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POINT-OF-USE PRE-CLEANING OF SURGICAL INSTRUMENTS: A NEGLECTED BUT FOUNDATIONAL STEP FOR SURGICAL SAFETY, STERILITY ASSURANCE, AND INSTRUMENT PRESERVATION

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ABSTRACT

Sterilisation failure is often discussed as a downstream problem of decontamination and processing, yet the success of the entire reprocessing cycle depends on the adequacy of point-of-use pre-cleaning. Instruments that are not promptly wiped, flushed, and kept moist after use accumulate dried blood, tissue, and proteinaceous debris, which can facilitate biofilm formation, compromise subsequent cleaning, and increase the risk of device damage and patient harm. This narrative review examines why point-of-use pre-cleaning should be recognised as a critical patient-safety intervention rather than a routine housekeeping task. It synthesises current guidance from infection prevention and perioperative practice standards with practical considerations for operating theatre and Central Sterile Services Department (CSSD) workflows. Particular attention is given to cannulated devices, orthopaedic and neurosurgical instruments, and flexible endoscopes, which are especially vulnerable to retained soil and difficult-to-remove bioburden. The review also discusses intraoperative wiping and flushing, post-procedure moisture retention, transport requirements, delayed reprocessing, staff training, audit, and shared accountability between OT and CSSD teams. Reframing pre-cleaning as a time-sensitive, team-based safety process may improve sterility assurance, preserve instrument integrity, strengthen audit readiness, and reduce reprocessing-related risks. Hospitals should therefore embed standardised point-of-use pre-cleaning into perioperative workflow, competency assessment, and quality monitoring.

KEYWORDS : Pre-Cleaning; Point-Of-Use Treatment; Surgical Instruments; CSSD; Sterilization; Biofilm; Flexible Endoscopes; Patient Safety

INTRODUCTION

Safe surgical care depends not only on operative technique and antimicrobial prophylaxis, but also on the reliability of reprocessing systems that prepare reusable instruments for the next patient. The source manuscript correctly places cleaning at the centre of this process and argues that pre-cleaning at the point of use serves as the foundation for successful reprocessing. Instruments that are not managed promptly after use are at risk of retaining gross soil, drying during transport, and arriving in decontamination in a condition that is more difficult to clean, inspect, and return safely to service.

In many hospitals, point-of-use pre-cleaning is still treated as a secondary task performed only after the procedure or deferred entirely to the CSSD. This fragmented approach is risky. It ignores the time-sensitive nature of bioburden removal and overlooks how operating-room workflow, staffing, and transport delays affect the effectiveness of the downstream sterilisation pathway. Reframing point-of-use pre-cleaning as a frontline patient-safety measure is therefore both clinically and operationally necessary.

This manuscript converts the submitted practical article into a journal-style narrative review. Its objective is to examine why point-of-use pre-cleaning should be regarded as a core safety practice, to synthesize relevant standards and literature, and to outline the operational elements required for a reliable OT CSSD pre-cleaning program.

2. Why Pre-cleaning Matters

The rationale for prompt pre-cleaning is straightforward: material left on an instrument after use does not remain benign. Blood, tissue fragments, proteinaceous soil, and cement residues can dry rapidly, bind to surfaces, and become progressively harder to remove. Hinges, box locks, serrations, lumens, and narrow channels are especially vulnerable to retained contamination. Once organic soil dries, subsequent manual or mechanical cleaning becomes less effective and more labour-intensive.

The consequences are both microbiological and mechanical. Residual soil can contribute to biofilm formation, particularly in narrow, moist, and hard-to-access areas. Biofilms are clinically important because they may protect microorganisms from detergents, disinfectants, and sterilants, thereby undermining the effectiveness of subsequent reprocessing steps. In addition, blood and saline residues may promote corrosion and pitting, compromising the cleanability and service life of reusable instruments. Point-of-use pre-cleaning should therefore be understood as both an infection-prevention intervention and an instrument-preservation strategy.

3. Point-of-Use Pre-cleaning as a Perioperative Safety Process

Point-of-use pre-cleaning is best understood as a process rather than a single act. It begins at the site where the instrument is used and continues through visible soil removal, moisture retention, containment, transport, and handover for terminal cleaning in the decontamination area. This process orientation is important because failures often occur not in a single dramatic event but through small delays and omissions across the chain.

A reliable point-of-use process should include at least five elements: immediate removal of gross soil; maintenance of moisture in accordance with the device manufacturer's instructions for use; avoidance of practices that damage instruments or compromise later processing; safe and timely transport in appropriate closed containers; and clear accountability between OT, procedure-room, and CSSD teams. Hospitals that do not define these elements explicitly are more likely to experience variability, survey non-conformities, and avoidable patient safety risks.

4. Intraoperative Pre-cleaning: An Underused Safeguard

A common misconception is that pre-cleaning begins only after the operation has ended. In reality, lengthy procedures can leave instruments contaminated for extended periods unless they are intermittently wiped and flushed during use.

Orthopaedic, neurosurgical, trauma, and high-bioburden procedures are particularly vulnerable because gross contamination from blood, bone, tissue, or cement can adhere firmly if not addressed promptly.

Intermittent wiping of instruments with sterile water-moistened material and, when indicated, flushing of lumen-containing devices reduces the risk of drying and eases later terminal cleaning. This approach is consistent with the principle that contamination should be controlled at the earliest feasible point. In journal terms, intraoperative pre-cleaning should be viewed as a preventive contamination-control strategy rather than an optional convenience measure.

5. Post-procedure Handling and Moisture Retention

When the procedure is completed, visible gross soil should be reduced as soon as practicable, and the instrument should be prepared for safe transport. A key principle is that devices should be kept moist, but not managed in ways that contradict manufacturer instructions or established reprocessing standards. Saline should not be used to soak instruments because it is corrosive to metal surfaces. Likewise, instruments should not be transported in unapproved soaking solutions.

Instead, post-procedure handling should focus on removing obvious debris, opening or disassembling devices when appropriate and permitted, and applying approved moisture-retention or pretreatment products in line with device-specific instructions. This is especially important for box locks, hinges, serrated surfaces, and other difficult-to-clean areas. Hospitals should ensure that pretreatment products are available at the point of care and that staff know both how and when to use them.

6. Transport, Holding Time, and the Risk of Re-drying

Even when pre-cleaning is performed correctly in the OT, prolonged transport delays or extended decontamination queue times can allow soil to dry again. Timely transport in puncture-resistant, closed, and appropriately labelled containers is therefore an essential extension of the point-of-use process. Transport systems should protect staff from exposure while preserving the condition of contaminated instruments for effective terminal cleaning.

Hospitals with off-site procedure areas, high operating volume, limited after-hours sterile processing, or long internal transport times are especially vulnerable to this problem. Such settings require defined maximum holding times, escalation rules for backlog, and contingency processes for delayed reprocessing. If pretreatment products are used, staff must also ensure that residues are thoroughly removed during cleaning, as dried pretreatment gel may interfere with subsequent processing if not properly rinsed away.

7. Flexible Endoscopes and Other High-risk Devices

Flexible endoscopes deserve special consideration because their long, narrow channels and complex design create ideal conditions for retained soil, residual moisture, and biofilm formation. Delays in bedside pre-cleaning or transport can impair subsequent manual cleaning and high-level disinfection or sterilisation. For this reason, many manufacturers and reprocessing guidelines place strong emphasis on immediate post-use care, prompt transfer to reprocessing, and additional steps when delayed reprocessing becomes unavoidable.

The same logic applies to other complex reusable devices, including cannulated instruments, powered orthopaedic tools, and implants or implant-associated trays that come into contact with blood or tissue. Any delay that permits drying inside channels or on hidden surfaces increases reprocessing difficulty and may compromise safety margins. A risk-based approach to pre-cleaning should therefore prioritise devices with lumens, joints, porous interfaces, or exposure to heavy bioburden.

8. Shared Accountability Between OT and CSSD

A recurrent systems problem in instrument reprocessing is the assumption that cleaning is the sole responsibility of CSSD. In practice, successful reprocessing depends on shared accountability between surgeons, scrub staff, circulating nurses, OT managers, infection prevention personnel, and CSSD technicians. Preventing dried soil at the point of use cannot be accomplished by CSSD alone, as it does not control the interval immediately following use.

A mature safety culture addresses this by clearly defining responsibilities. OT staff should perform immediate point-of-use actions; CSSD staff should verify incoming conditions and escalate recurrent non-conformities; and leadership should remove barriers related to supplies, staffing, training, and transport. When ownership is ambiguous, failure becomes normalised. When ownership is shared and visible, pre-cleaning becomes a stable part of perioperative safety practice.

9. Training, Competency, and Audit

Effective pre-cleaning programs require more than policy statements. Staff must understand why the practice matters, not only what steps to follow. Orientation, annual competency assessment, product-specific instruction, and direct observation are all necessary to convert policy into consistent practice. Training should cover wiping and flushing technique, moisture retention, containerization, handling of delicate or powered instruments, and the rationale for avoiding saline or non-approved soak methods.

Audit and feedback are equally important. Hospitals should monitor visible soil on return, compliance with point-of-use treatment, transport delays, decontamination backlogs, and repeat findings in specific specialities or procedural areas. Audit findings should be discussed jointly by OT, CSSD, and infection prevention teams. This converts pre-cleaning from an informal expectation into a measurable quality-and-safety process.

10. Implications for Patient Safety and Accreditation

Point-of-use pre-cleaning affects more than technical cleanliness. It influences sterility assurance, instrument lifespan, workflow efficiency, accreditation readiness, and potentially the risk of patient harm associated with inadequately reprocessed devices. The relationship between pre-cleaning and downstream sterilisation is particularly important because sterilisation cannot compensate for inadequate cleaning. If organic material remains on a device, the effectiveness of later disinfection or sterilisation may be compromised.

Accreditation and survey activity increasingly examine the transport and moisture management of soiled instruments, the handling of flexible endoscopes, and the consistency of OT–CSSD workflow. Hospitals that neglect pre-cleaning may therefore face both patient-safety consequences and regulatory scrutiny. Conversely, institutions that standardise this process are likely to gain advantages in quality assurance, instrument preservation, and team accountability.

11. CONCLUSION

Point-of-use pre-cleaning should be recognised as a critical component of safe surgical care rather than a routine housekeeping task. When gross soil is removed promptly, devices are kept moist, transport is controlled, and OT and CSSD teams operate within a shared-accountability model, the probability of effective downstream cleaning and sterilization improves. When pre-cleaning is delayed or

treated as optional, hospitals inherit preventable risks associated with retained bioburden, biofilm persistence, corrosion, workflow inefficiencies, and patient harm.

Hospitals should therefore formalize point-of-use pre-cleaning through written policy, device-specific instructions, competency assessment, audit, and interdisciplinary leadership oversight. Future research should evaluate measurable associations between structured pre-cleaning programs and outcomes such as visible soil on inspection, reprocessing turnaround time, instrument repair burden, and reprocessing-related incident reporting.

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