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Review

Surgical attire, practices and their perception in the
prevention of surgical site infectionS.M. McHugh^{a,*}, M.A. Corrigan^a, A.D.K. Hill^{a,b}, H. Humphreys^{c,d}^aDepartment of Surgery, Royal College of Surgeons in Ireland, Dublin 2, Ireland^bDepartment of Surgery, Beaumont Hospital, Dublin 9, Ireland^cDepartment of Clinical Microbiology, Royal College of Surgeons in Ireland, Dublin 2, Ireland^dDepartment of Microbiology, Beaumont Hospital, Dublin 9, Ireland

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ABSTRACT

Introduction: Clean surgical scrubs, surgical gowns and headgear are worn by operative teams to decrease bacterial contamination and lower surgical site infection (SSI) rates.**Methods:** A detailed review was undertaken of peer-reviewed publications and other sources of material in the English language over the last 50 years included.**Results:** Surgical scrubs should be clean and made of tightly woven material. Studies investigating single-use gowns and drapes versus reusable gowns report conflicting evidence. Double gloving may reduce SSI rates in procedures where no antibiotic prophylaxis was administered. Bacterial contamination of the operative field has been shown to be decreased by the wearing of surgical headgear by the operating team.**Conclusions:** Further consideration and better trials are required to determine the impact of different theatre clothing on SSI rates.

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Introduction

Approximately 5% of patients undergoing surgery develop a surgical site infection (SSI).¹ Patients who develop SSI are up to 60% more likely to spend time in an intensive care unit, five times more likely to be readmitted to the hospital, and twice as likely to die than are patients without an SSI.² Furthermore, post-operative length of hospital stay is extended by 7–10 days leading to substantially increased overall care costs.^{2–7}

Factors associated with SSI can be either intrinsic or extrinsic. Intrinsic patient factors are not reversible, such as diabetes mellitus. Extrinsic factors are those in which

adherence to best practice can decrease SSI.⁸ Standard procedures for the prevention of SSI include pre-operative patient preparation, appropriate prophylactic antibiotics, careful and skilled surgical technique, intra-operative medical management and post-operative surgical site or wound care.^{9–11}

Practices in the operating theatre complex therefore should be considered as extrinsic factors. This is a restricted area with emphasis on the need for sterility and aseptic techniques compared with pathogen-residing areas such as hospital wards,¹² with the use of clean surgical attire (i.e. scrubs, caps, masks, gloves and gowns) strictly regulated.⁹ Most surgeons have strong opinions on surgical attire,

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although many are based on behaviour and ritual rather than evidence based medicine.¹³ In this article we review evidence based best practice with regard to surgical attire in the field of general surgery.

Methods

A detailed literature review was undertaken through www.Pubmed.com and Google scholar (<http://scholar.google.com>). Surgical attire was defined as the wearing of clean surgical scrubs and footwear in the operating theatre complex and the wearing of surgical caps, masks, gowns and gloves for the operating team. Search terms used included “surgical attire”, “surgical scrubs”, “surgical site infection prevention”, “surgical masks”, “surgical caps”, “surgical gowns”, “surgical gloves”, “surgical shoes” and “surgical footwear”. Peer-reviewed publications in the English language over the last 50 years were included, up to and including June 2013.

Results

Surgical scrubs

In current practice it is a widely held opinion of healthcare professionals that the wearing of clean surgical scrubs in restricted areas of healthcare facilities such as the operating theatre helps ensure cleanliness and reduces infections by limiting the introduction of microorganisms from healthcare personnel to the theatre environment.^{12,14} From the patient's perspective, a study ascertaining their attitudes of the risks of cross-infection through healthcare workers attire has found that surgical scrubs are believed to be the most appropriate attire to prevent infection.¹⁵

While there has been no study demonstrating a direct link between non-sterile surgical attire and increased surgical site infections,^{13,14} the skin of staff working in the operating theatre is known to be a major source of bacteria dispersed into the air.¹⁶ Bacteria are dispersed on epithelial cells that break fragments of approximately 20 mm in size. Given that the interstices of standard cotton fabric have a pore size of 80 ± 100 mm these fragments are small enough to pass through such fabrics. As such recent Association of Perioperative Registered Nurses (AORN) guidelines recommend that the scrub material should be tightly woven, as well as low-linting, stain resistant and durable.¹²

With regard to the wearing of surgical scrubs when leaving the theatre complex for a short period, e.g. to attend a multi-disciplinary team meeting, a study by Copp et al. reported reduced levels of contamination on surgical scrubs when cover gowns were worn outside the operating room.¹⁷ Surgeons' attitudes differ depending on speciality, with orthopaedic surgeons more likely to change to regular clothing when leaving the theatre complex compared with general surgeons.¹⁸ However, theatre nurses have been shown to be especially compliant with regulations restricting surgical attire outside the theatre complex.^{13,14,19,20} Guidelines issued by the then National Association of Theatre Nurses (now the Association for Perioperative Practice, AfPP) in the UK state

that the covering apparel worn when leaving the theatre complex must be a “clean single use gown or coat, completely secured by ties or button fasteners, which is worn once and then appropriately discarded”.²⁰ The wearing of a white coat over surgical scrubs when leaving the operating theatre complex is controversial with some institutions advocating this practice but others arguing that pathogens living on scrub suits worn by healthcare personnel may still spread infection.^{14,21,22}

Recommendations

Surgical scrubs should be clean and made of tightly woven material. However, there is little research evidence to demonstrate that wearing surgical attire outside the theatre and returning to the theatre without changing into clean theatre suits increases SSI rates. In addition, there are no convincing studies demonstrating a relationship between the use of covering apparel and the prevention of infection. Nonetheless, given that surgical scrubs are used to minimise bacteria being shed by the operator, common sense dictates that surgeons should only leave the operating theatre complex when necessary, but when and if they do, they should cover the scrubs when outside the theatre complex or change in to new scrubs on returning to re-commence operating.

Surgical gowns

As well as preventing bacteria from the skin of the operating team contaminating the sterile field, surgical gowns also fulfil the dual role of protecting the team from being contaminated by blood from the patient.¹³

In current clinical practice surgical gowns and drapes are fabricated from either multiple- or single-use materials. These two basic types of products each have advantages and disadvantages.²³ With regard to reusable surgical gowns, there are two available types. The first is tightly woven polyester sheeting and the second a combination of fabrics laminated or coated with various types of films that provide increased protection.²⁴

Single use surgical gowns consist of nonwoven materials such as spunlace hydroentangled material often consisting of wood pulp and polyester fibres. These are often in combination with materials that offer increased protection from liquid penetration such as plastic films.^{23–25}

A number of previous studies have previously compared the use of reusable versus single-use gowns and drapes in the prevention of surgical site infection. A study by Moylan et al. involving 2181 general surgical procedures was performed to evaluate the effectiveness of a disposable gown and drape system versus a cotton system.²⁶ The study end point was the development of SSI. They noted that the disposable spunlaced fibre system had a significantly lower overall infection rate (2.83% vs. 6.5%). However this study was not a randomised prospective trial.

Garibaldi et al. in a comparative study took surgical site intra-operative swabs taken from the surgical site at time of skin closure. This study was a prospective randomised controlled trial (RCT). They noted no significant difference between procedures where reusable cotton gowns and drapes were used compared with nonwoven disposable material

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