INTRODUCTION

While there is considerable evidence available to indicate that surgical site infections are a significant health risk to hospital patients, there is ongoing debate over the appropriate extent and frequency of microbiological surveillance of operating theatres.

Exogenous infections of surgical wounds are caused predominantly by *Staphylococcus aureus*, and *Staphylococcus epidermidis*. *S. aureus* and *S. epidermidis* are shed into the environment by individual skin scales and, while healthy carriers have been found to shed few staphylococci, airborne contamination is inevitable owing to staff movement encountered during operating theatre activities. While there is evidence to indicate that most outbreaks are caused by heavy dispersers,\(^1\) every attempt should be made to minimise airborne transmission within operating theatres.

Principles

Health care facilities should implement proper design and ventilation of operating theatres as a means of controlling airborne contamination. Other strategies to prevent airborne microbial contaminants from entering surgical wounds should include:

- ensuring that staff are educated and take appropriate precautions to prevent shedding of microbes; and
- restricting excessive movement of staff within the operating theatre.

Australian Standard

There are no nationally agreed standards on when to undertake microbiological sampling in the operating theatre, or on the interpretation of sampling results. However, there is sufficient evidence to support the undertaking of microbiological air sampling:

- as part of the commissioning of an operating theatre;
- after any major structural refurbishment (not including High Efficiency Particulate (HEPA) filter changes); and
- as deemed necessary by the Infection Control Unit.

---

\(^1\) Some patients are dispersers of large numbers of *Staphylococcus aureus* and contaminate their immediate environment (e.g. those with upper respiratory tract infections or exfoliating skin lesions). Staff can pick up *Staphylococcus aureus* from the environment of such patients on their hands and can in turn transmit it to other patients. The nose may acquire *Staphylococcus* from hands or from the air.
Specialist microbiologist/infection control advice must be sought prior to undertaking air sampling in an operating theatre owing to the large number of factors that affect microbial air sampling results.

Types of Operating Theatres

Recommended Standards may vary between types of operating theatres. Design standards for operating rooms are defined in the Private Hospital Guidelines located at http://www.health.wa.gov.au/publications/

PLANNING FOR AIR SAMPLING

Health Care Workers should:

• prior to air sampling, obtain the air sampling equipment from a laboratory that is able to process the specimens;
• establish laboratory time-lines for sample collection, processing and provision of results; and
• consult with the hospital microbiologist/engineer. Health Care Workers (HCW) working in rural/regional areas should consult with the Medical Microbiologist at PathWest (Tel: 9346 4093) and their Hospital Engineer before proceeding with microbiological air sampling. Private hospitals should consult with their in-house or consultancy service microbiologist and engineer.

HOW TO AIR SAMPLE

There are several different types of air samplers available and the manufacturer's instructions for use must be followed. If available, the preferred method is to use a sampler that can be turned on by a timer or remote control. Moreover, air samples should be taken after all the following conditions have been met:

• all new or refurbishment work has been completed;
• all engineering commissioning procedures have been completed;
• the ventilation system has been running continuously for 24 hours following completion of structural work (during this time the theatre surfaces and fixed equipment can be cleaned); and
• ducting and air diffuser plates have been cleaned.

METHOD

The following process is recommended:

1. A single sample should be collected from each operating theatre.
2. The air sampler should be checked to ensure that it is clean before use. Follow the manufacturer’s instructions.
3. The theatre being sampled should have been left vacant for a minimum of 15 minutes, but preferably one hour, before sampling proceeds to avoid false-positive results due to recent theatre usage. The theatre doors must be kept closed prior to and during the sampling period.
4. Staff should wear theatre attire and a surgical mask, and the hands should be washed and sterile gloves worn.
5. Using aseptic technique, proceed with setting up and placing the agar strips or plate into the sampler.
6. The air sampler should be placed in the middle of the theatre table or secured on a trolley where the theatre table is usually located.

7. The air sampler should then be switched on either by remote control or manually, before leaving the room. **Note: doors must be kept closed and the theatre empty until sampling is complete.**

8. The sampling equipment will determine the volume of air sampled. Sampling volume needs to be greater than 0.25 m³ (250 L) and optimally around 1 m³ (1000 L).

9. Once sampling is completed, remove the test strips/agar plate aseptically to avoid contamination. The agar strip/plate and request form should be clearly labelled and the amount of air sampled recorded before forwarding the samples to a National Association of Testing Authorities, Australia (NATA) accredited laboratory for processing.

Any variation from the above operating theatre conditions should be noted on the laboratory request form as this information will influence interpretation of results.

**RESULTS AND INTERPRETATION**

Preliminary culture results are rarely available until after 24 hours incubation.

Aerobic cultures on non-selective medium should not exceed 35 colony-forming units (cfu) of bacteria and fungi per cubic metre of air for a conventional theatre and 1 cfu for an ultraclean theatre. These figures are not rigid standards and are intended as a guideline only. If the result exceeds these limits contact your Microbiologist/Infection Control Practitioner for interpretation and advice on further action.

**References**


Dr John de Campo

**ACTING DIRECTOR GENERAL**