The Role of the Theatre Practitioner in Surgical Site Infection

Alex Healey

October 18, 2023

Introduction

Surgical Site Infection (SSI) occurs up to 30 days after surgery or up to one year after surgery in patients receiving implants, affecting either the incision or deep tissue at the operation site [1]. They occur in 5% of patients who have an operation on the NHS, representing a significant clinical concern and a substantial economic burden, costing the NHS from £10,000 to £100,000 per occurrence [2]. The repercussions of SSIs extend beyond financial implications, typically resulting in extended hospital stays of an additional 7-10 days and escalating the mortality risk by 2-11 times compared to patients devoid of SSIs [3]. Some risk factors are out of a practitioner's control, such as a patient's age, comorbidities and BMI [4], but up to 60% of SSIs are thought to be preventable [2].

Theatre practitioners have a vital role in the MDT and a patient's perioperative journey. They can assist an anaesthetist in preparing a patient during the perioperative phase, assist a surgeon in a scrub role or as a surgical first assist during the intraoperative phase, and monitor and care for patients during the postoperative phase. An SSI can be detrimental to a patient's recovery or even fatal, so a theatre practitioner must use evidence-based practice to do everything possible to reduce the risk of a patient contracting an SSI in all phases of their perioperative journey.

Preoperative phase

The risk of a patient contracting an SSI is strongly linked to the quality of the operating theatre environment [5]. Therefore, a theatre practitioner should take steps to optimise the quality of the theatre environment before every procedure to reduce the risk of SSIs to the patient. This includes ensuring they and all team members wear appropriate clothing, following the 2019 NICE guidelines for preventing surgical site infections. This means that theatre staff should wear clean scrubs, not jewellery or nail polish [6].

They should also ensure that all theatre equipment has been wiped down to minimise dust particles that may be on the equipment, as during procedures, these particles can be released from the surroundings. Dust particles can be bacteria carriers, so if a dust particle carrying bacteria settles onto a surgical instrument used during the procedure or settles inside the surgical wound, this could cause the patient to contract an SSI [7]. This is also why theatres need high-quality air to reduce the dust particles in the air. Therefore, all theatres must have a contamination-controlled airflow system or an 'HVAC' system (heating, ventilation and air conditioning system). The purpose of the HVAC system is to maintain the theatre's temperature, humidity and air quality at a level that is comfortable and safe for the patient and the staff [8]. The specific features that help prevent SSIs are ventilation, air distribution, room pressurisation and filtration. Laminar flow or unidirectional flow systems can help reduce SSIs in orthopaedic surgery. Unidirectional flow systems push airborne particles through the operating area, preventing them from landing in the wound area and encouraging particles towards the exhaust outlets [9]. Charnley studied 5,800 total hip replacements and showed that when the theatre used a unidirectional flow system with a high number of hourly air exchanges, the SSI rate fell from 7% to 0.5%. However, this study did not prove that a unidirectional airflow system was the only reason the SSI rate fell as theatre staff wore special suits that covered their whole body rather than traditional scrubs [10].

Theatre practitioners could check that the environment is at an appropriate temperature, as the International Society for Infection Diseases (ISID) recommended. However, in orthopaedic theatres, the temperature should be kept slightly lower to help prevent the patient's infection risk, as lower temperatures can discourage bacteria growth. In contrast, in obstetrics, the temperature should be slightly higher to prevent the baby (or babies) from becoming hypothermic [11].

If hair removal is deemed necessary, it is recommended that the practitioner use single-use electric clippers instead of razors, as the latter has been associated with an increased risk of SSI. However, hair removal should only be performed if necessary, as it does not reduce the risk of surgical site infections [12].

Intraoperative phase

Before starting any surgical procedure, the theatre team must complete the WHO surgical safety checklist. According to Haynes et al, completing this checklist significantly reduced the risk of SSI to the patient [13]. Also, a theatre practitioner should communicate effectively with all team members. Vincent et al found that poor communication within the theatre increased the frequency of adverse events, including patients contracting SSIs [14].

When scrubbing for a procedure, a practitioner should follow the NICE guidance; before the first procedure of the day, they should scrub using an aqueous antiseptic, and for subsequent procedures, they could use either an alcoholic hand rub or a surgical antiseptic solution. They should not use anything that

could be contaminated, which can increase the risk of SSI [6].

Microperforations can happen in surgical gloves in about 18% of cases during surgical procedures. Shockingly, more than 80% of these microperforations go unnoticed by the person wearing the gloves. Such microperforations could allow microorganisms from the practitioner's hands to transfer to the patient, potentially leading to an SSI. Microperforations can double the risk of SSI for the patient. Punctures can occur up to 35% of the time if the procedure lasts longer than 2 hours, meaning water, and therefore bodily fluids, can penetrate the glove without pressure. This could pose a higher risk to immunocompromised patients, as they are more susceptible to waterborne microorganisms. Double gloving, in this case, may reduce the risk as it can reduce the risk of gloves puncturing during surgery, although there is no evidence that this reduces the risk of SSIs [5].

When draping the patient, the practitioner should use an iodophor-impregnated drape [4], as these have been shown to be clinically and cost-effective [15].

The scrub practitioner should use an appropriate aseptic solution to prepare the skin before incision. Alcohol-based solutions have a broader antimicrobial spectrum than other skin solutions, potentially reducing the patient's risk of SSI [16].

The lead practitioner in the theatre should make an effort to limit unnecessary movement of staff throughout the theatre, as this can cause contamination in the theatre environment, increasing the patient's SSI risk [17]. A study showed that opening the theatre door during an orthopaedic procedure can increase contamination above the surgical wound, which could lead to an increased risk of SSI [18].

During surgery, it is crucial for the anaesthetic practitioner to accurately position the patient's oxygen probe to obtain precise readings. This will help to optimise the patient's oxygen concentration level, as evidence suggests that maintaining a higher oxygen concentration can reduce the risk of SSI compared to a lower concentration [4].

When closing a surgical wound, the practitioner should use plus sutures. These are synthetic absorbable sutures that either have triclosan coating or contain triclosan. Triclosan is an antibacterial agent that has a broad-spectrum effect. It prevents biofilm formation and bacterial colonisation, which further prevents the growth of the most common organisms that lead to SSIs (Surgical Site Infections) for at least seven days following surgery. Within the NHS, plus sutures have been clinically proven to be a cost-effective way to reduce the incidence of SSIs [19].

Postoperative phase

After the wound is closed, a practitioner may cover it with a dressing. A dressing is not necessarily required; no evidence proves that covering a wound with a dressing reduces the risk of SSI. Suppose they choose to cover the wound with a dressing. In that case, they can use the most appropriate dressing as there is no

evidence that any specific dressing is better than others for reducing the risk of SSI [20]. However, there is some evidence that negative pressure dressings could reduce the risk of SSI, especially for higher-risk patients such as immunocompromised patients [21]. If a dressing covers the wound, it should not be removed for at least two days, ideally, four days post-surgery, unless the dressing leaks or the patient shows other symptoms of an SSI [22].

Conclusion

Surgical site infection poses a significant threat to a patient's recovery. It can have a significant negative impact on the NHS, so theatre practitioners must use evidence-based practice to do everything within their control to prevent SSIs. There are many ways practitioners can do this, by controlling environmental factors such as the theatre temperature, ensuring the sterility of the instruments, and monitoring the patient in all phases of their perioperative journey. It is also essential to communicate and work effectively with the rest of the MDT to ensure they are working as a team to act within the patient's best interest and ensure the patient's safety.

References

[1] Owens, C.D. and Stoessel, K., 2008. Surgical site infections: epidemiology, microbiology and prevention. Journal of hospital infection, 70, pp.3-10.

[2] (2020) State of the nation report (surgical site infections)- UK. Available at: https://www.molnlycke.com/SysSiteAssets/master-and-local-markets/documents/master/surgical-documents/time-to-act-report-final-uksu0273.pdf (Accessed: 24 September 2023).

[3] Spagnolo AM, Ottria G, Amicizia D, Perdelli F, Cristina ML. Operating theatre quality and prevention of surgical site infections. J Prev Med Hyg. 2013 Sep;54(3):131-7.

[4] National Institute for Health and Care Excellence (NICE) (2008) Surgical site infection: prevention and treatment of surgical site infection. NG125. Available at: https://www.nice.org.uk/guidance/ng125/evidence/october-2008-full-guideline-pdf-6727105694 (Accessed: 24 September 2023)

[5] Humphreys H. Preventing surgical site infection. Where now? J Hosp Infect 2009;73:316-22

[6] National Institute for Health and Care Excellence (NICE) (2019) Surgical site infection: prevention and treatment of surgical site infection. NG125. Available at: https://www.nice.org.uk/guidance/ng125/resources/surgical-site-infections-prevention-and-treatment-pdf-66141660564421 (Accessed: 24 September 2023)

[7] Diab-Elschahawi M, Berger J, Blacky A, et al. Impact of different sized laminar air flow versus no laminar air flow on bacterial counts in the operating room during orthopedic surgery. Am J Infect Control 2011;39:e25-9

[8] Fernstrom A, Goldblatt M. Aerobiology and its role in the transmission of infectious diseases. J Pathog 2013;2013:493960; doi: 10.1155/2013/493960

[9] Chow TT, Yang XY. Ventilation performance in operating theatres against airborne infection: review of research activities and practical guidance. J Hosp Infect 2004;56:85-92

[10] Charnley J. Postoperative infection after total hip replacement with special reference to air contamination in the operating room. Clin Orthop Relat Res. 1972 Sep;87:167-87. doi: 10.1097/00003086-197209000-00020.

[11] Roy MD, MSc, M.-C. (2021) The operating room, ISID. Available at: https://isid.org/guide/infectionprevention/surgical-site-infections/ (Accessed: 24 September 2023).

[12] Tanner J, Melen K. Preoperative hair removal to reduce surgical site infection. Cochrane Database Syst Rev. 2021 Aug 26;8(8)

[13] Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AH, Dellinger EP, Herbosa T, Joseph S, Kibatala PL, Lapitan MC, Merry AF, Moorthy K, Reznick RK, Taylor B, Gawande AA; Safe Surgery Saves Lives Study Group. A surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med. 2009 Jan 29;360(5):491-9.

[14] Vincent C, Moorthy K, Sarker SK, et al. Systems approaches to surgical quality and safety: from concept to measurement. Ann Surg 2004;239:475-82

[15] Sworn K, Poku E, Thokala P, et al. Effectiveness of iodine-impregnated incise drapes for preventing surgical site infection in patients with clean or clean contaminated wounds: A systematic literature review and cost-consequence analysis. Journal of Perioperative Practice. 2023;0(0).

[16] Hemani, M. L., & Lepor, H. Skin Preparation for the Prevention of Surgical Site Infection: Which Agent Is Best? Reviews in Urology, 11(4), 190-195. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2809986/

[17] Burden, M. (2019) 'The link between surgical site infection and traffic flow in the Operating Theatre', British Journal of Nursing, 28(1), pp. 18–18.

[18] Andersson AE, Bergh I, Karlsson J, Eriksson BI, Nilsson K. Traffic flow in the operating room: an explorative and descriptive study on air quality during orthopedic trauma implant surgery. Am J Infect Control.. 2012; 40:(8)750-755 https://doi.org/10.1016/j.ajic.2011.09.015

[19] Edwards M, Graziadio S, Shore J, Schmitz ND, Galvain T, Danker WA, Kocaman M, Pournaras DJ, Bowley DM, Hardy KJ. Plus Sutures for preventing surgical site infection: a systematic review of clinical outcomes with economic and environmental models. BMC Surg. 2023 Oct 3;23(1):300. doi: 10.1186/s12893-023-02187-0. PMID: 37789307; PMCID: PMC10548560.

[20] Dumville, J. C., Gray, T. A., Walter, C. J., Sharp, C. A., Page, T., Macefield, R., Blencowe, N., Milne, T. K., Reeves, B. C., & Blazeby, J. (2016). Dressings for the prevention of surgical site infection. The Cochrane Database of Systematic Reviews, 2016(12). https://doi.org/10.1002/14651858.CD003091.pub4

[21] Simone, B.D. et al. (2021) Intraoperative surgical site infection control and prevention: A position paper and future addendum to WSES intra-abdominal infections guidelines - world journal of emergency surgery, BioMed Central. Available at: https://wjes.biomedcentral.com/articles/10.1186/s13017-020-0288-4 (Accessed: 25 September 2023).

[22] Stryja J, Sandy-Hodgetts K, Collier M et al (2020) Surgical site infection: preventing and managing surgical site infection across health care sectors. J Wound Care 29: 2 (Suppl 2b): S1–S69