

## Special Article

## Nursing Practices in the Prevention of Post-Operative Wound Infection in Accordance with Evidence-Based Approach

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### Abstract

Nurses, working around the clock, are in an ideal position to participate or play a leading role in taking initiatives that aimed to ensure quality of care and thus to enhance patient safety which includes prevention of surgical site infections. Previous research has used survey, chart audit and algorithm methods to describe wound care practices. However, little research has been published using contemporaneous observations to describe the surgical wound management practices of nurses. The aim of this study is to describe the postoperative wound care practices of surgical nurses and the evidence-based guideline recommendation of wounds.

**Keywords:** Postoperative wound infection, prevention, nursing practice, nursing, evidence-based.

### Introduction

Surgical site infections (SSIs) are one of the important complications after surgery that can cause undesired patient outcomes. SSIs is a type of wound infection which occurs after a surgical operation. SSIs have been shown to consist up to 20% of all of healthcare-related infections. At least 5% of patients undergoing a surgical procedure develop a surgical site infection (Ding, Lin and Gillespie, 2016). Although some surgical complications are inevitable, the quality of surgical care can be improved if the focus is on evidence-based practice recommendations and decisions are made (Gillespie et al., 2014). The most important factor in preventing surgical site infections is the full and absolute compliance of health professionals with the recommendations in the guidelines (Han and Choi-Kwon, 2011, Maurya and Mendhe, 2012; Ding et al., 2017; Qasem and Hweidi, 2017).

### Surgical Site Infections

The infections that occur within first 30 days after a surgical operation if no implant is placed or within 1 year after a surgical operation if an implant is placed and the infections appears to be related to a surgical operation, are called as surgical site infections (Famakinwa et al., 2014;

Harrington, 2014; Ding et al., 2017). Despite innovations in the surgical techniques, technological advances in the operating room, environmental improvements, and the use of prophylactic antibiotics, surgical site infections (SSI) remains an important source of morbidity and mortality in patients after surgery (Gillespie et al., 2014).

SSIs have a significant impact on the global health care system and are associated with increased duration of stay in hospital, extra health care costs, mortality, pain, discomfort, and, in some cases, permanent disability (Maurya and Mendhe, 2014; Ding, Lin, Gillespie, 2016; Ding et al., 2017). In addition, in some studies SSI has been shown to significantly influence patients' mobility, independent life, and psychological health (Cahill et al., 2008; Andersson et al., 2010; Harrington, 2014; Maurya and Mendhe, 2014; Qasem and Hweidi, 2017). In the UK, the National Institute for Health and Care Excellence (NICE) estimated that 5% of all surgical procedures resulted in SSI, accounting for up to 20% cases of health care associated infections (Ding, Lin, Gillespie, 2016).

SSI continues to be a problem for postoperative care and wound management because of the

increased number of surgeries performed each year, the increased cost to patient and health care systems, and the increased mortality rate (Ding et al., 2017). Notwithstanding the imperative to implement preventative measures to reduce the risk of SSI, their negative effects remains an international concern for frontline clinicians and hospital administrators alike (Gillespie et al., 2014).

### **Prevention of Surgical Site Infections**

SSI is a health care-related disease in which a wound infection occurs after an invasive (surgical) procedure. Prevention of SSI is an important issue in both high- and low-income countries (Maurya and Mendhe, 2014). It was stated that although all bacterial infections can not be prevented, a significant number of infections may be avoided by precautions to be taken in preoperative, operative and postoperative periods, and evidence-based infection control measures (Maurya and Mendhe, 2014; Gillespie et al., 2014; Ding, Lin, Gillespie, 2016).

For this reason, a number of prevention strategies are proposed for preoperative, operative, postoperative periods to reduce surgical site morbidity by Australian Wound Management Association (AWMA, 2016), Canadian Association of Wound Care (CAWC, 2018), Centers for Disease Control and Prevention (CDC, 2017), National Institute for Health and Care Excellence (NICE, 2017), World Health Organization (WHO, 2016). In this study, some principles were included for postoperative wound management in reducing the SSI rate in the direction of current guidelines These include the guidelines in Table 1.

However, prevention of surgical site infections is complex and requires several precautions to be taken before, during and after surgery. In addition, the implementation of these measures has not been standardized worldwide. There is no international directive at the moment and there is often inconsistency in the interpretation of the evidence and recommendations between national guidelines (Ozbayir, 2016).

### **Use of Evidence-Based Guidelines to Prevent Surgical Site Infections**

The highest level evidence is required for evidence-based medicine and ultimately practice with focus on wound care (Maurya and Mendhe, 2014). It has been suggested that the use of

evidence-based guidelines in wound care has the potential to improve patient outcomes and reduce hospital wound care costs (Gillespie et al., 2014). According to Maurya and Mendhe (2014), proof based wound management was defined as the combination of best scientific evidence with clinical expertise and patient values by David Sackett (2000) Maurya and Mendhe, 2014). In relation to the subject, Gillespie et al. (2014) carried out an audit in the United Kingdom; it indicated that nursing time spent on dressing changes was 88.5 full-time equivalents over 1 year, while wound-related costs of patients were found to be between 19,000–31,000 bed days per year. In the United Kingdom, economic estimations demonstrate that wound-related costs consist approximately 4% of all health costs and this ratio is rising (Gillespie et al., 2014). According to Ding et al. (2017), it was stated in the systematic compilation of Umscheid et al. (2011) conducted with hospitals in United States, 55% of the SSIs can be avoided by existing evidence-based guidelines (Umscheid et al., 2011; Ding et al., 2017). In a study by Maurya and Mendhe (2014) on the prevention of post-operative wound infection according to evidence-based practice, educators trained in wound care informed nurses about new evidence-base practices of wound care. Knowledge, attitudes and behaviors of nurses in the study were evaluated before and after the training. It was found that nurses' knowledge, skills and attitude of wound care was 58.57% while developed by 100% and that patients were satisfied with this practice (Maurya and Mendhe, 2014).

### **Role of Nurse in Surgical Site Infections Prevention and Effective Wound Care**

Nurses working all day are in an ideal position to take part or to become the leader in interventions aimed at ensuring the quality of care, thereby increasing patient safety, including the prevention of SSIs (Teshager, Engeda, Worku, 2015). Nurses should have knowledge of high-quality nursing care; and reasons, effects, management and evidence - based recommendations of SSI's (Han and Choi-Kwon, 2011; Harrington, 2014; Qasem and Hweidi, 2017). Nurses should be aware of surgical site infections, classifications, risk factors and populations at risk, signs and symptoms of surgical site infection, antibiotic prophylactic use, preoperative skin preparations, postoperative surgical field care, infection control standards and surgical site infection prevention strategies.

Nurses should also defend their patients in any case (Gould, 2012; Yao, Bae, Yew, 2013; Qasem and Hweidi, 2017). Nurses need evidence-based guidelines for effective wound care. Evidence-based clinical practice guidelines are an effective communication tool for health care professionals and can help them make decisions (Han and Choi-Kwon, 2011).

The training of healthcare professionals can improve the level of knowledge, thus it promotes the implementation of anti-infection guidelines that directly contribute to the reduction of health-related infections (Belowska, Panczyk, Gotlib, 2014). However, a significant number of studies have shown that health professionals do not have sufficient knowledge to prevent surgical site infections, evidence-based guidelines and recommendations are not being applied correctly, and health professionals need information (Meeks et al., 2011; Awad, 2012; Belowska, Panczyk, Gotlib, 2014; Brisibe, Ordinihoa, Gbeneolol, 2014; Famakinwa et al., 2014; Mitchell et al., 2014; Surme, 2014; El-Sayed, Gomaa, Abdel-Aziz, 2015; Teshager, Engeda, Worku, 2015; Qasem and Hweidi, 2017). Labeau et al. (2010) conducted a study in Belgium, to evaluate nurses' knowledge levels about evidence based guidelines for the prevention of SSIs for identifying their specific educational needs. They found that male nurses were more knowledgeable than their female colleagues on the implementation of the SSIs prevention guidelines (Labeau et al., 2010). Awad (2012) found that the compliance with SSI prevention guidelines was poor at two different county hospitals. Clinicians' adherence to surgical care bundle tactics such as the 'Surgical Care Improvement Project' for the prevention SSIs was insufficient (Awad, 2012). Another study which was conducted in Australia found that there was a positive relationship between the number of years of occupational experience and nurses' level of knowledge on the prevention of SSIs (Qasem and Hweidi, 2017). In a descriptive study conducted by Surme (2014) with 311 nurses working in the surgical services to determine the knowledge and practice levels of the nurses on wound healing at the incision site, it was found that half of the nurses do not perform practices for wound healing, and more than half of them do not regularly perform discharge trainings related to wound care and that nurses need training (Surme, 2014).

Another important issue about effective wound care is the education of the patient, family and relatives of the patient. Nursing who give care in the preoperative perioperative and postoperative periods have an important role in counseling about the risks associated with SSIs and how the infection should be managed (Harrington 2014).

The guidelines of NICE (2017) and AWMA (2010) contains consideration of patient training, which state that nurses should provide information and advice to patients and caregivers through all care stages. Information should contain the risks of developing SSIs, how to reduce the risks and how to manage SSIs (AWMA, 2010; NICE, 2017).

The guidelines recommend that clinicians inform the patient and/or their caregivers with evaluation outcomes and education that is suitable for their age and cognitive status (Ding et al., 2017). Study of Ding et al. (2017) which examined nursing practices to prevent postoperative wound infections, reported that more than one-third of the surgical nurses did not use clean gloves properly, one-fifth of nurses did not use sterile gloves properly, more than half of them did not train patients on postoperative wound management, and the recommended and applied practices in wound care show difference (Ding et al., 2017).

Nurses have the responsibility to ensure that all SSI standards are met and that evidence-based guideline principles are applied to ensure optimal patient outcomes (Harrington, 2014). The successful application of infection control measures, especially SSI prevention measures, and well-structured continuing education programs are considered as a substantial element that would improve nurses' knowledge about evidence based guidelines to prevent SSIs and ultimately leads to positive impacts on surgical patients who admitted to the acute care settings in the context of patients' quality of care, and patient safety.

Thus, hospital administrators and all other related parties should continue to emphasize more on nurses' educational needs, particularly nurses working in acute care settings in order not to compensate quality of care delivered in acute care settings (Qasem and Hweidi, 2017). A infection control policy and procedures for guiding surgical unit nurses should be established.

## Wound Care Assessment and Documentation

Accurate assessment and documentation of wounds by staff is essential for effective wound care and best practice (Gartlan et al., 2010; Kinnunen et al., 2012; Gillespie et al., 2014). Comprehensive wound assessment and documentation has the potential to reduce the incidence of SSI, morbidity and mortality, and the economic burden on patients, hospitals, and the health care system (Kinnunen et al., 2012; Ding, Lin, Gillespie, 2016).

The management of SSIs and the protection of surgical patients from SSIs are determined by accurate wound assessment and documentation practice, updated knowledge of proof-based wound care clinical practice guidelines. Experts have recommended that the prevention of SSIs should concentrate on preoperative, intraoperative and postoperative assessment and management. According to the AWMA, the documentation of wounds provides a legal and complete record of the patients' history of health, wound assessment outcomes, diagnostic investigations, the plans of prevention and treatment (Ding, Lin, Gillespie, 2016).

The importance of surgical wound assessment and documentation to decrease SSI complications is increasingly known. Wound assessment, including direct observation of surgical wounds, is reported to be the most accurate technique for identifying SSIs (Ding, Lin, Gillespie, 2016). Evidence-based clinical practice guidelines (EBCPRs) have been published worldwide to emphasize recommended practices for wound assessment and documentation. EBCPRs recommend that acute wounds should be evaluated daily or upon every dressing change. Wounds should be reassessed after receiving patients from the operating room or a different facility, or if the wound markedly deteriorates, and develops an odour or purulent exudates (Ding, Lin, Gillespie, 2016). From these guidelines, NICE recommends correct wound assessment since it directs medical treatment, and identifies problems during the recovery process (NICE, 2017). According to AWMA, a comprehensive wound assessment is the best way to determine if the wound is progressing and whether the wound has reached its desired recovery goal. The comprehensive and continuous evaluation include wound type, wounding aetiology and wounding mechanism, wounding duration, anatomical location of the

wound, wound dimensions should be conducted. Clinical characteristics of wound bed and wound edge, peri-wound and surrounding skin characteristics, exudate, wound healing stage, the signs and symptoms of inflammation or infection should be documented by digital photography or technologie (AWMA, 2010). According to Ding et al. (2016), The World Union of Wound Healing Societies (WUWHS) has recommended that the assessment of wound infections' symptoms should include an increase in wound dimensions, offensive odour, pyrexia, wound dehiscence or breakdown (WUWHS, 2008). These recommendations provide broad guidance only on wound assessment. However, it was noted that there are shortcomings as to which instruments can be used to evaluate surgical wounds and how the obtained information will be documented (Gartlan et al., 2010; Ding, Lin, Gillespie, 2016).

Wound care is a worldwide concern, and appropriate documentation process of wound evaluation, interventions, and patient outcomes is a substantial challenge for all health care system (Kinnunen et al., 2012). Wound documentation process is also required for legal aims because it provides a legal record of the care provided and enables to evaluate wound treatment or the standards of wound care retrospectively (Gartlan et al., 2010). Accurate documentation of wound assessment and management is valuable for early identification and early intervention of SSIs (Gillespie et al., 2014; Ding, Lin, Gillespie, 2016), it has also been shown to facilitate effective communication in the multidisciplinary health care team (Gartlan et al., 2010). However, the limited number of studies (Gartlan et al., 2010; Han and Choi-Kwon, 2011; Kinnunen et al., 2012; Ding, Lin, Gillespie, 2016) reported that acute wound assessment and documentation do not meet the needs of the country. It has been reported that nurses meet various problems with documentation of wound care, and that lack of time, limited number of nurses, non-mentoring of experienced nurses, nursing culture which sabotages orders constitute reasons of bad nursing documents (Gartlan et al., 2010).

It was stated standardized systems in the documentation of the wound status and wound care interventions that provide evidence to nurses and prospective observational studies to measure these systems are needed (Gartlan et al., 2010; Kinnunen et al., 2012; Gillespie et al., 2016;

Ding, Lin, Gillespie, 2016; Ding et al., 2017; Timmins et al., 2018).

### Multidisciplinary Approach in Wound Care

Wound care is a common concern for different disciplines, even though it is generally accepted as a responsibility of nurses (Gartlan et al., 2010). A multidisciplinary team work based on supervision and surveillance is needed to early identification of symptoms and indications, the implementation of evidence-based guidelines, reduction and prevention of SSI. Multidisciplinary team should include surgeons, anesthetists, operating room managers, microbiologists, infection control nurses, administrative staff, surveillance and supervisory staff. A coherent multidisciplinary team analyzes reports on SSIs and communicates results to all team members and monitors local policies and procedures to avoid risking patient safety (Harrington, 2014). In Australia, quality improvement unit has created a team of clinic services director, orthopedic surgeon, infection control nurse, managers of operating room and nurse surgical unit, general surgeon and university professors to prevent SSI, and employees and patients were trained. As a result, it was noted that postoperative infection rates were reduced with team effort (Maurya and Mendhe, 2014).

### Conclusions and recommendations

Nurses have an important role in the prevention of surgical site infection and in providing wound healing. Surgical nurses need to know and apply the recommendations of the evidence-based clinical practice guidelines to ensure optimal patient outcomes in postoperative wound care management. However, there is a need for an internationally accepted standard checklist that can be used with a multidisciplinary health team in the prevention of postoperative wound infections and wound management. The standard checklist to be used is thought to have an important effect in preventing and reducing wound infections.

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**Table 1. Recommendations of current guidelines on postoperative wound care management**

<b>Guidelines</b>	<b>Recommendations</b>	<b>References</b>
Glycemic Control	<ul style="list-style-type: none"> <li>• Implement perioperative glycemic control and use blood glucose target levels less than 200 mg/dL in patients with and without diabetes.</li> </ul>	CDC 2017 (HQE)
Normothermia	<ul style="list-style-type: none"> <li>• Maintain perioperative normothermia</li> </ul>	CDC 2017 (H-M QE) WHO 2016 (MQE)
Perioperative oxygenation	<ul style="list-style-type: none"> <li>• For patients with normal pulmonary function undergoing general anesthesia with endotracheal intubation, administer increased FIO<sub>2</sub> during surgery and after extubation in the immediate postoperative period</li> </ul>	CDC 2017 (MQE) WHO 2016 (MQE)
Assessment of the surgical wound	<ul style="list-style-type: none"> <li>• Type of wound</li> <li>• Duration of wound</li> <li>• Location of wound</li> <li>• Dimension of wound (length x width x depth)</li> <li>• Clinical characteristics of wound bed (red, pink, yellow, black, undermined)</li> <li>• Wound edge appearance (callus and scale, maceration, erythema, oedema)</li> <li>• Periwound appearance</li> <li>• Exudate type (serous, haemoserous, sanguineous, seropurulent, purulent) and colour</li> <li>• Phase of wound healing (e.g. haemostasis, inflammation, reconstruction, maturation/remodelling).</li> <li>• Wound pain</li> <li>• Presence of foreign bodies</li> <li>• Early signs and symptoms of infection (serous exudate with erythema, swelling with an increase in exudate volume, edema, increase in local skin temperature and unexpected pain or tenderness)</li> <li>• Prior wound treatments and their therapeutic outcome</li> </ul>	AWMA 2010 WHO 2016
Wound assessment method: nursing check list	<ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Assessment tools used</li> </ul>	CDC 2017 AWMA 2010
Dressing management	<ul style="list-style-type: none"> <li>• Use an aseptic non-touch technique for changing or removing surgical wound dressings</li> <li>• Perform hand hygiene before and after dressing changes and any contact with the surgical site</li> <li>• Protect an incision that has been closed primarily with a sterile dressing for 24–48 hours postoperatively</li> <li>• Eusol and gauze, or moist cotton gauze or mercuric antiseptic solutions are not recommended on surgery wounds healing by secondary intention.</li> </ul>	NICE 2017

	<ul style="list-style-type: none"> <li>• Use an appropriate interactive dressing to manage surgical wounds that are healing by secondary intention.</li> <li>• Refer to a tissue viability nurse for advice on appropriate dressings healing by secondary intention.</li> </ul>	
Wound cleansing	<ul style="list-style-type: none"> <li>• Use sterile saline for wound cleansing up to 48 hours after surgery.</li> <li>• Advise patients that they may shower safely 48 hours after surgery.</li> <li>• Use tap water for wound cleansing after 48 hours if the surgical wound has separated or has been surgically opened to drain pus.</li> </ul>	NICE 2017 CAWC 2018
Topical antimicrobial agents	<ul style="list-style-type: none"> <li>• Topical antimicrobial agents are not recommended on surgery wounds healing by primary intension.</li> </ul>	NICE 2017
Antibiotic treatment	<ul style="list-style-type: none"> <li>• When a surgical site infection is suspected (eg. cellulite), the patient should be given antibiotics. Consider local resistance patterns and the results of microbiological tests in choosing an antibiotic.</li> </ul>	NICE 2017
	<ul style="list-style-type: none"> <li>• Administer the appropriate parenteral prophylactic antimicrobial agents before skin incision in all cesarean section procedures.</li> <li>• In clean and clean-contaminated procedures, do not administer additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room, even in the presence of a drain.</li> </ul>	CDC 2017 (HQE)
	<ul style="list-style-type: none"> <li>• Surgical antibiotic prophylaxis administration should not be prolonged after completion of the operation</li> </ul>	WHO 2016 (MQE)
Debridement	<ul style="list-style-type: none"> <li>• Avoid eusol and gauze, or dextranomer or enzymatic treatments yo manage wound infection.</li> </ul>	NICE 2017
Education of the patient, family, and caregiver	<ul style="list-style-type: none"> <li>• Advise the patients that they may shower safely 48 hours after surgery</li> <li>• Inform about how to recognize an SSIs and who to contact if they are concerned.</li> <li>• Inform the patients after their operation if they have been given antibiotics.</li> <li>• Educate the patient on how to care for the wound after discharge and follow up wound care.</li> </ul>	AWMA 2010 NICE 2017 CAWC 2018
Documentation of findings using a standardized approach	<ul style="list-style-type: none"> <li>• Initial and ongoing wound assessments</li> <li>• Environmental assessment</li> <li>• Documented care plan</li> <li>• Integrated care pathway for the management of wound complications</li> <li>• Collaborative multidisciplinary approach to patient care</li> </ul>	AWMA 2010 NICE 2017
Team approach in wound healing	<ul style="list-style-type: none"> <li>• Effective communication</li> </ul>	AWMA 2010 CAWC 2018

HQE: High-Quality Evidence; MQE: Moderate-Quality Evidence

**Note:** We abstracted data from the following guidelines: the Australian Wound Management Association (AWMA), the Canadian Association of Wound Care (CAWC), the Centers for Disease Control and Prevention (CDC), the National Institute for Health and Care Excellence (NICE), the World Health Organization (WHO).