. Patients need to understand this treatment option and to facilitate their decision making.

Post-operation

The post-operative care of robotic surgeries is pain, activity level, possible complications and care of surgical site similar to mini-invasive-surgery. As the cutting-edge technology in healthcare [5].

The nursing standards of post-operative robotic surgeries stay same as minimally-invasive procedures. The postoperative care should various depends on different procedures. Adjustment of postoperative patients' education program is necessary for the content, methods and timing because of shorter hospital stay. Postoperative recovery means back to preoperative daily activities, including management of pain, complications and appropriate activity level. It is estimated the outpatients take three days return to preoperative lifestyles after surgeries. Nurses need to ensure that patients understand how to recover from their procedures. Enrichment of education material and methods for patients and care attendants is important for patients underwent robotic-assisted surgeries. Providing instructions in written form or verbally to patients give them time to ask and clarify questions [6].

Program Design

The number of robotic-assisted surgeries is growing rapidly. It was 8000 robotic-assisted surgeries in 2007 and became worldwide. In 2016, the robotic surgeries had reached 25000 cases globally, more than three times of 2007. The robotic surgeries have been one of the most popular cutting-edge technologies. Most of the robotic surgeries performed in advanced countries, United States, European countries [7]. The first case o robotic surgery conducted in Taiwan in 2004, then developing very fast afterward [8]. Most of the literature related to robotic surgery is focusing on surgical technique and outcome of surgeries, very much less related perioperative nursing care and educational programs [9-11]. The robotic surgery is more challenging than endoscopic surgeries, both for surgeons and perioperative nurses. As the fast developing of robotic surgeries, an integrated educational program of robotic surgeries is needed. The patients would be in danger without properly program education of perioperative nurses.

The program design is based on three dimensions of perioperative teaching goal: intraoperative environment management, patient safety management and robotic team management [4].

Robotics has been invading in a different area of medical. The Florida Hospital Nicholson Center celebrated the success of remote simulated surgery, from Nicholson Center to ft.Worth, Texas. It is important for nurses to embrace new technology and adjust the roles of nurses. Failure to recognize the impact of technology will compromise the capability to guide the future of the nursing revolution [12,13].

Conflict of Interest

The authors declared no conflicts of interest.

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