Letter to the Editor

Journal of Infection Prevention

Journal of Infection Prevention
2021, Vol. 22(1) 46–48

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DOI: 10.1177/1757177420956257
jip.sagepub.com
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Plastic and reconstructive surgical procedures should be incorporated into the surgical site infection (SSI) surveillance programme across Scotland

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Keywords
Surgical site infection, surveillance, quality improvement, patient satisfaction, healthcare-associated infections, infection prevention

Date received: 25 May 2020; accepted: 29 July 2020

The impetus for this communication emanates from the upward trend in readmission rates and long hospital stays due to surgical site infections (SSI) from plastic and reconstructive surgical procedures as observed in an inpatient surgical practice experience. While adequate measures are being undertaken to prevent SSIs, there was an increasing number of cases that were being put forward for further medical intervention.

Using the ASEPSIS grading scale, SSI is characterised by Additional treatment, Serous discharge, Erythema, Purulent exudate, Separation of deep tissues, Isolation of bacteria and Stay as inpatient prolonged over 14 days (Wilson et al., 1990). This could be superficial, affecting only the skin, or more severe, involving underlying skin tissues, organs or implants. Infection often occurs 30 days after a surgical procedure for superficial surgical sites or within 90 days to one year if an implant is placed (European Centre for Disease Prevention and Control [ECDC], 2016).

SSI is one of the most common healthcare-associated infections (HAI) and is a major problem that contributes to the poor health outcome of patients with consequences such as social disruption, increased pain, hospital readmission and, in some cases, further surgical intervention (National Institute for Health and Care Excellence [NICE], 2019; World Health Organization [WHO], 2016). The presence of fever, formation of abscesses and accumulation of fluid around the tissues may prevent wound healing, and could further lead to severe health challenges which is estimated on the average to double the cost of treatment, mainly due to the resultant increase in length of stay and fewer hospital beds.

Diagnostic tests, such as white blood cell (WBC) count, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), are frequently used to confirm SSI where patients present with symptoms. However, CRP level is superior to WBC and ESR in detecting SSI because of its rapid increase in response to inflammation. While increased CRP may be a response to pain, it is often recommended to determine the preoperative and postoperative level of CRP in order to rule out surgical pain and pre-existing infection. Several factors that may be responsible for the prevalence of SSI include: the type of procedure (trauma or elective); age and susceptibility to infection; nature of preoperative site (i.e. clean, clean-contaminated, contaminated or infected wound); possible hypothermia emanating from a drop in core temperature below 36 °C; and the use of complex surgical interventions and threats from multidrug-resistant microorganisms (NICE, 2019; WHO, 2016).

SSI remains one of the most frequent type of HAI in high-income countries (ECDC, 2016; WHO, 2016). It is estimated that an average of £183 million is spent on HAI, which accounts for about 16.5% of inpatient HAI within NHS Scotland (Health Protection Scotland [HPS], 2019a).

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Recent epidemiological data on SSI in Europe per 100 procedures shows that colon surgery has a cumulative incidence of 9.5% followed by coronary artery bypass graft (3.5%), caesarean delivery (2.9%), cholecystectomy (1.4%), hip prosthesis (1.0%), laminectomy (0.8%) and knee prosthesis (0.75%) (ECDC, 2016). It was further disclosed that species of Gram-positive cocci, such as *Staphylococcus aureus*, and Gram-negative bacilli and Enterobacterales, such as *Escherichia coli* and Klebsiella species, respectively, made up a higher percentage of the microorganisms identified in SSIs across the reported surgical procedures from 13 European countries. Moreover, methicillin-resistant *S. aureus* (MRSA) and carbapenemase-producing enterobacterales (CPE) are also likely to dominate surgical wounds.

Although the risk associated with HAI can be significantly reduced using standard infection control measures, the inadequate implementation of these principles within the perioperative environment by healthcare professionals poses a great risk to patients. The poor selection of antibiotics for prophylaxis and change in the route of administration of antibiotics from intravenous to oral (IV to PO) before discharge also increases the risk of SSI (NICE, 2019; Thompson et al., 2015). Furthermore, improper administration of intravenous antibiotics to patients within their own homes by the outpatient parenteral antimicrobial therapy (OPAT) team has also been associated with SSI (Chapman, 2013). Owing to concerns about antimicrobial resistance and the lack of evidence on the effectiveness of topical antiseptics and antibiotics before wound closure, there has been limited use of intraoperative topical antibiotic and antiseptics until the establishment of an evidence base to inform practice (NICE, 2019).

SSI may also result from the use of inappropriate dressings for the management of surgical wounds (NICE, 2019). While the risk of infection is likely to increase outside the care environment, it is necessary that good hygienic practice is maintained by the patient after discharge. The increase in ambulatory surgeries comes with a timely discharge of patients. However, there is a risk of complications from infection because patients are far from the watchful eyes of caregivers. It is necessary to ensure that adequate measures are taken to minimise infection.

Surveillance of SSI plays a key role in informing practice to enhance patient safety, quality improvement and effective clinical governance within the NHS. Hence, it becomes possible to identify patients at risk of developing SSI and put in place interventions to prevent its occurrence. Surveillance systems also provide a means of measuring the quality of care delivery by healthcare professionals with respect to the use of evidence-based strategies and the need for further staff training to ensure positive patient outcome and allocation of resources for post-discharge follow-up. Besides, SSI may have a lasting impact on individuals resulting in reduced satisfaction with the surgical outcome due to impaired body image and low self-esteem.

NHS Scotland routinely collects epidemiological data through the mandatory SSI national surveillance programme across all NHS boards in Scotland. So far, the four mandatory procedures included for SSI surveillance protocol are caesarean delivery, hip arthroplasty, planned large bowel and vascular procedures (Health Protection Scotland, 2019a, 2019b). Furthermore, the criteria for inclusion into the SSI surveillance programme has been restricted to only planned procedures and may occasionally include emergency procedures which could may give a wrong estimate of its prevalence.

The health impact and decreased quality of life from the complications of SSI after breast reconstruction, skin graft, amputation and lymphadenectomy have been emphasised in recent literature (Olsen et al., 2017; Onyekwelu et al., 2017; Palubicka et al., 2019). Surgical reconstructive procedures with autograft or breast implants after mastectomy is aimed at enhancing body image. According to Olsen et al. (2017), the rate of SSI in mastectomy without immediate reconstruction was 3%−18%, compared to 0.4%−17% and 1%−12% for mastectomy with implant reconstruction and autologous flap reconstruction, respectively. The higher rate of SSI after mastectomy could be a result of lengthy operative time and accumulation of serous fluid which serves as a source of nutrients for microorganisms. Although reconstruction can be carried out 3−6 months after mastectomy, rates of SSI after immediate implant reconstruction or autologous flap reconstruction were in the range of $< 1\%$ to $> 10\%$ (Olsen et al., 2017). It can be further speculated that the huge disparities between the rate of SSI in breast reconstruction suggests the need for a strict surveillance system and follow-up after discharge.

The incidence of SSI after amputation and reconstruction using artificial prosthesis has also been reported to be greater than 14% (Onyekwelu et al., 2017). Notwithstanding that Gram-positive S. aureus accounts for more than 60% of isolated microorganisms, the introduction of foreign material further increases the likelihood of infection (Palubicka et al., 2019; Russell et al., 2020). So while wound drainage is often required for deep tissue procedures, prolonged drainage is a major predisposing factor for infection in surgical patients. Consequently, wound sites may further become colonised by drug-resistant variants, which is likely to increased treatment cost and length of hospital stay.

In conclusion, there has been an omission of breast reconstruction, skin graft, amputation and lymphadenectomy in previous reports on HAI, which are the major reconstructive surgical procedures. An infection resulting from any of these procedures may lead to a poor quality of life and wellbeing for the affected patient. While epidemiological data of SSI on large bowel and vascular procedures have been incorporated in the SSI surveillance programme, there is a need to include that of plastic and reconstructive surgical procedures owing to its place in most cancer therapy and palliative care.

Acknowledgements

The author acknowledges the clinical team at the Canniesburn Plastic and Reconstructive Surgery Unit for the excellent practice learning support.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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