Duration of Wound Coverage for the Prevention of Surgical Site Infections After Surgery

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Introduction

Surgical procedures generally involve the skin being cut and then fully closed ("primary closure") following completion of the surgery. Almost all (>90%) surgical wounds contain pathogenic bacteria that can multiply during wound closure.[1-4]

Surgical site infections (SSI) are infections of the incision, organ or space that occur within 30 days of surgery (or within one year of a surgical implant).[1, 5] SSI are classified according to the anatomical areas involved: superficial (skin or subcutaneous tissue adjacent to the incision), deep (muscle or fascia layers) or organ-space (area of the body on which surgery was performed).[6, 7] The type of surgical wound is an important factor in the incidence of SSI, with wounds classified as clean (uninfected operative wounds with no inflammation; respiratory, alimentary, genital or uninfected urinary tracts not entered; primary closure), clean-contaminated (respiratory, alimentary, genital or uninfected urinary tracts entered under controlled conditions; no unusual contamination; no evidence of infection or major break in sterile technique) or dirty (old traumatic wounds with retained devitalised tissue or those that involve existing clinical infection or perforated viscera).[8] Symptoms experienced by patients with SSI may include redness, pain, fever, general fatigue, swelling, tenderness, and delayed healing.[9] In some cases, the wound may reopen or need to be opened by the medical team, causing pus to be discharged and leading to further complications. When this occurs, the wound may require weeks, and in worst cases months, to heal, closing gradually by secondary intention, which involves the wound healing from the bottom of the wound upwards, rather than being closed by surgical means. This prolonged recovery can significantly impact the patient's overall well-being and quality of life.

The rate of SSI varies depending on the type of surgery, with significant implications for patient health including increased morbidity and mortality and reduced quality of life.[10, 11] In England, the highest rates of SSI are observed after emergency laparotomy (18.8%), breast implant (16.3%) and lower limb surgery for peripheral arterial disease (13.0%).[12] According to the UK Health Security Agency report of 2022-2023, there were 1122 cases of SSI out of 125,095 surgical procedures in England, occurring either during hospital stay or upon readmission. For individual surgery subgroups, the highest SSI rates were reported in surgeries involving the bile duct, liver or pancreas (18.3%), large bowel (8.5%) and small bowel (7.8%).[13] A recent systematic review of the worldwide incidence of SSI following general surgery revealed an overall cumulative incidence of 11%.[14] Notably, studies that

track incidence of SSI after hospital discharge report higher rates, highlighting the occurrence of SSI in the community.[15-18] Surgical site infections constitute the second most common class of hospital-acquired infection (HAI) in Europe and the USA (and the most common HAI in some countries of Europe).[19] Early recognition and prompt management of all surgical wounds are crucial for achieving the most favourable outcomes. Current evidence-based approaches may prevent around half of all SSI,[3, 20] with wound dressings being one of them.[7]

Wounds can be closed using sutures, staples, adhesive tapes or skin glues[21] and the closed wound is often covered using dressings or adhesive tape.[7] Dressings can provide protection from infection until skin continuity has been reinstated, a period of around 48 hours.[22] Warm, moist wound environments have been shown to promote rapid healing, and contemporary dressings have been developed accordingly, which also facilitate circulation of oxygen and a low bacterial load.[23, 24] Vacuum-assisted therapy that utilises negative pressure has been used to minimise dressing changes, decrease oedema and stimulate tissue granulation.[25] No particular dressing is appropriate for treating all wounds as wounds do not all have the same dressing requirements; choice of dressing should take into account factors such as anatomical and pathophysiological characteristics of the wound, stage of the healing process, patient co-morbidities and compliance, social and environmental factors, dressings' physical properties, cost, ease of changing dressings and need for additional antibiotics.[23, 24, 26-28] Ideally, a dressing for a surgical wound should protect the wound from an excess of slough, toxic chemicals and infections, whilst maintaining the temperature and pH at optimal levels for healing.[3]

Several guidelines on preventing SSI generally conclude that there is no robust evidence for the timing of dressing removal but recommend keeping dressings in place for 48 hours,[19, 29-32] albeit with slight variations in the wording of the recommendation, i.e. specified as either 48 hours itself,[30, 32] a minimum of 48 hours,[19] or 24 to 48 hours.[29] There are advantages and disadvantages to early removal of dressings (within 48 hours after surgery) and delayed removal (at least 48 hours after surgery). For example, the wound healing process can be assisted by the moist conditions created by a dressing.[33] On the other hand, a moist environment combined with wound exudate can lead to maceration (or softening) of the wound and delayed healing.[3, 34] Thus, there is a balance for clinicians when deciding on an

appropriate dressing between protecting a wound/promoting healing and avoiding issues such as maceration.

The available literature on the optimal timing for wound dressing removal after surgery to prevent surgical site infections (SSI) remains unclear. An initial search of relevant electronic databases found no existing or ongoing scoping reviews on this specific topic. However, two systematic reviews were identified that are related to this clinical area.[3, 7] Both reviews compared early dressing removal (within 48 hours post-surgery) with delayed removal (after 48 hours). One review focused on clean and clean-contaminated wounds,[7] while the other included clean and contaminated wounds.[3] Both concluded that there was no significant difference between early and delayed dressing removal regarding SSI, wound dehiscence, adverse events, or patient satisfaction. Despite this, neither review specifically addressed how long wounds should remain covered post-surgery. Therefore, this systematic review is necessary to explore the literature on the appropriate duration for wound coverage with dressings to prevent SSI.

Review questions

- *What evidence is available on how long surgical wounds should be covered with dressings after surgery to prevent SSI?*
- *Does the duration for covering surgical wounds depend on the type of dressing, wound characteristics, type of surgery, or a combination of these factors?*

Inclusion criteria

Participants

All patients, both adults and children, with a wound resulting from a surgical incision will be eligible for inclusion. We will use the definitions of "adults" and "children" as provided by the authors of the included studies.

Clinical condition

This review will include studies of randomised comparisons of different lengths of time wounds are covered (with the same type of dressing in each group) after surgery. The focus is on the wound being covered thus surgical interventions that only close the wound are not eligible for inclusion. The following aspects will be considered relevant:

- Type or size of wounds
- Anatomical location of the wound
- Type of surgery (elective versus emergency but also clean/clean contaminated/contaminated/dirty)
- Type of dressing (including newer techniques such as glue and negative pressure therapy)
- Whether antibiotics have been administered or not.

Types of outcome measures

Outcomes of interest will include:

- Surgical site infection within (including up to 30 days and 1 year)
- Wound opening
- Unintended readmission to hospital
- Reoperation for wound dehiscence
- Length of hospital stay
- Length of time for wound healing
- Quality of life
- Mortality.

Context/setting

We will consider randomised controlled trials (RCTs) conducted in any relevant clinical setting involving all types of surgery.

Types of studies

This systematic review will include published randomised controlled trials (RCTs) that examine surgical wounds covered by dressings and compare the effects of varying durations of wound coverage on outcomes at specified time points. Specifically, we will include:

- RCTs comparing different durations of the same dressing (where randomisation is based on the duration of wound dressing).
- RCTs comparing dressing of a specified duration with no dressing
- RCTs comparing glue plus dressing to glue-only (trials assessing the effect of using tissue adhesive alone versus adhesive combined with a dressing.)
- RCTs involving minimally invasive surgery including laparoscopic procedures and minor skin excisions, with a focus on the duration of dressing in such contexts.

Although the primary focus will be on published studies, we will also aim to identify relevant ongoing research to provide a comprehensive overview of current randomised evidence.

Studies meeting the following **exclusion criteria** will not be included in this systematic review. Research focusing on in vitro studies, chronic wounds, or wound healing by secondary intention will be excluded, as our primary focus is on surgical wound healing by primary intention. Additionally, studies involving open wounds requiring prolonged hospitalisation, epidermal skin grafts, endoscopic sinus surgery, or military wounds are outside the scope of this systematic review. Research on highly specific conditions or procedures, such as punch biopsies, bacterial colonisation of drains, or anastomotic leaks, will not be deemed suitable for inclusion. Similarly, studies examining the frequency of dressing changes, immediate revision surgery (within one month of the original procedure), arthrodesis, or specific niche dressings (e.g., Robert Jones bandages) do not align with the objectives of this systematic review. Specialised procedures (e.g., anal fistulas, diabetic foot procedures, pilonidal sinus) and skin graft donor sites will also be excluded as these often involve unique wound management considerations. Lastly, studies that incidentally report dressing duration as part of comparisons between different dressings will be excluded to maintain a focus on research explicitly addressing dressing duration. This approach will ensure the review remains targeted on relevant, high-quality evidence assessing the effects of varying durations of surgical wound dressings.

Methods

This systematic review will be conducted following the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions[35] and reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 checklist.[36]

Search strategy

An Information Specialist will develop a comprehensive search strategy to identify relevant published studies. This strategy will include database index terms and free-text keywords covering surgical wounds, dressings, and timing. The databases to be searched are MEDLINE, Embase, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the Cochrane Library, including the Database of Systematic Reviews and the Central Register of Controlled Trials (CENTRAL). No restrictions will be placed on study

type or language during the search phase, but the search will be limited to studies published from 1989 onward. If the literature search yields a large number of citations, we will consider dividing them by publication year: 1989-2000 and 2000 onwards. Our initial focus will be on the 2000 onwards results, evaluating whether they provide sufficient evidence and determining the resources needed for their assessment. The 1989-2000 results will be considered only if resources allow or if the 2000 onwards batch does not yield sufficient evidence. Additionally, clinical trial registries, including ClinicalTrials.gov and the WHO International Clinical Trials Registry Platform, will be searched for ongoing studies. Reference lists of included studies and relevant systematic reviews will be checked for eligible studies.

Study selection

Following the search, all identified citations will be collated and uploaded into Endnote X9 and duplicates removed. Following a pilot test, titles and abstracts will then be screened by one reviewer with a 10% check by a second reviewer for assessment against the inclusion criteria for the review. Potentially relevant articles will be retrieved in full. The full text of selected citations will be assessed in detail against the inclusion criteria by one reviewer with a 20% check by a second reviewer. Reasons for the exclusion of full-text articles that do not meet the inclusion criteria will be recorded. Any disagreements between the reviewers at each stage of the selection process will be resolved through discussion or arbitration. The results of the search and the study inclusion process will be reported in full in the final report and presented in a PRISMA flow diagram.[37]

Data extraction

Data will be extracted from the studies included in this systematic review by one reviewer and cross-checked by a second reviewer using a data extraction form specifically developed for this purpose. This form will undergo a pilot phase and be modified as necessary to enhance its effectiveness. The extracted data will encompass detailed information regarding participants, the concept studied, the context of the research, the study methodology and key findings relevant to the review question. Any disagreements between reviewers will be resolved through discussion. If deemed appropriate and time allows, the authors of the studies may be contacted to obtain missing or additional data as required.

Risk of bias assessment

Two reviewers will independently assess the risk of bias in each included study using the revised Cochrane risk of bias tool (RoB2).[38]

Data analysis and presentation

We will provide a description of the characteristics of included studies and participants, as well as specific information regarding dressings, pertinent timeframes, types of wounds/surgeries and relevant outcomes (including SSI, wound opening, unintended readmission to hospital, reoperation for wound dehiscence, length of hospital stay, length of time for wound healing, quality of life, mortality). Continuous outcomes will be reported as mean differences (MD) with 95% confidence intervals (CI). Dichotomous outcomes will be reported either as risk ratios (RR) or odds ratios (OR), with corresponding 95% CIs. Where appropriate, we will summarise the results of relevant RCTs using standard meta-analysis methods. Sensitivity analyses will be performed by excluding studies assessed as having a high overall risk of bias. All statistical analyses will be conducted using either the Cochrane RevMan Web (version 8.14.0) or Stata (version 17 or the latest version). A two-tailed p-value < 0.05 will be considered statistically significant for all outcome measures.

For outcomes that cannot be pooled quantitatively, a narrative synthesis will be provided. This will include tabular presentations and a description of key findings from individual studies.

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