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Robotic nurse duties in the urology operative room: 11 years of experience

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Abstract *Purpose:* Role of robotic nurse is indispensible during robotic surgery; nevertheless, few researches have focused on it in literature. We aimed to discuss in details the robotic nurse role in this review.
Materials and Methods: We used the PubMed database (2000—2015) and searched for original English-language studies using the keywords "robotic nurse", "nurse role in robotic surgery" , and "bed-side assistant". We searched studies including preoperative, intraoperative and postoperative nurse care during robotic surgery.
Results: In all, 7 original studies were identified using the selected search criteria. All studies were selected according to their relevance to the current topic and the most pertinent reports were incorporated into this review.
Conclusions: The robotic nurse plays an essential role in a successful robotic surgery. As part of the robotic surgical team, the robotic nurse must demonstrate a high level of professional knowledge, and be an expert in robotic technology and dealing with robotic malfunctions. Each one of the robotic nursing team "nurse coordinator, scrub-nurse and circulating-nurse" has a certain job description to ensure maximum patient's safety and robotic surgical efficiency. Well-structured training programs should be offered to the robotic nurse to be well prepared, feel confident, and maintain high-quality of care.
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1. Introduction

Since its introduction in 2001, the use of robotic surgery is expanding rapidly in all surgical fields and subspecialties such as thoracic, colorectal, hepatobiliary, gynecological, and urological surgeries. Subsequently, both the facilities purchasing robotic systems and the number of surgeons using them are increasing, which creates many challenges in terms of cost, training and safety.

Robotic surgery has many advantages for the patients, surgeons and nurses. It provides benefit of minimal invasive surgery (e.g. less blood loss, lower transfusion rate, and shorter recovery time), minimizes the inconvenience, enhances visualization through three-dimension high-definition binocular lens, better ergonomics, and motion scaling. For nurses, it provides better visualization in vision cart which make surgery more easy and clear. And as operating nurses, it allows them to have experience of new technologies and roles. Moreover, they can establish territory as a clinical expert and expand roles as professional nurses.

Accomplishment of successful robotic surgery requires a comprehensive skillful teamwork that could play together in a harmony like orchestra symphony, while maintaining the maximum safety of the patient and quality of care. The robotic surgery team work inside the operating room is composed of the main robotic surgeon, bed-side assistant, robotic nurse, and anesthesia team.

Among this team, the robotic nurses' role has gained a rapid development and was discussed in many previous reports which emphasized on the great importance of their role during surgery [1—4]. The robotic nurse is capable of building a comprehensive picture of how, why, and when the robotic system is being used. Subsequently, the nurse configures the optimal use of equipment, instruments, and supplies. Having a properly trained robotic nurse team could reduce the cost of robotic surgery [5]. Moreover, the robotic nurse allows fast and accurate solving for problems with the robotic equipment and instruments [1]. Kang et al. [2] categorized robotic nurses work experience of major hospitals in South Korea into four main themes: (a) checking patients' safety and the robot's functions; (b) dealing with any unexpected robotic machine malfunctions; (c) feelings of burden in a robotic surgical team; and (d) need for more education and training. They recommended that offering more support for nurses involved in robotic surgery should be a priority to empower them to play an extended role in robotic surgery.

The present article describes in details the role of robotic nurse in Severance Hospital since the introduction of robotic surgery in our urology department, and its evolution until the present time.

2. History of robotic surgery in South Korea

The Korean Ministry of Food and Drug Safety approved da Vinci robotic surgery (Intuitive Surgical, Inc., Sunnyvale, CA, USA) on 13th of July 2005. After approval and up-to-date, a total of 53 da Vinci surgical systems had been installed in 40 institutions in South Korea. Severance Hospital was honored to launch the start of robotic surgery in South Korea when the first robotic-assisted cholecystectomy was carried out in July 2005. From 2005 to 2014, more than 16,000 urological robotic procedures were performed in South Korea (Fig. 1); of these cases more than 3400 were in the year 2014 only. Subsequently, many Korean studies entitling different robotic procedures were published. Cho et al. [6] reported that robotic-assisted radical prostatectomy (RARP) ($n = 60$) had better results in operating time, estimated blood loss, hospital stay, and urinary catheterization duration compared to the laparoscopic approach ($n = 60$). While there was no difference regarding the trifecta achievement. On the other hand, Jang et al. [7] compared the perioperative outcomes of robotic-assisted partial nephrectomy RAPN ($n = 89$) and laparoscopic partial nephrectomy ($n = 38$) for tumors with R.E.N.A.L. score ≥7. They found no significant differences in warm ischemic time blood loss, intraoperative complications, or operation time between groups. Interestingly, Kang et al. [8] presented a developed technique of robotic-assisted radical cyctectomy (RARC) with complete intracorporeal urinary diversion, and concluded that their technique is a feasible procedure with less blood loss and earlier recovery.

2.1. History of robotic surgery in Severance Hospital

Severance Hospital contains 10 robotic surgical systems: 6 da Vinci Si and 4 da Vinci Xi. The first RARP was performed by Dr. Koon Ho Rha in July 2005, using the da Vinci Standard surgical system in Severance Hospital [9]. By that time, the number of da Vinci surgical procedures in Severance Hospital has been increased dramatically, and from July 2005 to March 2016 the total number of robotic procedures has reached 14,371, representing the largest robotic volume among all Korean hospitals. The main subjects in our robotic procedures are general and urologic surgeries. The general surgery is interestingly more frequent than urologic surgery procedures (7743 vs. 4780), respectively (Fig. 2). Recently, we reported the largest Asian cohort ($n = 800$) of
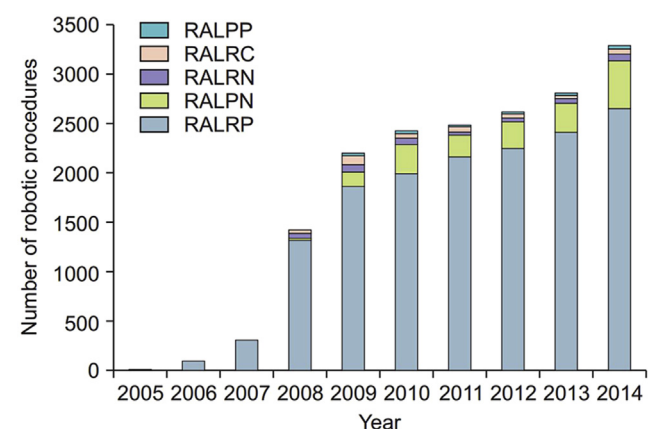

Figure 1 Number of urologic robotic surgeries (Y-axis) from the year 2005—2014 in South Korea (data from Intuitive Surgical Korea) adapted from Seo Y. 2015 [25]. RALPP, robot-assisted laparoscopic pyeloplasty; RALRC, robot assisted laparoscopic radical cystectomy; RALRN, robot-assisted laparoscopic radical nephrectomy; RALPN, robot-assisted laparoscopic partial nephrectomy; RALRP, robot-assisted laparoscopic radical prostatectomy.