ACCURACY OF SURGICAL WOUND INFECTION DEFINITIONS - THE FIRST STEP TOWARDS SURVEILLANCE OF SURGICAL SITE INFECTIONS

Alina Petrica¹, Cristina Brinzeu², Antoniu Brinzeu², Razvan Petrica³, Mihai Ionac⁴

ABSTRACT
Surgical site infections (SSIs) are a common postoperative complication and represent a significant burden in terms of patient morbidity and mortality, and cost to health services around the world.¹ The surveillance of SSIs has been undertaken in many centres worldwide to ascertain the extent of the problem and where possible, to improve the incidence rates, thereby decreasing the undesirable outcomes.² This paper aims to assess the validity and reliability of definitions and methods of measuring surgical wound infection. The use of standardized definitions is fundamental to the accurate measurement and monitoring of SSIs.

Key Words: Surgical site infection (SSI), infection control, wound infection, ASEPSIS score, Southampton Wound Assessment Scale

INTRODUCTION

Surveillance is defined as “the ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know”¹.³ Surveillance identifies clusters of infection, risk factors and establishes risk indexes for infection, provides comparisons between hospitals or surgical specialties, and permits evaluation of control measures.⁴

An ideal surveillance system should have several attributes: meaningful definitions of infection, consistent interpretation of classification criteria, applicability to procedures performed in both inpatient and ambulatory facilities, ability to detect events after discharge, sufficient precision to distinguish small absolute differences in attack rates, and reasonable cost.⁵ ⁷

In 2001, Bruce et al made a comprehensive review of the literature in searching for evidence for the validity and reliability of definitions of wound infection.⁸ Authors searched the MEDLINE, CINAHL, EMBASE, Cochrane Library, and HealthSTAR databases from 1993 to 1999 and strict inclusion and exclusion criteria were applied to studies retrieved for appraisal. Of 2,490 abstracts identified to assess the definition of surgical wound infection, 90 prospective studies from 20 countries were included in the analysis. Forty-one different definitions of surgical wound or SSI were identified; some were “standard” definitions used by national surveillance programmes: the Public Health Laboratory Service (NPS), the Surgical Infection Society Study Group, the Second UK National Prevalence Survey, and the Centers for Disease Control (CDC) 1988 and 1992 definitions. There was no single symptom common to all definitions, but the most common criteria of infection was purulent discharge.
DEFINITIONS

The most widely recognized definition of infection, used throughout the USA and Europe, is that devised by Horan and colleagues and adopted by the CDC.9 According to CDC definition, surgical site infections are classified into three groups – superficial, deep incisional SSIs and organ-space SSIs – depending on the site and the extent of infection. These definitions are summarized in Table 1.

ASEPSIS is an acronym of seven wound assessment parameters. (Table 2)

It’s a quantitative scoring method that provides a numerical score related to the severity of wound infection using objective criteria based on wound appearance and the clinical consequences of the infection.10,11

Table 1. CDC definitions of surgical site infections.

<table>
<thead>
<tr>
<th>Superficial surgical site infections</th>
<th>Deep incisional surgical site infections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial incisional surgical site infections must meet the following two criteria:</td>
<td>Deep incisional surgical site infections must meet the following three criteria:</td>
</tr>
<tr>
<td>• occur within 30 days of procedure</td>
<td>• occur within 30 days of procedure (or one year in the case of implants)</td>
</tr>
<tr>
<td>• involve only the skin or subcutaneous tissue around the incision.</td>
<td>• are related to the procedure</td>
</tr>
<tr>
<td>Plus</td>
<td>• involve deep soft tissues, such as the fascia and muscles.</td>
</tr>
<tr>
<td>At least one of the following criteria:</td>
<td>Plus</td>
</tr>
<tr>
<td>• purulent drainage from the incision</td>
<td>• purulent drainage from the incision but not from the organ/space of the surgical site</td>
</tr>
<tr>
<td>• organisms isolated from an aseptically obtained culture of fluid or tissue from the incision</td>
<td>• a deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of following signs or symptoms – fever (&gt;38°C), localized pain or tenderness – unless the culture is negative</td>
</tr>
<tr>
<td>• at least one of the following signs or symptoms of infection – pain or tenderness, localized swelling, redness or heat – and the incision is deliberately opened by a surgeon, unless the culture is negative</td>
<td>• an abscess or other evidence of infection involving the incision is found on direct examination or by histopathologic or radiological examination</td>
</tr>
<tr>
<td>• diagnosis of superficial incisional SSI by a surgeon or attending physician.</td>
<td>• diagnosis of a deep incisional SSI by a surgeon or attending physician.</td>
</tr>
</tbody>
</table>

The following are not considered superficial SSIs:

- stitch abscesses (minimal inflammation and discharge confined to the points of suture penetration)
- infection of an episiotomy or neonatal circumcision site
- infected burn wounds
- incisional SSIs that extend into the fascial and muscle layers (see deep SSIs).

Deep incisional surgical site infections

An organ/space SSI must meet the following criterion:

Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure and infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure and patient has at least 1 of the following:

- a. purulent drainage from a drain that is placed through a stab wound into the organ/space
- b. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space
- c. an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination
- d. diagnosis of an organ/space SSI by a surgeon or attending physician.

The ASEPSIS system was meant to assess wounds resulting from cardiothoracic surgery, while the Southampton scale was designed for use in the postoperative assessment of hernia wounds.

The Southampton system is much simpler than the ASEPSIS system, with wounds being categorized according to any complications and their extent.12 Both systems, however, have been developed for use following specific types of surgery and this may limit their usefulness.1

Southampton scale - by using the worst wound score recorded and information about any treatment instituted either in hospital or the community, wounds were regarded in four categories: (Table 3)

- a. normal healing;
- b. minor complication;
- c. minor complication;
- d. major complication;
Table 2. ASEPSIS wound scoring system.

<table>
<thead>
<tr>
<th>ASEPSIS WOUND SCORE</th>
<th>Proportion of wound affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound characteristic</td>
<td></td>
</tr>
<tr>
<td>Serous exudate</td>
<td>0 &lt; 20 20-39 40-59 60-79</td>
</tr>
<tr>
<td>Purulent exudate</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>Erythema</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>Separation of deep tissues</td>
<td>0 2 4 6 8 10</td>
</tr>
<tr>
<td>Points are scored for daily wound inspection.</td>
<td></td>
</tr>
</tbody>
</table>

**Category of infection:**
- Grade 0: Normal healing
- Grade 1: Normal healing with mild bruising or erythema:
  - A: Some bruising
  - B: Considerable bruising
  - C: Mild erythema
- Grade 2: Erythema plus other signs of inflammation:
  - A: At one point
  - B: Around suture
  - C: Along wound
  - D: Around wound
- Grade 3: Deep or haemorrhagic discharge:
  - A: At one point only (<2 cm)
  - B: Along wound (>2 cm)
  - C: Large volume
  - D: Prolonged (>3 days)

**Pus:**
- A: At one point only (<2 cm)
- B: Along wound (>2 cm)

**Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration**

(Adapted from Bailey IS et al, BMJ 1992)

Table 3. Southampton wound scoring system.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Appearance</th>
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<tbody>
<tr>
<td>0</td>
<td>Normal healing</td>
</tr>
<tr>
<td>1</td>
<td>Normal healing with mild bruising or erythema:</td>
</tr>
<tr>
<td></td>
<td>A: Some bruising</td>
</tr>
<tr>
<td></td>
<td>B: Considerable bruising</td>
</tr>
<tr>
<td></td>
<td>C: Mild erythema</td>
</tr>
<tr>
<td>2</td>
<td>Erythema plus other signs of inflammation:</td>
</tr>
<tr>
<td></td>
<td>A: At one point</td>
</tr>
<tr>
<td></td>
<td>B: Around suture</td>
</tr>
<tr>
<td></td>
<td>C: Along wound</td>
</tr>
<tr>
<td></td>
<td>D: Around wound</td>
</tr>
<tr>
<td>3</td>
<td>Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration</td>
</tr>
</tbody>
</table>

DISCUSSION

Wilson et al. in his study from 1998, compared two standard definitions [Centers for Disease Control (CDC), USA and National Prevalence Survey (NPS), UK] with ASEPSIS and Southampton scales examining 325 wounds in 230 patients (divided into two groups). There was no significant difference between the two surveys. The two scoring methods were more sensitive than the standard definitions but CDC and NPS did not differ significantly from each other. For ASEPSIS it was reported an interrater reliability of 0.96 in patients having general surgery and similar reliability for sternal and leg wounds of patients after cardiac surgery.

In 2004 Wilson and Bruce made a study on 4773 patients in order to assess the level of agreement between definitions.

The mean percentage of wounds classified as infected differed substantially between definitions: 19.2% with the CDC definition (95% confidence interval 18.1% to 20.4%), 14.6% (13.6% to 15.6%) with the NINSS version, 12.3% (11.4% to 13.2%) with pus alone, and 6.8% (6.1% to 7.5%) with an ASEPSIS score > 2014.

The agreement between definitions with respect to individual wounds was poor. When superficial infections (according to CDC category) were included, 13% (778) of all observed wounds received conflicting diagnoses, and 6% were classified as infected by both definitions. When superficial infections were excluded, the two definitions estimated about the same overall percentage of infection (6.8% and 7.0% respectively), but there were almost twice as many conflicting infection diagnoses (n = 371) as concordant ones (n = 215). Surgical wounds where pus was present were diagnosed as infected by the CDC, NINSS, and pus alone definitions, but only 39% of these (283/714) had ASEPSIS scores > 20. In these cases, greater infection severity was often diagnosed by CDC scale comparing with ASEPSIS. In wounds without pus the relation of ASEPSIS and CDC scales was less consistent. 42% (177/421) of wounds classified only as “disturbance of healing” by ASEPSIS were considered infected by the CDC definition. Conversely, four of the six wounds classified as “severe wound infections” by ASEPSIS were classified as superficial by the CDC definition. Finally, classifications with
different definitions disagreed for more than twice as many wounds as those for which they agreed, and small changes in the interpretation of a definition caused substantial variation in the percentage of wounds classified as infected.

Also in 2004, Chiew YF and Theis JC studied infection rate of total hip replacement operations using different methods of assessment of surgical site infections. These were: (a) clinician diagnosis; (b) ASEPSIS score; (c) presence of pus cells; and (d) assessment by a clinical microbiologist. Two hundred and six patients were enlisted in the study and 22 revision replacements were carried out. Infection rates which were calculated according to the risk indexes varied considerably among these four methods. The infection rates for risk index 0 were 4.35% (method a), 2.61% (method b), 0.87% (methods c and d); and for risk indexes 1 and 2 were 4.17% (method a), 2.08% (method b), 1.04% (methods c and d). The CDC NNIS approach places an important role on the surgeon who may be more inclined to prescribe antimicrobials for suspected infections, that being the reason for higher rates of SSIs when the CDC definitions are used.

CONCLUSIONS

There is no validated universal system designed specifically to aid the assessment and management of surgical wounds. The most commonly used, the CDC definition, employs stringent criteria to classify infection. A single, standard definition of surgical wound infection is needed so that comparisons over time and between departments and institutions are valid, accurate and useful. Meanwhile, comparisons will be compromised by discrepancies in the way that infections are defined. So, using wound infection rates as a performance indicator to compare centres or countries is probably premature.

REFERENCES