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Nursing innovation: Improved perioperative care with a redesigned urological drape

Abstract

Inventions and innovations have the potential to change lives.¹ Perioperative nurses strive for improved patient care² and are well positioned to develop creative and innovative solutions to clinical challenges faced when caring for patients in the perioperative environment. Fluid leakage during percutaneous nephrolithotomy (PCNL) surgery poses risks to both patients³ and staff. The PCNL drape was developed by a collaborative perioperative team to reduce these risks and improve the quality of care provided to patients.

Keywords: nurse, nursing, innovation, drape, urology, urological, surgical

Identified problem

Percutaneous nephrolithotomy (PCNL) is a technique used to remove large renal stones and is traditionally performed as a two-stage procedure with the patient starting in lithotomy position and then being repositioned intra-operatively to a prone position.⁴ Patients are at risk of several complications when in the prone position; therefore, the supine Valdivia position, a modified supine position, is more commonly adopted during PCNL to maximise kidney stone clearance by allowing surgeons both antegrade and retrograde approaches to the kidney stone.⁵

During endoscopic urological procedures, such as PCNL, large volumes of irrigating fluid are used to allow adequate surgical vision. Between three and 12 litres of saline are used during a standard PCNL procedure.⁶ This contaminated irrigation fluid needs to be collected once it has passed through the patient to avoid contamination of the perioperative environment.^{7,8} When drapes and draping techniques provide an inadequate seal, or the fluid is not contained within the receptacle

provided to collect it, the irrigation fluid leaks onto the operating room floor and perioperative staff. Leaking irrigation fluid causes the surgical environment and patient to become damp, which poses a risk to staff and creates the potential for cross contamination.⁹

Prolonged contact with leaking fluid during a PCNL procedure puts patients at risk of perioperative hypothermia¹⁰ from heat loss as moisture evaporates. Perioperative hypothermia should be avoided whenever possible¹⁰ as it is associated with adverse effects including impaired coagulation, reduced rates of drug clearance and post-operative shivering, resulting in a significant rise in oxygen consumption.¹⁰ Patients undergoing PCNL have demonstrated reduced core temperatures related to the length of the procedure, absorption of fluid, and environmental factors. The impact of these effects are particularly significant for elderly patients and those with cardiovascular issues.^{6,8}

In addition, leaked fluid requires extended cleaning of the perioperative environment after the procedure, which affects turnover time between surgical cases – on



Previously used draping technique with leaked irrigation fluid

average 28 minutes in the Australian hospital system¹¹ – and increases the cost of operating theatre services. Waqas¹² states that operating theatre services represent a significant proportion of hospital costs.

Development of a surgical drape that minimised fluid leakage could not only reduce risk for patients and staff but also reduce costs by optimising operating theatre utilisation.

Proposed solution

The issues associated with currently available draping techniques were identified by the urological perioperative team, led by a specialist associate nurse unit manager and the urology surgical consultant, of a tertiary, public hospital in Victoria, Australia. The team engaged with Defries Industries to produce a drape, known as the 'PERC' drape, that was specifically designed for the PCNL

procedure and aimed to reduce leakage of irrigation fluid and the associated risks.

Compared to currently available drapes, the PERC drape provides adequate sealing and has wider drainage pockets to catch more irrigation fluid. It also has three layers of absorbent, impervious material that prevent moisture from coming into direct contact with the patient's skin. This reduces the risk of prolonged skin exposure to the wet parts of the drape and reduces evaporative heat loss for the patients.³

The PERC drape is a single-piece drape that covers both the patient's legs, rather than being pulled over each leg separately as the latter technique presents inherent risks to sterility.⁷ The PERC drape also includes transparent adhesive sheets for bilateral loin approaches. These allow one surgeon to approach the bladder, while a second surgeon can simultaneously access either of the kidneys.

Project plan

The urological perioperative team identified the vital requirements of a prototype drape, considering the desired ease of application and adherence to relevant policies and national standards. The drape was developed under the guidance of policies from the Association for the Advancement of Medical Instrumentation (AAMI) national standards for surgical drapes, which adhere to the AAMI and European Union (EU) standards for single-use surgical drapes.¹³

Initial prototype drawings outlining dimensions, fenestrations, adhesive properties and other required components (such as velcro holders and cable loops) were developed. After consultation with the nurses and surgeons of the urological perioperative team a technical



PERC drape with fenestrations

manufacturing design artist from Defries Industries transformed the prototype drawings into a digital manufacturing drawing.

Sterile prototypes were produced to trial in the team's hospital. After this trial, the drape was made wider to improve sterility, and deeper pouches were added to secure surgical instrumentation. Once the drape design was agreed upon by the urological perioperative team and Defries Industries, approval from hospital administrators was

sought and the PERC drape went through a strict quality assurance process to conform with Therapeutic Goods Administration requirements. Trilaminar fabric was chosen for the PERC drape to be made from as it is highly fluid repellent.¹⁴

The process took approximately six months from the initial drawings to the final development and manufacture of the PERC drape. More than 636 drapes have been ordered, to date, across four hospitals.

Project challenges and successes

Challenges

The challenges encountered in this project occurred once the PERC drape had been developed, and involved justifying, quantifying and legitimising, to the organisation management, the costs associated with ordering the newly developed PERC drape from Defries Industries to replace the previously used drapes.

Successes

The PERC drape not only achieves the aim of significantly reducing irrigation fluid leakage but is also easier to apply than the previously used drapes. The reduction in excess irrigation fluid mitigates the risk of perioperative hypothermia and skin exposure for the patient, and the health and safety risks for the perioperative team.⁹ The PERC drape has the added benefit of reducing perioperative waste and supporting health care organisations' awareness of sustainability.¹⁵

Standard 1 of the Nursing and Midwifery Board of Australia (NMBA) Registered nurse standards, states 'think critically and analyse nursing practice'.¹⁶ This project demonstrates nurses thinking critically, analysing their practice and collaborating with surgeons and industry to implement quality improvement practices.

Opportunities for improvement

The use of the PERC drape is not exclusively limited to PCNL surgery. The drape can be used during other procedures, such as conduitoscopy, that require similar surgical approaches. Further modification to reduce the size of fenestration on the perineal exposure site and



PERC drape with large pouch

increasing the size of the fluid collection pouch to enable further efficiency in containing contaminated fluid that drains into a fluid collecting system would be desirable and is a potential modification for the future.

Recommendations

Perioperative nurses can be great innovators, leading to quality improvement and practice change. The perioperative teamwork implemented to design and

manufacture the PERC drape exemplifies the boundless potential of collaborative practice. Further exploration into the impact of the PERC drape on turnover time between surgical cases and cost of operating theatre services would be beneficial in the future.

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Conflicts of Interest

The authors have declared no competing interests.

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