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Reusable surgical gowns and drapes. Should we be adopting them?

Hussameldin M Nour, Safer Javid, Rhodri Gwyn and Riem Johnson

Surgical site infection (SSI) is a major complication in orthopaedic surgery, as introducing micro-organisms into the operating field can lead to periprosthetic infections (PPI), which can have a devastating outcome for patients as well as wider healthcare systems¹.

Gowns and drapes are universally used to reduce the risk of SSIs, as well as protecting healthcare providers as part of maintaining the sterile surgical field².

Single use or reusable?

Gowns and drapes can be either single use or reusable. There is an acceptance that reusable drapes could be better for the environment, yet there are concerns regarding increased surgical site infection, as well as user comfort and safety³.

Early reusable surgical gowns were made from woven cotton fabrics, which are not resistant to liquid penetration⁵ and failed to protect the wearer, as well as the patient from microbial transmission.

Single-use gowns and drapes were therefore introduced and this led to a parallel introduction of single use equipment.

The latter gained popularity in the 1990s after the discovery of variant Creutzfeldt-Jakob Disease (vCJD) for infection control purposes, when sterilisation techniques at that time were not as efficient as they are now⁴.

More recently, these older woven cotton fabrics have been replaced by cotton/polyester (PET) blended fabrics and full PET fabrics⁵.

However, despite the almost universal use of disposable gowns in T&O, there is no data to suggest that disposable gowns and drapes are superior to reusable ones in reducing SSI^{6,7}.

There is some work looking at physical properties. The Association for the Advancement of Medical Instrumentation (AAMI) defines four levels of protection for all types of gowns which are:

- Level 1: Minimal level of fluid barrier protection.
- Level 2: Low level of fluid barrier protection.
- Level 3: Moderate level of fluid barrier protection.
- Level 4: Highest level of fluid and viral barrier protection⁸.

McQuerry⁹ studied single-use gowns using the American Association of Textile Chemists and Colourists test method. This study suggested that level I and II disposable gowns did not satisfy AAMI standards for impact penetration water resistance.

All levels of disposable gowns did not fulfil the American Society for Testing and Materials performance prerequisites for breaking strength in the crosswise direction, but reusable gowns had superior protection in comparison to disposable gowns.

There are currently no studies comparing disposable gowns and drapes in surgery, which requires a high level of protection such as arthroplasty.

The aforementioned study would suggest that although reusable gowns have superior physical properties than disposable gowns and drapes, that does not mean that there is protection from developing infection and SSI.



Rhodri Gwyn is a Post CCT fellow in Hand Surgery. University Hospitals Sussex NHS Foundation Trust. Trained in Wales.



Riem Johnson qualified from Leicester and undertook basic surgical training on the NE England Training Programme. She did her MD at the University of Newcastle and completed her CCT. Her subspecialty interest is Hand Surgery and did her fellowship at the Chelsea and Westminster Hospital, as well as working as a locum consultant at the Pulvertaft Unit in Derby. She was subsequently appointed as consultant at University Hospitals Sussex working in the UHS Hand Unit. She is the current sustainability lead in the department.

Ecological impact

The biggest issue threatening human health and health care systems in the world is the climate crisis¹⁴, yet our health systems are contributing to this crisis.

Healthcare contributes to 4.4% of the global greenhouse gas emissions¹⁰. In the UK, the National Health Service (NHS) produces 22.8 million tons of carbon dioxide (CO₂) per year¹¹ and 10% of the NHS carbon footprint in England is caused by medical equipment¹².

Rizan¹³ reported that operating theatres are 3–6 times more energy-intensive than the rest of the hospital and are a major contributor of waste with an estimate footprint of 6–814kg carbon dioxide equivalents per a single operation.

A study done in Canada, the United States and the United Kingdom estimated that emission contributions from the annual operation of surgical suites were found to range from 3,200,000 to 5,200,000 kg of carbon dioxide equivalent, which is equivalent to the annual carbon footprint of 2 million passenger vehicles^{15,16}.

Single-use items account for a large proportion of the carbon footprint of procedures. In carpal tunnel decompression for example, drapes account for 32% and single-use PPE for 23% of the overall carbon footprint¹⁷. It has been shown that selecting reusable gowns, rather than single use items, reduces natural resource energy consumption by 64%, greenhouse gas emissions by 66%, blue water consumption, defined as any water that is removed from and not returned to the water supply, by 83% and solid waste generation by 84%.

Recent studies have shown that 1,000 grams of disposable surgical gowns consumes 26,286 megajoules (MJ) of natural resource energy, in comparison to only 2,366 MJ in reusable gowns. Moreover, 1,000 grams of reusable gowns releases 557kg of CO₂ equivalent in comparison to 1,636kg with single-use gowns. The figures above were calculated in relation to gown manufacturing and supply chain, packaging manufacturing, sterilisation, phase transport and end of life¹⁸.

Financial cost

Health systems consume a huge share of a country's budget. In the UK, it is estimated that £153 billion was spent on the NHS in 2022/23¹⁹. In the USA, 4.2 trillion US dollars

was spent on healthcare in 2021²⁰. Health care demand is expected to increase over time. By 2030, the global demand for primary total hip arthroplasties is estimated to expected grow by 174% to 572,000. Likewise, the global demand for primary total knee arthroplasties is projected to grow by 673% to 3.48 million procedures²¹ and this will cause a further financial burden to health systems.

Surgical equipment and gowns play a role in this financial impact, and there is a debate about the cost effectiveness of reusable gowns and drapes versus disposable ones.

Baykasoglu *et al*'s study²² showed that the cost of reusable gowns was approximately 25% of the cost of disposable gown costs.

Wedmore *et al*²³ suggested that reusable clothing and draperies may result in cost savings through requiring less waste output

and landfill use. The initial investment barrier being addressed by implementing cost-effective methods of laundering.

Conclusion

Therefore, reusable gowns and drapes have a smaller carbon footprint. As well as being cheaper, they should tick the sustainability boxes not only on the environmental, but also on the financial front.

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In returning to the question posed in the title, the answer is yes. We believe that more sustainable and environment friendly solutions such as reusable textiles should be adopted for these reasons.

How that is brought about will require leadership by the BOA and other stakeholders as well as grass roots commitment. We as a group have access to NHS data, along with the orthopaedic registries and most recently the Medical Outcome Devices Registry. If we were to record what type of gowns and drapes were used in the insertion of an implant, we would then be able to allay our concerns about SSI and reusable drapes. This could be supported by BOA-led guidelines on the adoption of reusable materials for gowns and drapes. ■

References

References can be found online at www.boa.ac.uk/publications/JTO.