Surgical site infections in vascular patients: The incidence, the impact and the importance of SSI prevention

KEY WORDS
- Surgical wounds
- Surgical site infection
- Vascular surgery
- Leukomed Sorbact

Surgical site infection (SSI) is a type of healthcare-associated infection, in which a surgical incision becomes infected within a 30-day period following surgery, or up to one year after surgery in patients receiving implants. SSI can be a devasting complication and cause significant morbidity and mortality if left untreated. Risk of SSI varies depending on the type of surgery, but have been shown to account for up to 16% of all healthcare-associated infections (NICE, 2013) and is the third most commonly reported healthcare-associated infection (Stryja et al, 2020). In 2017/2018, the NHS spent £8.3 billion on the management of an estimated 3.8 million patients with a wound across the UK, of which 14% (519,000) had a surgical wound; it was reported that only one-third of admissions attributable to surgical wounds and trauma appeared to be linked to a suspected infection (Guest et al, 2020). This article will explore the burden of SSI and its associated consequences, focusing on vascular patients, while highlighting the importance of preventative strategies and the value of using the new NICE pathway on preventing and treating SSI (NICE, 2021a). This includes new recommendations that Leukomed Sorbact (Essity) should be considered as an option for people with wounds that are expected to have low to moderate exudate after caesarean section and vascular surgery.

Reported rates of SSI vary depending on the type of procedure, with rates of less than 1% for orthopaedic procedures and rates of over 10% for large bowel surgery (NICE, 2013). The true rate of SSI is difficult to ascertain: many SSIs go unreported as they are only detected after the patient has left the hospital setting. The 'Getting It Right First Time' programme (GIRFT, 2019) attempted to capture the true SSI rate for vascular surgery by collecting data from 95 NHS Trusts over a year-long period. They reported the overall SSI rate for vascular surgery as 2.5%, which ranged from 0.2% for carotid endarterectomy up to 3.4% for lower limb bypass operations, and further upwards to 13% of all lower limb surgery for peripheral arterial disease (excluding lower limb bypass). The infection rate reported in vascular surgery was substantially higher than any other type of surgery undertaken in the NHS, including bowel surgery. There are alternative infection rates in the literature: Totty (2019) reported a 21.8% pooled rate across a range of vascular procedures; it was highlighted that SSI may complicate up to 40% of procedures, with those undergoing lower limb revascularisation and major limb amputations at highest risk. The groin wound infection after vascular exposure (GIVE) multicentre cohort study described an 8.6% SSI rate for groin incisions (GIVE Study Group, 2021) and a further study on elective open lower-limb revascularisation procedures records an SSI of 28.3% (Hasselmann et al, 2020).

Furthermore, in many other specialist areas such as orthopaedic surgery, the number of patients with an SSI requiring inpatient/readmission are decreasing; however, in vascular surgery, the rates are increasing. Vascular surgery reported the greatest annual percentage increase in risk of inpatient/readmission for SSI across all disciplines, from 2.1% in 2017/18 to 3.3% in 2018/19 (Public Health England, 2019). GIRFT (2018) noted re-admissions rates of 10% for abdominal aortic aneurysm, 8% for carotid endarterectomy, 16.5% for patients undergoing major amputation for lower limb vascular disease

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THE RISK

The risk of SSI is influenced by a number of intrinsic patient-related factors (e.g. patient age, underlying illness, BMI), plus a similar number of extrinsic procedure-related factors (e.g. duration of procedure, type of surgery, skill of surgeon/team, whether implants are used, elective or emergency surgery), and particularly the number of micro-organism present at or introduced to the incision (Stryja et al, 2020). There are several known risk factors which contribute to a higher rate of SSI in vascular patients, including:

- **Length of procedure:** Prolonged duration of an operation is recognised as a strong predictor of SSI (Stryja et al, 2020). Vascular operations are often long and complex, with the average length of operation for vascular patients being 192 mins (range: 127–278) (GIRFT, 2019).
- **American Society of Anesthesiologist (ASA) score:** ASA score is a measure of a patient's pre- operative physical status, which considers underlying illness and co-morbidities. There are 5 ASA scores, ranging from A1 (denoting a normally healthy patient), to A5 (denoting a moribund patient with little chance of survival), where an increased score is strongly associated with risk of SSI. 83% of vascular patients had a ASA score greater than 3 (GIRFT, 2019).
- **Age:** Increasing age is also an important independent predictor of SSI risk, with many studies demonstrating that the risk of SSI steadily increases with age across different types of surgery. It should be noted that the mean age of a vascular patient undergoing surgery is 73.
- **BMI:** Obesity (defined as BMI greater than 30) independently increases the chance of developing an SSI (Peterson and Starr, 2012), with a threefold increase in risk (Stryja et al, 2020). Obesity increases the risk of SSI due to the poor vascularisation of adipose tissue combined with the increased complexity of surgery. On average, 26% of all vascular patients had a BMI greater than 30 (GIRFT, 2019).
- **Groin incisions:** The groin is a common site for incision within vascular surgery, as this allows access to the common femoral artery, which is required in a wide range of vascular interventions. Groin wounds are particularly susceptible to developing infection, due partly to the risk of iatrogenic lymphatic injury, in addition to the skin flora in the groin skin crease, owing to its proximity to the genitalia (Gwilym et al, 2021). Reported rates of vascular groin SSI range widely from 2.6–31% (Gwilym et al, 2021).

CONSEQUENCE: COST/PATIENT

The development of an SSI has several consequences that may affect the patient's wellbeing or quality of life, but there is also a significant economic cost to the health care service. Across all surgical specialities, the development of an SSI led to the need for re-operation in an average of 36% of all cases (GIRFT, 2019). The total cost of SSI places a heavy burden on the NHS; Jenks et al (2014) reported that a cost of an SSI in vascular surgery is £2,702. However, within vascular surgery, these costs are substantially more, with cost increases for an additional £1,793 per primary admission (due to delays in discharge) and £5,065 per subsequent admission (GIRFT, 2019). Additionally, there are liability costs to be considered: in England, between April 2012 and March 2017, 383 medical negligent claims relating to SSI were settled at an estimated cost of £35.2 million (NHS Resolution, 2019; a specific reference to the cost of litigation for vascular surgery is available in the GIRFT vascular report).

Further to the financial cost, there are significant costs to the patient's wellbeing. The development of an SSI, particularly in vascular patients, can have devastating consequences. In cases where prosthetic graft material is used, there is a risk of graft failure resulting in catastrophic haemorrhage, which risks both the limb and life of the patient. Sepsis is a common complication of SSI, with 12–47% of all SSI resulting in sepsis. The mean all-cause mortality associated with SSI for vascular patients was 11.3% (GIRFT, 2019).

Additionally, patients who develop an SSI (even in its less severe forms) describe their initial reaction to their infection and wound breakdown with words such as 'unexpected', 'alarm', 'shock' and 'disbelief'. Having a wound healing by secondary intention may go on to have a profound negative effect on the patient's quality of life, affecting physical and psychological

functioning and wellbeing, with potential feelings of frustration, powerless, guilt and debilitation, with the added unrealistic hope of accurate healing times (McCaughan et al, 2018). The frequency and consequence of SSI development necessitates urgent action to try and minimise the occurrence of SSI, with the aim of limiting the impact on the individual's quality of life.

GUIDELINES

There are several published documents (Stryja et al, 2020) that relate to the prevention and management of SSI. These include:

- **National Wound Care Strategy:** Recommendations for Surgical Wounds (NWCS, 2021). The recommendations provide a clinical navigation tool that aims to reduce the risk of wound healing complications with swift escalation of treatment or service provision for those who develop such complications.
- **National Institute for Health and Care Excellence (NICE):** Surgical site infections: prevention and treatment (NICE, 2019). The guideline covers preventing and treating SSI in adults, young people and children who are having a surgical procedure. It focuses on methods used before, during and after surgery to minimise the risk of infection.
- **World Health Organisation:** Global guidelines on the prevention of surgical site infections (WHO, 2018). The aim of the guideline is to provide a comprehensive range of evidence-based recommendations for interventions to be applied during the pre-, intra- and postoperative periods for the prevention of SSI, while also considering aspects related to resource availability, values and preferences.

There are also specific publications relating to post-operative wound care:

- **Wounds UK Best Practice Statement:** Post-operative wound care: reducing the risk of surgical site infection (Wounds UK, 2020). The objectives of this document are to: raise awareness of SSI surveillance and clarify areas for improvement; promote antimicrobial stewardship and highlight issues related to antibiotic resistance; and develop strategies for the prevention of post-operative SSI by providing practical tips for clinicians and patients.

The most recent guidance in relation to SSI comes from NICE, who in March 2021 published an updated pathway on preventing and treating SSI (NICE, 2021a). This includes new recommendations that Leukomed Sorbact (Essity) should be considered as an option for people with wounds that are expected to have low to moderate exudate after caesarean section and vascular surgery.

These recommendations derive from the recent NICE medical technologies guidance assessment carried out on Leukomed Sorbact (NICE, 2021b). Technologies are only assessed by this programme if they are deemed to have the potential to offer substantial benefits to the patient and/or the NHS and if the development of NICE guidance will facilitate more consistent and rapid uptake by the NHS. The case for adoption is based on the claimed advantages of introducing the specific technology compared with current management of the condition; it is evaluated based on the clinical and economic evidence submitted with input from leading experts in the relevant field. NICE will only make a positive recommendation for adoption by the NHS if there is sufficient certainty that the claims are supported, and that the technology will offer the benefits it claims to.

As part of this process the submitted evidence is reviewed by an independent external assessment centre commissioned by NICE. Their role is to critically evaluate the company's clinical and economic evidence submission and report on whether it supports the case for adoption by the NHS. Draft guidelines are subsequently drawn up by the Medical Technologies Advisory Committee and subject to a public consultation period in which stakeholders can comment, prior to final guidance being released. In the case of Leukomed, the following evidence was included within the review:

- 1 randomised controlled trial (RCT), which focused on women undergoing caesarean section (Stanirowski et al, 2016a)
- 2 pilot RCTs, looking at vascular surgery patients and women who had undergone caesarean section (Stanirowski et al, 2016b; Totty et al, 2019)
- 1 pilot non-randomised controlled trial in vascular surgery patients (Bua et al, 2017)

The NICE guidance report concluded that all the above studies compared Leukomed Sorbact against standard surgical dressings. Two studies stated the specific standard dressing: Opsite in Totty et al (2019) and Tegaderm in Stanirowski et al (2016a). The results from these studies indicated that there was a lower rate of SSI in the Leukomed Sorbact group compared to the standard surgical dressing. Their cost modelling shows that the reduced rate of SSI with Leukomed Sorbact compared with standard surgical dressings leads to savings of £107 per person after caesarean section and £18 per person after vascular surgery. They concluded that, by adopting this technology, the NHS may save up to £5.3 million per year for caesarean section and up to £1.2 million per year for vascular surgery. (NICE, 2021b).

SORBACT TECHNOLOGY

Leukomed Sorbact is a sterile, single-use, bacteria-binding, adhesive-bordered wound dressing. Use of such dressings with a physical mode of action are effective in wound bioburden management and support AMS, as there is no risk of bacteria developing resistance (Wounds UK, 2020; Rippon et al, 2021). Leukomed Sorbact comprises of an absorbent non-woven wound contact pad and an outer transparent adhesive polyurethane film. The pad is made of a white viscose polypropylene and polyester mesh that is coated with the compound dialkylcarbamoyl chloride (DACC) (NICE, 2021b).

The unique DACC™-coated surface of Sorbact® has special characteristics and highly hydrophobic properties. In presence of water molecules, bacteria commonly responsible for causing SSI will irreversibly bind to the dressing surface.

These bound microorganisms are then removed from the wound site when the dressing is changed. Binding to Sorbact does not cause bacteria to be lysed (broken open), which avoids causing inflammation at the wound site (NICE, 2021b). The polyurethane film is designed to maintain a moist environment and protect the wound from external contamination. For patients with wounds at risk of high exudate, these should be identified at the time of surgery and would likely not be treated with Leukomed Sorbact dressings.

IMPLEMENTATION

To achieve the described cost savings and clinical/patient benefits, it is important that early, widespread adoption of the recommendations is implemented, ensuring that patients receive care based on the best available clinical evidence. Clinicians need to look at the enablers and barriers to implementation of the guidance and look to overcome the difficulties in implementation caused by the associated administration processes due to the siloed working of the NHS service.

One of the key questions that will need to be considered is 'who is responsible for implementing change in this case?' – is this tissue viability nurses, infection control leads, theatre practitioners, vascular consultants, vascular nurse specialists, governance leads? However, it is vital that we do not let the complexity of the hospital impact overrule the need for evidence-based care (Thomas et al, 2011; Kueny et al, 2015).

CONCLUSION

SSI is a frequent complication of vascular procedures. SSI rates in vascular surgery are high due to a number of factors, including the general comorbidity of the patients undergoing surgery, with high prevalence of diabetes, smoking and frailty (Gwilym et al, 2021). SSI can often be prevented with appropriate care before, during and after surgery (NICE, 2013).

Evidence suggests that adopting Leukomed Sorbact instead of standard dressings for closed surgical wounds following caesarean section and vascular surgery reduces the risk of SSI and leads to cost savings (NICE, 2021b). It is therefore vital that clinicians and hospitals enable the implementation of this technology, guaranteeing that cost and clinical benefits highlighted are realised. WUK

REFERENCES

Bua N, Smith GE, Totty JP et al (2017) Dialkylcarbamoyl chloride dressings in the prevention of surgical site infections after nonimplant vascular surgery. *Ann Vasc Surg* 44: 387-92

Groin wound Infection after Vascular Exposure (GIVE) Study Group (2021) Groin wound infection after vascular exposure (GIVE) multicentre cohort study. *Int Wound J* 18(2): 164-75

GIRFT (2018) Getting It Right First Time Vascular Surgery National Specialty Report

GIRFT (2019) Getting It Right First Time SSI National Audit

Guest JF (2020) Burden of wounds to the NHS: what has changed since 2012/13? *Wounds UK* 17: 10-5

Guest JF, Fuller GW, Vowden P (2020) Cohort study evaluating the burden of wounds to the UK's National Health Service in 2017/2018: update from

2012/2013. *BMJ Open* 10: e045253

Gwilym BL, Dovell G, Dattani N et al (2021) Editor's choice – systematic review and meta-analysis of wound adjuncts for the prevention of groin wound surgical site infection in arterial surgery. *Eur J Vasc Endovasc Surg* 61: 636-46

Hasselmann J, Björk J, Svensson-Björk R (2020) Proposed Classification of Incision Complications: Analysis of a Prospective Study on Elective Open Lower-Limb Revascularization. *Surg Infect (Larchmt)* 21(4): 384-90

Kueny A, Shever LL, Lehan Mackin M, Titler MG (2015) Facilitating the implementation of evidence-based practice through contextual support and nursing leadership. *J Healthc Leadersh* 7: 29-39

McCaughan D, Sheard L, Cullum N et al (2018) Patients' perceptions and experiences of living with a surgical wound healing by secondary intention: A qualitative study. *Int J Nurs Stud* 77: 29-38

NHS Resolution (2019) Claims Management. https://resolution.nhs.uk/services/claimsmanagement

NICE (2011) National Institute for Health and Clinical Excellence: Medical Technologies evaluation Programme methods guide

NICE (2013) National Institute for Health and Care Excellence: Surgical site infections: Quality standards 49

NICE (2019) National Institute for Health and Care Excellence: NICE guideline. Surgical site infections: prevention and treatment

NICE (2021a) National Institute for Health and Care Excellence Pathway: Preventing and treating surgical site infections

NICE (2021b) National Institute for Health and Care Excellence: Medical technologies guidance [MTG55]: Leukomed Sorbact for preventing surgical site infection

NWCS (2021) National Wound Care Strategy (NWCS) Programme: (2021) Recommendations for Surgical Wounds

Peterson L, Starr J (2012) PS126. Influence of obesity on groin surgical site infections after vascular surgery. *J Vasc Surg* 55: 59S

Public Health England (2019) Surveillance of surgical site infections in NHS hospitals in England: April 2018 - March 2019

Rippon MG, Rogers AA, Ousey K (2021) Antimicrobial stewardship strategies in wound care: evidence to support the use of dialkylcarbamoyl chloride (DACC)-coated wound dressings. *J Wound Care* 30(4): 284-96

Stanirowski PJ, Bizon M, Cendrowski K, Sawicki W (2016a) Randomized controlled trial evaluating dialkylcarbamoyl chloride impregnated dressings for the prevention of surgical site infections in adult women undergoing cesarean section. *Surgical Infections* 17: 427-35

Stanirowski PJ, Kociszewska A, Cendrowski K, Sawicki W (2016b) Dialkylcarbamoyl chloride-impregnated dressing for the prevention of surgical site infection in women undergoing cesarean section: a pilot study. *Arch Med Sci* 12: 1036-42

Stryja J, Sandy-Hodgetts K, AlCME (2020) Surgical site infection: preventing and managing surgical site infection across health care sectors. *J Wound Care* 29 Suppl 2b: S1-69

Thomas A, Saroyan A, Dauphinee WD (2011) Evidence-based practice: a review of theoretical assumptions and effectiveness of teaching and assessment interventions in health professions. *Adv Health Sci Educ Theory Pract* 16: 253-76

Totty JP, Hitchman LH, Cai PL et al (2019) A pilot feasibility randomised clinical trial comparing dialkylcarbamoylchloride-coated dressings versus standard care for the primary prevention of surgical site infection. *Int Wound J* 16: 883-90

WHO (2018) Global guidelines for the prevention of surgical site infection, second edition. Geneva: World Health Organization (WHO). Licence: CCBY-NC-SA3.0IGO

Wounds UK (2020) Best Practice Statement: Antimicrobial stewardship strategies for wound management

Wounds UK (2020) Best Practice Statement: Post-operative wound care – reducing the risk of surgical site infection