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**Nursing interventions that affect safety in the operating
room**

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ABSTRACT

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<p>The operating room (OR) is a place requires close and careful attention. Nurses play an indispensable role in the OR and influence the success of an operation. We chose to write our thesis on this topic to help nursing students study what nursing interventions can affect patients' safety in the OR.</p> <p>In this Bachelor's thesis, several nursing interventions that affect the patient safety in the OR will be reviewed. The purpose of this thesis is to study what nursing interventions affect patient safety in the OR. The aim of this thesis is to help nursing students who want to be, or will become OR nurses be more vigilant toward patient safety in the OR. The research question of our thesis is what nursing interventions affect the patient safety in the OR.</p> <p>The thesis was conducted as a qualitative research study. Data was collected through the formal academic database with keywords. We explain basic concepts by researching and studying related websites and books. We studied aforementioned articles to find answers to our research problem. Wrong-site, wrong-procedure, wrong-patient errors, retained foreign bodies, medication and anesthesia errors, risks of a puncture are four essences that negatively affect patient safety in the OR. In order to reduce these hazards, OR nurses can use the surgical safety checklist, effective communication, aseptic technique and infection prevention as nursing interventions.</p>		

<p>Keywords the operating room, the operating room nurse, nursing interventions, patient safety, surgery environment</p>

LIST OF ABBREVIATIONS

AORN: Association of Perioperative Registered Nurses

BBFEs: Blood and body fluid exposures

NSIs: Needle stick injuries

ODPs: Operating department practitioners

OR: Operating room

RFBs: Retained foreign bodies

RN: registered nurse

SIs: Sharps injuries

SSC: Surgical safety checklist

WHO: World Health Organization

WSPEs: Wrong-site, wrong-procedure, wrong-patient errors

ABSTRACT

LIST OF ABBREVIATIONS

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1 INTRODUCTION

Nowadays, people may be concerned about that the problem of the operating failure or problem usually due to the doctor's duties. However, the member of the surgical team is also likely to be a factor that reduces the rate of successful surgery or even causes surgery failure. People should notice that the nurse in the operating room (OR) also serves as a very important role. Some nurses may neglect the importance of the patient safety during the operation and pay more attention to the operation or equipment. The newly graduated nursing student may be not alert enough to the importance of the patient safety. Because they don't have enough experience in the OR, we want to introduce the safety in the OR.

The safety in the OR can be classified to the patient safety, the nursing safety, the surgeon safety, the environmental safety, etc. "Wrong-site, wrong-procedure, wrong-patient errors" (WSPEs) are termed as never event errors that should never occur and indicate serious underlying safety problems. The patient is safe from the operation when errors never occur and nurses are patient-oriented instead of surgeon-oriented or operation-oriented. That threat for the patient safety in the OR contains inadequate protection, ineffective communication, infection prevention, medication errors and instrument negligence. (Herman, 2011.)

Nursing interventions for ensuring the safety should include many things. For example, effective communication, infection prevention, aseptic technology appliance, and correct use of the surgical safety checklist (SSC). These measures tend to avoid postoperative complication. Less morbidity and mortality, improved quality and greater efficiency are potential benefits of surgery that is safe for the patient. In our thesis, we want to talk about the patient safety which is the most important thing during a surgery. We will explain what factors might threaten patient safety in the OR in the following content. Also, we will describe some measures to prevent risk and unsafety away from the patient during the surgery. (Herman, 2011.)

The purpose of this thesis is to study what nursing interventions can affect the patient safety in the OR. We choose this topic which is aims at the nursing students, those who want to be or soon will to be OR nurse in the near future. They can effectively and quickly acquire the basic information, be aware of OR nurse responsibility, and possess aseptic consciousness, and understand the importance of the patient safety, the hazards and nursing errors in the OR after reading this thesis. This thesis will help the nursing student to study and upgrade alert on the patient safety in the OR. We hope this thesis will help the nursing student to learn more about the OR before they work and maximize patient safety during the operation.

2 THEORETICAL FRAMEWORKS

The theories and concepts in this thesis will be defined and explained in this section. We will show the relationships and the connection between each concept. Specifically, the theoretical framework is a thorough approach which will be used to serve as a guide in aware of nursing interventions in the OR for the nurse.

This chapter will explain what kind of place the OR is, communication in the OR, the safety checklist, the nurse responsibility as well as the patient safety in the OR. Since the newly nursing student may don't know the work system and environment, the OR nurse might be affected by some basic issues such as power backup system and sterile area. Let's start with the OR environment.

2.1 The operating room

This part will explain the OR environment and equipment. As a nurse work in the OR, the first thing needed to know is the environment information. They should know that how the work system works in the OR, what kind of equipment in the OR and how to use them. The basic knowledge about the OR environment and the equipment related to the patient and the surgical team safety. It is dangerous if the nurse lack of the basic knowledge about the OR environment and the equipment. For example, they don't know the equipment should keep sterile or not. It is dangerous for the patient who will use this equipment during his surgery.

2.1.1 The operating room environment

The OR is a facility within a hospital where the surgical operation is carried out in a sterile environment. The OR usually is well-lit, typically with overhead surgical lights, spacious and easy to clean. The OR usually has no windows. However, the OR in Finnish hospitals have the windows that never can be opened to let the patients relax with the scenery before the operation start. There is a central control system can control the temperature and the humidity

in the OR. There is a special air filter can filter the air inside the OR and improve the pressure in the OR slightly. There are suction and oxygen, maybe other gases on the wall. The OR is equipped with a monitor and the well-equipped surgical facilities. Electricity supports has backup systems in case of a black-out. In a nutshell, even if there is a blackout during the operation, the power backup system will start immediately and support the operation continues. (ASPAN, 2017.)

An operating team including surgeons, anesthetists, operating department practitioners (ODPs) and nurses. These individuals take on different roles, each of which requires subtle interaction with others to provide a seamless journey through the perioperative environment. The nursing student also need to know the responsibility of each member of the surgical team. It can avoid the lack of a response and the repetition of a responsibility. The most important thing for the nursing student is to always have a sterile awareness in the OR. Also, the nursing student who will be an OR nurse should be familiar with the OR environment. If there is an emergency condition happen such as power failure suddenly. They have to know the emergency measure and know how to use the backup power system without panic. (ASPAN, 2017.)

2.1.2 The operating room equipment

Because the OR is a sterile environment, the dress in the OR always special. The surgical clothing includes the following: a protective cap covering their hair; the mask over their lower face, covering their mouths and noses; sometimes shades or glasses over their eyes; the long sterile gowns, protective covers on their shoes; the sterile gloves on their hands. After putting on the sterile gloves, don't touch anything, only touch the stuff in the sterile area. All cloth should be change when the next patient comes. One suit of clothing only for one patient. If the nursing student just starts to work in the OR, she/he must know those rule with sterile

consciousness. it can prevention of infection in the hospital or interlacing of the OR. (Stanford children's health, 2017.)

The equipment of the OR usually depends on the type of surgery. However, some equipment can be used for every type of surgery. We have to use them with no matter which types of surgery. For example, the operation table: All the surgical instruments the doctor needs are on the table, so it must be sterile. The operation light: it can give the doctor enough lights during the operation. The anesthesia machine: this machine has a respirator and a monitor to help the patients to breath and to detect the patient condition include vital signs, muscles conditions, electrocardiogram and so on. Anesthesia cart is always beside the anesthesia machine. There are some stuff the anesthesiologist may need such as the medication, the equipment, and other supplies. An electrocautery machine uses high-frequency electrical signals to burn or close blood vessel. It also can cut off some small amounts of tissue that hemorrhage. The function depends on how high the frequency electrical signals are. Sometimes the circulating nurse helps the surgeon to adjust the electrocautery machine. (Stanford children's health, 2017.)

The patient in the OR experienced dangerous, complex, potentially life-threatening procedures. In addition to the technical operation of the surgical team and good coordination each other, medical devices that use energy cutting and burning tissue during the operation can also be potentially dangerous. Failure or misuse of these devices will endanger patient and surgeons. As a result, the circulating nurse responsibility includes ensuring the proper function of the equipment, coordinating the use of supplies, the instrumentation, and the equipment for operative care. All the members of the surgical team have the responsibility for maintaining the patient safety standards. As a circulating nurse, she should know the function and basic information about the equipment before use it. If surgery requires, a heart-lung machine or the other specialized equipment may be brought into the room. (Stanford children's health, 2017.)

2.2 Nursing interventions

What are nursing interventions? Nursing interventions are the actual treatments and actions that are performed to help the patients. Nurses usually use basic knowledge, experiences and critical thinking skill to decide which nursing interventions will help the patients most. Nursing interventions can be classified into dependence and interdependence. Interventions can be focused on basic physiological need, complex physiological needs, behavioral functioning, promoting the safety, caring for the family, using the health system and the overall health of the community. In our thesis, nursing interventions in the OR are related to maximizing the patient safety. The responsibility of the OR nurse is closely related to the patient safety index. As a nursing student who will work in the OR, she/he must know what is the nurse responsibility in the OR very well to make sure every patient safety. (Saba, 2007.)

2.2.1 Nurse responsibility in the operating room

The OR nurse is to provide care for patients before, during and after surgery. The OR nurse is an individual role who helps the patient prepare before surgery. The OR nurse also is an important part of the surgical team that helps the doctor operate on the patient during the operation. The OR nurse helps to evaluate the patient, then plan and implement various steps before, during, and beyond surgery. The OR nurse can be divided into three different types in the nursing system, the preoperative RN (registered nurse), the intraoperative RN or the perioperative nurse and the postoperative RN. In this thesis, we only focus on the intraoperative RN who plays a big role in the operating team. The intraoperative RN usually has two duties in the OR. One of the duties is working as a circulating nurse in the operating suite but outside of the sterile field. The responsibility of the circulating nurse is to ensure all necessary personnel, equipment, and supplies are readily available, as well as complete necessary paperwork and being sure anyone who enters the OR under a necessary and documented addition to the environment, such as monitors, records and communicates patient condition with the interdisciplinary team; manages overall care of the patient during the

surgical procedure; documents the operative care to be delivered in accordance with surgeon, hospital; evaluates, remediates and documents the surgical environment for aseptic merit and so on. The other one of the duties is working as a scrub nurse handle and prepare operating instruments and equipment within the sterile field. The responsibility of the scrub nurse is to help the doctor operate on the patient. For example, delivery the surgical sterile instrument on the surgical table. Notice that all objects touched by the scrub nurse must be sterile. The perioperative nurse work in every type of healthcare facility. In surgical settings, a perioperative nurse may act as a scrub nurse or a circulating nurse. The patient under anesthesia is totally dependent on the surgical team for their well-being. Therefore, the nursing student who will work in the OR must know every different responsibility in the surgical team. They must accurately distinguish the difference of the nurse responsibility so that can understand what kind of stuff he/she can touch when she/he is a scrub nurse or circulating nurse. (Brown, 2017.)

2.3 The patient safety

What is the patient safety? Here is a defined of the patient safety in World Health Organization(WHO) which is a specialized agency of the United Nations. The patient safety is a fundamental principle of health care. In the nursing process, each point may have a certain degree of internal insecurity. Research published in several countries has shown that a large number of patients are injured during health care, or that they cause permanent damage, increase hospital stay, and even death. (WHO, 2017.)

The way to ensure the sustainable and significant improvement of health care is explicit policies, organizational leadership capacity, data to drive safety improvements, skilled healthcare professionals and the patient in the care of effective participation. The patient safety helps doctors, nurses and all other healthcare professionals practice safer and better medicine. Therefore, it is good not only for patients but also for everyone in health care. So, the nursing student who will work in the OR must have a concept of the importance of the

patient safety. In the process of the OR care, protect the patient safety and minimize the damage to the patient while doing an invasive procedure in the OR. The nursing student also needs to know which factor can affect the patient safety in the OR. (WHO, 2017.)

We can classify the unsafe factors in two aspects: one may cause by the external factor, the other may cause by the internal cooperation factor in the surgical team. In the OR, the external factor usually occurs related to the OR environment and the equipment. The internal cooperation factor usually occurs because of incomplete nursing interventions and bad communication. Therefore, learning an effective and excellent communication skill also belongs to ensure the patient safety in the OR. It helps the surgical team work together much better as well. (Gardezi, Lingard, Espin, Whyte, Orser & Baker, 2009.)

2.3.1 Communication in the Operating room

A scalpel will accurately cut, but a problem can arise from improper sterilization. Similarly, all the members of the surgical team are very precise in their work, but one of the biggest pitfalls is their communication. The lack of communication in the study of British Medical Journal is a major factor in surgical complications. At each stage of the operation, better communication is essential to improve the patient safety, and it is crucial for hospital staff to work. Good communication in the OR is important and can be achieved by improving technology and implementing best practices. If we want an excellent communication between the surgical team, we should know what is communication skill first. (Košič, 2010.)

Communication skills are the ability to receive and send information by the written, oral or body language of the media, effectively and specifically to express thoughts, feelings, and attitudes, can rapidly and correctly interpret the information of others, to understand other people's thoughts, feelings, and attitudes. Communication within the surgical team is one of the most important factors for the patient safety in the OR. Communication related to the phases of activity of surgical team in the OR: patient preparation, commencement of

procedure, moments of teaching in the procedure, a conclusion of the procedure, and patient changeover. Room turnover, patient cancellation, sending for the next patient; resources such as equipment allocation and distribution, personnel distribution; roles such as responsibilities, constraints; relationships; the safety and the sterility such as aseptic technique; situation control such as temperature regulation, recording activities. Excellent and effective communication also can affect the result of nursing interventions and the patient safety index in the OR. One of the reliable and effective ways to improve communication in the surgical team is using the surgical safety checklist. (Gardezi, Lingard, Espin, Whyte, Orser & Baker, 2009.)

2.3.2 The Surgical Safety Checklist (SSC)

The SSC is a core that WHO raised in order to avoid the surgical injury and risks endangering. Its intention is to reduce errors and adverse events, increase team cooperation and communication in the surgical operation, reduce morbidity and mortality, and improve the patient safety. The SSC divides the operation into three phases, each corresponds to a specific time period in the normal flow of a procedure. The period before induction of anesthesia (Sign In), the period after induction and before surgical incision (Time Out), and the period during or immediately after wound closure but before removing the patient from the OR (Sign Out). (WHO, 2008.)

3 PURPOSE, AIM, AND RESEARCH QUESTION

The purpose of this thesis is to study what nursing interventions can affect the patient safety in the OR.

The aim of this thesis is to help nursing students who want to be or will become OR nurses to improve vigilance on patient safety in the OR. From this thesis, they can effectively and quickly understand the responsibility of the OR nurse and the importance of patient safety, strengthen the aseptic consciousness and learn to know how to prevent nursing errors and keep patients away from risks in the OR after reading the thesis. We hope this thesis will help nursing students to learn more about the OR before they work there.

Hence, the research problem seeks to provide answers to the following question:

1. What nursing interventions affect the patient safety in the operating room?

4 METHODOLOGY AND DATA

This methodology chapter includes three parts: literature review, data collection, and data analysis. In this part, we will tell the steps how we searched and analyzed the data.

4.1 Literature review

In this thesis, we use qualitative data to systematically solve the research question and in the implementation of the research operation, we use the literature synthesis to summarize selected article content. The literature review covers research questions, the retrieval, and selection of original scientific articles of their quality as well as an estimation of their analysis and presentation. The literature review was established as the most reliable and effective method for summarizing previous findings. It avoids system bias, highlights potential shortcomings, and identifies existing but non-systematic scientific knowledge. Therefore, literature review may either increase the need for primary research or prevent the start-up of unnecessary new studies. (Shuttleworth, 2012.)

4.2 Data collection

Web searching is our primary instrument for collecting information. Nowadays, with the help of the Internet, we are able to collect data from mobile devices, website traffic, and other relevant sources, depending on the project. (Rouse, 2016.)

In collecting academic articles for this work, Academic Search Elite (an EBSCO database), nursing databases CINAHL (an EBSCO database), Sage Premier and Google Scholar (an article searching engine) are used. These databases were chosen in accordance with the relevancy to our study program. Academic Search Elite is a multiple discipline search portal for electronic journals. CINAHL is an international database for nursing journals. Sage Premier is a collection of journals. Main topics are education, cultural studies, medicine and health professions, psychology and sociology. Google Scholar is a freely accessible web

search engine that collects the full text of scholarly literature of publishing formats and disciplines.

Our thesis is based on nursing intervention in the OR. Published scientific articles written in English from the year 1996 to 2017 were targeted in searching for articles. All the result we found must be academic articles. Our inclusion criteria are these keywords: OR, the OR nurse, patient safety, nursing intervention and risk factors to limit the databases. Because our research question in this thesis is what nursing intervention affect patient safety in the OR, we excluded some articles whose target readers are not nurses. Then we got thousands of results from database, which made us hard to choose the useful sources from. Therefore, we used many keywords to get more accurate result. Due to less information for nurse and less nursing standard revision, we expanded the search year limit from 1995 to 2017. We choose one article from 1996 which is because the content has a detail explanation about the basic aseptic principles which have not changed a lot even now. Then we found 30 sources in Academic Search Elite; 5 sources in CINAHL; 2 sources in Sage Premier; and 20 sources in Google scholar. We read the title of these search results and analyzed how these articles related with our thesis with trustful reference. We eliminated the articles that only had a little information on OR safety and nursing intervention. At last, we chose 6 articles from the 30 sources in Academic Search Elite; 1 article from the 2 sources of Sage Premier; 1 article from 5 sources in CINAHL; and 2 articles from the 20 sources in Google scholar. Finally, we had 10 articles in total.

4.3 Data analysis

In a qualitative thesis, we need to present findings in the data analysis part. Data analysis is a systematic process, where the source data strongly determines the purpose. In other words, we present generated key words and expressions in data analysis. (Margaret. 2000.)

Data analysis can be split into four steps. First, the original contents of data are listed in a table. Secondly, we simplify the contents into lesser words, retaining the main concept and idea. After these steps, we try to find connections between each simplified expression and classify them into several parts which are given names. The classification is seen as the strength of strictly qualitative content analysis. The third part is a result of clustering, consisting categories. (Margaret. 2000.)

We found totally 10 academic articles for the result part. From these ten articles, we would study what nursing interventions affect the patient safety in the operating room. In Table 2 we present the analysis of all 10 articles we chose.

5. RESULTS

Our thesis studied what nursing intervention can affect the safety in the OR. According to the thesis theme and the research studies, we get following two parts.

5.1 What factors threaten the patient safety in the operating room?

We find out several major risk factors that will threaten patient safety by researching and studying articles from the database. In the following part, we describe and explain these factors.

5.1.1 Wrong-site, wrong-procedure, wrong-patient errors (WSPEs)

“Wrong-site, wrong-procedure, wrong-patient errors” (WSPEs) are termed as never events, which are terrible, unacceptable, and often result in litigation with unknown causes. This only had received little attention and had been considered as a random and unusual event. They may not happen at the same time. While wrong-site surgery is the most infamous. Wrong patients undergoing invasive surgery are very awful and deserve special attention. Wrong procedures may come from a variety of reasons. The most important potential conditions of the WSPEs include failures of communication and teamwork. (Seiden & Barach, 2006.)

5.1.2 Retained foreign bodies (RFBs)

RFBs, also known as retained sponges and instruments (RSIs), has become a rare but still persistent problem. The earliest published reports date was traced back to Wilson, who reported a sponge left after a laparotomy in 1884. Ensuring that no unintended retained foreign bodies are left in the body is a primary responsibility of nurses and surgeons. Gauzes are the most common retainers compared with needles and general instruments. No matter what the foreign body is, the consequences of left-behind objects can cause serious health implications to patients, and also indefensible litigations, and irreparable damage to the reputations of health institutions or hospitals. (Rowlands & Steeves, 2010.)

However, despite the hospital policy and AORN recommended the precautionary guidelines, these events still occur. In this kind of situation, the surgical count plays a vital role in preventing retained items and protecting patients from harm. Although the error can be thought as a result of the decision made by the nurse and the surgeon which complicate the procedure of the operation or may directly affect the outcome of the operation count. These range from a lack of adherence to AORN standards and hospital policies. Nurses should prepare to identify problematic areas and design systems and processes that protect patients. (Al-Qurayshi, Hauch, Slakey & Kandil, 2015.)

5.1.3 Medication and anesthesia errors

Nowadays medication security is a high priority in a hospital environment. The OR is clearly distinguished as a unit with a high probability of medication errors occurrence. When medication errors occur in the OR, the patient is likely to suffer much more harms than when they occur in other units in the hospital. Medication security in the OR is a unique issue since the medicines are taken out and laid aside in the aseptic field from its primitive marked bottle. The most common factors that can cause medication errors are distractions, lack of experience, and emergency situations. The quick rhythm characteristics of the OR and the complication of care provided may contribute to errors. (Hendrickson, 2007.)

Oral orders in the OR are common among surgeons and nurses. For a variety of reasons, oral orders are not always clear. Many medications names sound similar to other medication names, such as methimazole and metolazone, morphine and hydromorphone, gentamicin and gentian violet, and doxycycline and dexamethasone, which can lead to confusion and potentially harmful medication errors. This problem needs to be solved to reduce the potential for miscommunication of these orders. (Hendrickson, 2007.)

5.1.4 Risk of puncture

In the clinical situation, they should use a knife blade with a blade guard function as much as possible and use a blade to remove the accessory. Also, remove all unnecessary sharp equipment. Scalpels, surgical lines, flaps and towel clips not always have needs of sharp points. Let all the staff wear gloves and protective glasses. The blood may be sprayed with a considerable distance, so the protective glasses should be as important as the surgical mask. And evaluate the safety function of the device. Because of the complexity of the OR environment, the use of various devices to reduce exposure will take time and many changes. But this is an investment that will ultimately benefit the staff and the patient. (Perry & Jagger, 2000.)

Needle stick injuries (NSIs), sharps injuries (SIs), and blood and body fluid exposures (BBFEs) occur frequently in hospitals causing by the risk of infection, physical trauma and psychological trauma. The OR presents unique risks of blood-borne pathogen exposure: prolonged exposure to open surgical sites, frequent manipulation of sharp and the presence of relatively large amounts of blood. (Perry & Jagger, 2000.)

5.2 What nursing interventions maximize the patient safety?

According to the risk factors through many studies, we found out three ways to keep patient away from danger and risk.

5.2.1 The use of surgical safety checklist. (SSC)

SSC has become a key security process in the OR and has been introduced into clinical practice in the past few years. Now it is routinely used in many places of the world. It plays a key role in the OR environment. But the WHO encourages that successful implementation of checklists requires modification to suit clinical requirements. (Low, Walker & Heitmiller, 2012.)

Sign in is the stage before induction of anesthesia. Nurse anesthesiologists should do verbal confirmation of the patient's identity, surgical site, and surgery. If appropriate, one should

follow the visual confirmation of the surgical site. Nurse anesthesiologists should talk with anesthesia professionals, and circulatory nurses should examine the patient's risk of blood loss, airway difficulties and allergies, and whether the safety check of anesthesia machines and drugs is completed or not. (Wæhle, Haugen, Søfteland and Hjälmhult, 2012.)

At time out stage, the entire operating team should immediately stop before the incision of the skin to confirm that the correct surgery is on the correct patient as well as the correct location. All team members should orally review the key elements of their operational plans. They should also confirm that prophylactic antibiotics have been given in the last 60 minutes and the necessary imaging is displayed as needed. (Wæhle, Haugen, Søfteland and Hjälmhult, 2012.)

Sign out is the final stage. The team should check the performed actions together. This includes the completion of the gauze and instruments count and the label of any surgical specimen obtained. They should also check key plans and concern about postoperative management and rehabilitation before the patient moves to the recovery room. (Wæhle, Haugen, Søfteland and Hjälmhult, 2012.)

5.2.2 Aseptic technique

Asepsis means the absence of pathogenic microbes in living tissues. All activities here must obey OR sanitation and sterility standards. Everything that comes into the OR must be at least clean. Nurse in the OR should strictly obey the routine of hands preparation in order to ensure the sterilization of hands. When the nurse is preparing the surgical site, the wearing of surgical gloves during preparation decreases the risk of contamination. Gloves do not need to be sterile during these stages of the procedure. Antibacterial agents are usually applied to the skin with swabs. Draping maintains asepsis by preventing contamination of the surgical site by hair and environment. The drapes, typically blue or green, should cover the entire patient and table and expose only the surgical site. (Baines, 1996.)

The sterile field, as an area of asepsis created by unwrapping a large sterile pack onto an instrument trolley, is set up as near to the time of surgery as possible and monitored to avoid contamination. The sterile field includes the sterile table that contains the items required for the surgery, the draped patient and the surgical team members with sterile gowns. The instruments should be laid out by the nurse who is wearing a sterile gown and gloves. It is not recommended for a circulating nurse to complete this equipment arrangement by using forceps. Because the greater risk of contamination might occur when ungloved hands are moved across a sterile table. (Baines, 1996.)

All items within this field should be sterile and a new set of sterile instruments should be used for each procedure. Sterile items added to the sterile field are not allowed to touch nonsterile areas, such as the hands. The front of the gown from chest to table level and the sleeves from above the elbow to the cuff are considered as sterile. The back of the gown is considered as nonsterile. Gowns and gloves must immediately be replaced or changed when they are punctured or broken. Any other sterile break should be noticed and changed immediately. (Baines, 1996.)

5.2.3 Infection prevention

The sterile gown is an occlusive, but not impermeable, barrier to microorganisms, the aim of using this suit is to reduce particulate shedding in the OR. Hair is the primary source of bacterial contamination from the operating team and should be covered. Hoods are considered more effective than caps. The hood chosen should cover the occipital and temporal regions, should be durable and comfortable to wear and should not let shed lint into the surgical site. (Barnes, 2015.)

The majority of hospital-acquired infections are direct and indirect contact transmission. Disposable gloves shouldn't be washed or disinfected for reuse. Wearing the same glove

between the patients may cause indirect contact transmission of microorganisms from patient to patient. If one patient needs the second operation, gloves should also be changed, otherwise, gloves may spread infection. After removing the gloves, one should wash hands immediately to prevent gloves leaks or contamination when the gloves are being removed. Note that fingernails should be no longer than 0.25 inch to prevent puncture of a disposable glove and possibly result in hand exposure to blood or other potentially infectious materials. (Barnes, 2015.)

No matter how the surgery is performed, the same basic surgical infection prevention measures must be reliably implemented, for example, antibiotics application, aseptic and sterile technique, careful equipment preparation, removal of hair from surgical site if needed, containment of staff member's hair. In addition, the nurse should instruct patients to take a preoperative bath or shower before surgery. (Barnes, 2015.)

Cleaning in the OR during the operation aims to remove the adherent visible soil, such as blood, tissue, and pus, from the surfaces, crevices and jaws of instruments, devices and equipment usually with cleaning agent and water. That prepares the items to be continued in use if needed. Decontamination is a critical step in breaking the chain of disease transmission and promoting the sterilization process. (Lynch, Englesbe, Sturm, Bitar, Budhiraj, Kolla, Polyachenko, Duck, Campbell, 2008.)

In the clinical situation, use a sharp instrument with a blade guard as much as possible and use a blade to remove the sharp accessory. In addition, remove all unnecessary sharp instruments, scalpels, surgical lines, flaps, and clips do not always have the need of sharp points. Let all the staff wear gloves and protective glasses. The blood possibly sprays quite far distance; therefore, the protective glasses should be as important as the surgical mask. Furthermore, evaluate the safety feature of the equipment. As a result of the complexity of the

OR environment, the use of various types of equipment to reduce the exposure will take time and money. But this is an investment that finally will help the staff and patient. (Lynch, Englesbe, Sturm, Bitar, Budhiraj, Kolla, Polyachenko, Duck, Campbell, 2008.)

5.2.4 Effective communication

Effective communication in the OR is essential for patient safety in the perioperative environment. In the past, there have been many cases of medical errors caused by the lack of effective communication during the operation, which lead to patient injuries and deaths. It can be the main reason for establishing effective communication in clinical practice as a national and international policy. Effective communication is also an important factor which determines the safety and quality of the patient's operation. Over half of all the adverse events and complications are associated with the procedure. That's why we suggest effective communication between surgeons, nurses, and anesthesiologists. One way to promote effective communication is to obey the SSC. The use of SSC can strengthen and improve teamwork between clinical disciplines. (Phillip 2013.)

When it comes to facilitating effective communication, communication skills have to be mentioned. As a nurse, communication skills are also required in clinical practice. The nurse needs to send information about preoperative preparation to the patient before the operation. The nurse also needs to receive the medical doctor's orders during operation. Excellent communication skills play a key role. The ability of the nurse in communication determines the quality of cooperation with the patient. If the patient cannot coordinate with nurses smoothly in preoperative preparation, the operation will be delayed. Communication skills in the OR can improve the patient safety, quality of the surgery, work atmosphere, giving the others respect. As a key member of the surgical team, the OR nurse must have the communication skills required to provide safe perioperative patient care in a calm atmosphere. (Lingard, Espin, Whyte, Regehr, Baker, Reznick, Bohnen, Orser, Doran & Grober. 2004.)

6 DISCUSSIONS

We used qualitative data to solve the research question. In the implementation of the research operation, we use the literature synthesis to summarize selected articles. It avoids system deviations, highlights potential shortcomings, and identifies existing but non-systematic scientific knowledge.

The aim of this paper is to help the nursing student who wants to become an OR nurse to improve the vigilance of the patient in the OR. From this thesis, they can quickly and effectively understand the importance of the responsibility of the OR nurse and the patient safety, strengthen the consciousness of sterile, know how to prevent nursing errors and keep the patient away from risks in the OR.

For our research problem, we got answers after reading those articles from the database. Wrong-site, wrong-procedure, wrong-patient errors, retained foreign bodies, medication and anesthesia errors, risks of a puncture are four essences that affect the patient safety in the OR. In order to reduce the hazards, the OR nurse can use the surgical safety checklist, effective communication, aseptic technique and infection prevention as the nursing interventions.

When we were doing research, we learnt some key nursing interventions in the operating room. Information loss seems the main reason for most synthetic errors in the OR. Ineffective communication, incorrect oral medication implementation as well as RFBs, all of these point to unequal information exchange. Information loss is common in the other units, but nurses have time to react to this problem. The nurse can call the doctor or ask others if she/he is not determined about the treatment or medication. In the OR, due to its feature of quick paces, it might lead to avoidable serious error. In order to make sure all nurses and surgeons have a clear map of the operation, there comes the SSC, double verbal confirmation, and the surgical count. Most nursing interventions are designed for patient safety in the OR. Usually, nursing interventions in the ward follow the patient's needs to build trust and rapport. However, in the

OR, we cannot follow the patient or even talk with him because of anesthesia during the surgery. Therefore, nursing interventions here are a little different from the other wards. How to protect the patient safety and prevent infection depends on the surgical safety checklist, effective communication, aseptic technique and so on. In addition to those elements, we still need an effective cooperation between the members of the surgical team. Information can be a foundation to make an effective cooperation. We get the conclusion that information loss stimulates the development of nursing interventions while nursing interventions avoid information loss. Both of them keep patient safe in the OR.

When we were writing this thesis, we learnt that a few places not only easily cause the patient safety problems but also easily overlook them. We are reminding the nursing student as well as improving our own knowledge about the OR. For example, the circulating nurse maintains the aseptic OR environment including limited the number of people in the OR. This one can be easily neglected in the responsibility of circulating nurse which might become a risk to threaten the patient safety. We think our thesis is worthy for the nursing student who will work in the OR but doesn't know some specific things in the OR. That knowledge can help and protect everybody in the OR.

There are still some problems that needed to be studied in the future. The electrical appliance in the OR is a big and common part during an operation. The OR nurse should be familiar with all appliances so that they can coordinate with surgeons and patients. But we don't have enough working experience and appliances knowledge to describe a comprehensive concept for readers. What's more, we are not familiar with the staff management so we cannot discuss about how the change of surgical team affecting the patient safety.

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Appendix 1. The surgical safety checklist

Surgical Safety Checklist		
World Health Organization		Patient Safety <small>A World Alliance for Safer Health Care</small>
Before induction of anaesthesia	Before skin incision	Before patient leaves operating room
(with at least nurse and anaesthetist)	(with nurse, anaesthetist and surgeon)	(with nurse, anaesthetist and surgeon)
<p>Has the patient confirmed his/her identity, site, procedure, and consent?</p> <input type="checkbox"/> Yes	<input type="checkbox"/> Confirm all team members have introduced themselves by name and role.	<p>Nurse Verbally Confirms:</p> <input type="checkbox"/> The name of the procedure <input type="checkbox"/> Completion of instrument, sponge and needle counts <input type="checkbox"/> Specimen labelling (read specimen labels aloud, including patient name) <input type="checkbox"/> Whether there are any equipment problems to be addressed
<p>Is the site marked?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	<input type="checkbox"/> Confirm the patient's name, procedure, and where the incision will be made.	
<p>Is the anaesthesia machine and medication check complete?</p> <input type="checkbox"/> Yes	<p>Has antibiotic prophylaxis been given within the last 60 minutes?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	
<p>Is the pulse oximeter on the patient and functioning?</p> <input type="checkbox"/> Yes	<p>Anticipated Critical Events</p> <p>To Surgeon:</p> <input type="checkbox"/> What are the critical or non-routine steps? <input type="checkbox"/> How long will the case take? <input type="checkbox"/> What is the anticipated blood loss?	
<p>Does the patient have a:</p> <p>Known allergy?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes	<p>To Anaesthetist:</p> <input type="checkbox"/> Are there any patient-specific concerns?	
<p>Difficult airway or aspiration risk?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes, and equipment/assistance available	<p>To Nursing Team:</p> <input type="checkbox"/> Has sterility (including indicator results) been confirmed? <input type="checkbox"/> Are there equipment issues or any concerns?	<p>To Surgeon, Anaesthetist and Nurse:</p> <input type="checkbox"/> What are the key concerns for recovery and management of this patient?
<p>Risk of >500ml blood loss (7ml/kg in children)?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes, and two IVs/central access and fluids planned	<p>Is essential imaging displayed?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged. Revised 1 / 2009

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Appendix 2.

AUTHORS & JOURNALS & YEARS	NAME OF THE ARTICLE	CONTENT & RESULTS OF THE ARTICLE
Al-Qurayshi, Z.H., Hauch, A.T., Slakey, D.P. & Kandil, E. Journal of the American College of Surgeons. Volume 220, Issue 4, Pages 749-759. 2015.	Retained Foreign Bodies: Risk and Outcomes at the National Level.	Retained foreign bodies after operative interventions have a relationship with an increased risk of morbidity and mortality. Retained foreign bodies have harmful clinical and economic outcomes. The risk factor for RFB indicates an association with clinical factors including nature of the procedure, type of admission, and trauma status. There is a need for targeted efforts to identify high-risk groups to avoid these costly complications.
Barnes, S. May 1, 2015. AORN Journal.	Infection Prevention: The Surgical Care Continuum.	Lack of careful attention to the increasing complexity of surgical procedures and instrument cleaning can contribute to surgical site infection risk. Regardless of the location of an intervention, when basic infection prevention measures are applied reliably, even low infection rates can be reduced. To address infection prevention challenges, infection perfectionists must be well informed

		regarding infection risk and prevention during surgical and other invasive procedures and the effect a facility type may have on patients' infection risk.
Baines, S. In Practice. 1996.	Surgical asepsis: principles and protocols.	This article discusses the stages in the prevention of wound contamination. The basic principle of aseptic technique is that microbiological contamination and subsequent infection cannot occur if microorganisms are totally excluded from a wound. The reality of aseptic technique is a working set of complementary and independent technologies and OR protocols designed to prevent or minimize microbiological contamination of the surgical wound. All items that come into contact with the wound should be sterile. If an item cannot be made sterile, it is rendered surgically clean by washing with antiseptics or disinfectants which destroy most, but not all, microorganisms.

<p>Hendrickson, T. AORN JOURNA.VOL 86, No. October 2007.</p>	<p>Verbal Medication Orders in the OR.</p>	<p>Medication errors are the fourth most commonly reported sentinel event, and changes in practice are needed to provide a safe environment for patients in the OR. Existing measures for preventing medication errors in the OR have focused on labeling medication containers on and off the sterile field. Very little attention, however, has been given to the potential for errors caused by verbal orders in the OR or to developing processes to prevent such errors. Simple solutions for improving the safety of verbal medication orders include instituting a read-back system in which verbal orders are written on a dry-erase board and verified by the ordering physician, requesting clarification of questionable orders, and reducing distractions in the OR.</p>
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<p>Lingard, L., Espin, S., Whyte, S., Regehr, G., Baker, G. R., Reznick, R., Bohnen, J., Orser, B., Doran, D., Grober, E. Qual Saf Health Care. 2004.</p>	<p>Communication failures in the operating room: an observational classification of recurrent types and effects.</p>	<p>The author considers that ineffective team communication is the cause of medical error in the OR. The purpose of this study is to describe the features of communication failures in the OR and their effects. The failures can be identified as occasion failures, content failures, audience failures, purpose failures.</p>
<p>Low, D., Walker, I., Heitmiller, E.S., Kurth, D. Pediatric Anesthesia. 2012.</p>	<p>Implementing checklists in the operating room.</p>	<p>This paper describes the background and context of how checklists have evolved in medicine. It also highlights human factors training with relation to checklist design, testing and implementation and ongoing coaching.</p>
<p>Lynch, R.J., Englesbe, M.J., Sturm, L., Bitar, A., Budhiraj, K., Kolla, S., Polyachenko, Y., Duck, M.G., Campbell, D.A. American Journal of Medical Quality, vol. 24, 1: p45-52. December 5, 2008.</p>	<p>Measurement of Foot Traffic in the Operating Room: Implications for Infection Control</p>	<p>Surgical site infections are the most common nosocomial infection among surgical patients and cost much money on per infection. The author considers that the proper OR environment against infection requires sterile equipment, adequate disinfection of the patient's skin, and maintenance of clean air in the OR. All staff should wear masks, hats, and gowns designed to minimize seeding</p>

		the air with bacteria.
Rowlands, A., Steeves, R. AORN Journal. October 1, 2010.	Incorrect Surgical Counts: A Qualitative Analysis.	This article talks about the safety culture is arguably the best defense in providing a safe environment for patients. Patient safety practices can be enhanced by using a variety of tools to reduce the likelihood of errors. Given the complex nature of the OR environment, perioperative nurses must be committed to the common goals for patient safety and take the necessary steps to ameliorate incorrect surgical counts as well as correct other problem areas.
Seiden, S.C., Barach, P. JAMA Surgery. September 1, 2006.	Wrong-Side/Wrong-Site, Wrong-Procedure, and Wrong-Patient Adverse Events. Are They Preventable?	Wrong-side/wrong-site, wrong-procedure, and wrong-patient adverse events, which are regarded as things that cannot have, are more common in clinical work with unknown reason. Preventing WSPE needs new ideas and technology of innovation, studies the clinical case-reporting, as well as successful safety initiatives.
Wæhle, H. V., Haugen, A. S., Søfteland, E. and Hjälmhult, E. BMC Nursing. January 1, 2012.	Adjusting team involvement: a grounded theory study	The author thinks even if after the use of SSC causes the remarkable reduction of mortality rate and disease

	<p>of challenges in utilizing a surgical safety checklist as experienced by nurses in the operating room.</p>	<p>incidence rate, improves the information communication, however, the use of the checklist as if also differs from. In this basic study, the purpose is to carry out the challenge and strategy of SSC. Even if the nurse admits SSC as a detailed list with a loyal manner about their duty work, in the actual use, the society and specialized condition may adjust their action to involve in their working conditions which is an incomplete use of low obedience rate.</p>
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