27th WFHSS CONGRESS - 2026 -

BELGRADE

21ST - 24TH OCTOBER 2026

Clinical Evaluation of an Ultrasonic-Assisted Reprocessing Protocol for Robotic Surgical Instruments Under Real Clinical Conditions

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Disclosure of Interests

Collaboration with Antonio Matchana S.A · Testing at the Matachana Test Center

No personal financial compensation was received

The authors declare no conflict of interest

Bellvitge
Hospital Universitari
Institut Català de la Salut

1. Backgroun

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OUR HISTORY

1972 — Inauguration as "Ciudad Sanitaria Príncipes de España".

1980–2000 — Consolidation as a hospital of reference for Catalonia and development of new specialities and services.

2000–2015 — Expansion of transplant programs, complex surgery and biomedical research. Strong commitment to innovation.

2015–PRESENT — University hospital of international reference, integrated in the Bellvitge Campus together with the University of Barcelona and IDIBELL.

OUR IMPACT ON THE REGION

>2 MILLION people served in our area of specialized reference.

>5,000 professionals committed to excellence and care.

CENTER OF REFERENCE in multiple areas of high specialization.

TEACHING Undergraduate, postgraduate and continuous training for thousands of health professionals each year.

RESEARCH One of the hospitals with the highest scientific output in Spain, in collaboration with IDIBELL and the University of Barcelona.



USOS

wfhss World Federation for Hospital Sterilisation Sciences

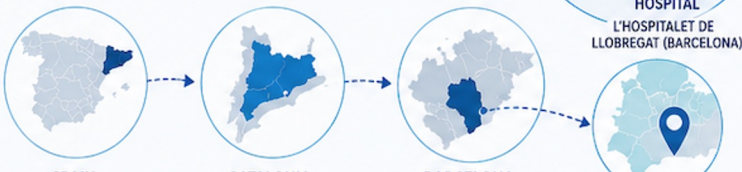
BELLVITGE UNIVERSITY HOSPITAL

Clinical excellence, research and innovation for health, from the heart of Catalonia

A high-complexity public hospital, part of the Catalan Health Service (CatSalut), nationally and internationally recognized for its patient care, teaching and research.



ON THE MAP OF SPAIN

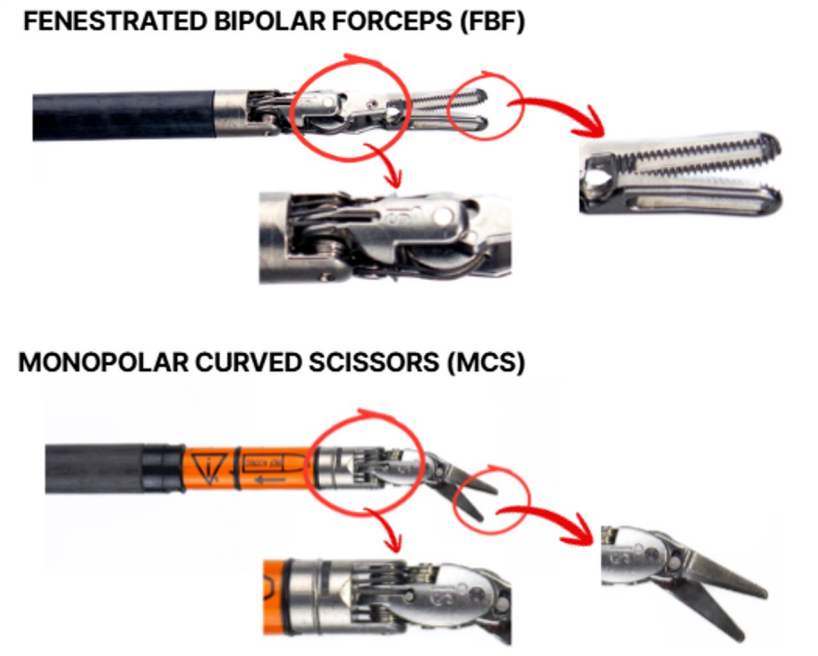


REFERENCES IN

- Transplants
- Neurosciences
- Robotic surgery
- Oncology
- Cardiology
- Complex traumatology

1. Background

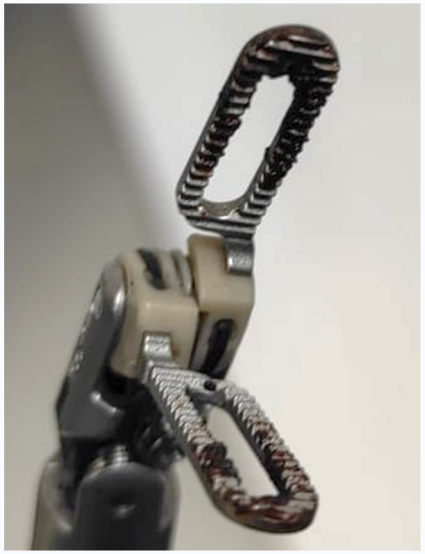
Robotic surgical instruments used in minimally invasive surgery present significant challenges for cleaning validation due to their complex geometry, articulated mechanisms, and internal structures, which can retain biological residues.



1. Background

These challenges are particularly relevant for instruments used with electrosurgical energy, where thermal effects may produce tenacious organic deposits that strongly adhere to instrument surfaces.





1. Background

This study aimed to evaluate the cleaning efficacy of an ultrasonic-assisted reprocessing protocol combining ultrasonic irrigation and automated washer-disinfector processing for Da Vinci robotic surgical instruments under real clinical conditions.





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2. Study Overview

STUDY

SURGERY

MAT UIRI

ULTRASONIC IRRIGATOR

15min
Mildly alkaline enzymatic detergent at 1%

Visible residues after cycle?

YES

NO

MANUAL BRUSHING

<1 min

Washer Disinfector
MAT LD1000

WASH CYCLE

PREWASH – 2 min – 20°C – Cold deionized water
WASH – 10 min – 55°C – Mildly alkaline enzymatic detergent (0.5%)
RINSE I – 3 min – Reverse osmosis water
RINSE II – 3 min – Reverse osmosis water



BCA SPECTROPHOTOMETRY (MATEC TEST CENTER)

PROTEIN EXTRACTION

RUMED Routine

VALIDATED REPROCESSING

MAT UIRI

MAT LD1000

Double washing step

STERILIZATION

NEXT SURGERY

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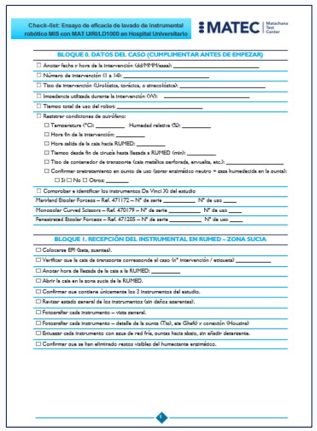
2. Study Overview

CHECK LIST QUESTIONS

- **TYPE OF SURGICAL PROCEDURE:** UROLOGICAL
- **OPERATING ROOM CONDITIONS** (Temperature and relative humidity)
- **IMPEDANCE:** 4 W
- **ROBOT OPERATING TIME**
- **TIME TO REACH THE MEDICAL DEVICE REPROCESSING UNIT**



FENESTRATED BIPOLAR FORCEPS



MONOPOLAR CURVED SCISSORS



- Protein extraction was performed separately from the ***tip and shaft*** of the same surgical instruments.
- Measurements were taken at cycles ***1, 2, 3, 10, and 14 throughout their lifecycle***.
- All measurements were performed under ***real operating-room conditions***.

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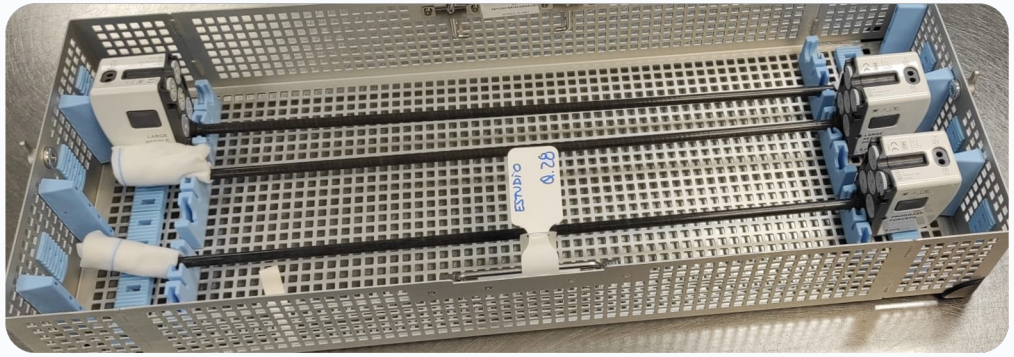
2. Study overview

Preliminary Phase

*



1. Operating room: Spray the tips of the da Vinci instruments with a pH-neutral enzymatic detergent. and wrap with gauze.

1. *Transport the instruments in protected perforated metal trays to the CSSD within 60 min of surgery.

1. Rinse the instruments immediately with water. This removes excess enzymatic detergent and prevents harmful foam formation.

2. Study overview

STEP 1- MAT UIRI IRRIGATOR

- Equipment used: MAT UIRI ultrasonic system
- Cycle duration: 15min
- Chemical agent: mildly alkaline enzymatic detergent at 1%
- Continuous active irrigation through internal shaft ports simultaneous with external ultrasonic vibration + rotation movement of distal tip.
- Full traceability: USB logging/ recording



STEP 2- AUTOMATED WASHING, WITH NO THERMAL DESINFECTATION

(Only to analyze the cleaning effect)

- Equipment used: MAT LD1000 washer- disinfector
- Critical phases of the specific MIS cycle:
  1. Pre-wash
  2. Mildly Alkaline Enzymatic washing step (0,5%)
  3. Two rinsing phases
  4. High-temperature drying
- Specific rack/support
- Full traceability: USB logging / recording





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2. Study overview

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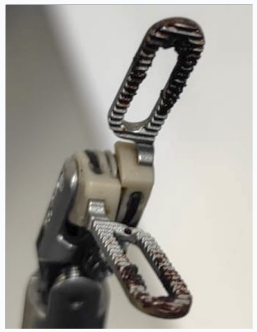


PRE UIRI



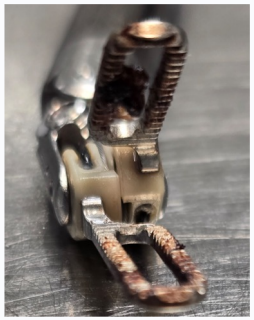
POST UIRI



PRE UIRI



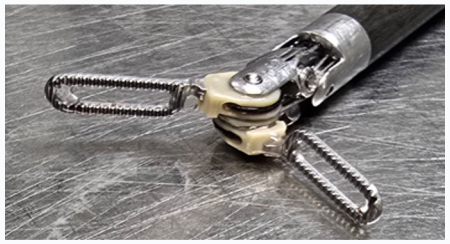
POST UIRI



PRE UIRI



POST UIRI



After manual brushing <1min

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3. Results & Discussion

RESULTS

	MCS (monopolar curved scissors)	**FBF** (Fenestrated bipolar forceps)	**Logarithmic reduction**
Initial contamination level	**21,861.6 µg**	**43,858.7 µg**	
MANUAL CLEANING	**79,7 µg**	**243,1 µg**	**2,31- log**
MANUAL CLEANING + WASHER-DISINFECTOR	**24,3 µg**	**92,8 µg**	**2,75- log**
FULL PROTOCOL WITH ULTRASONIC IRRIGATION	**13,6 µg**	**15,1 µg**	**3,36- log**

Contamination level <100µg/ instrument (recommended by KRINKO/BfArM and aligned with ISO 15883-5)

3. Results & Discussion

2,31-log

Manual cleaning

2,75-log

Manual + washer

3,36-log

Full protocol with MAT UIRI

Respect our current manual protocol, the inclusion of active irrigation improves a +0.61 log of protein extraction, with a standardized cycle for MIS instruments, fully automatized.

4. Conclusion

Robotic surgical instruments may carry substantial organic contamination immediately after clinical use, reaching protein loads in the milligram range. However, the combination of ultrasonic irrigation and automated washer-disinfector processing achieved protein reductions exceeding 99.9% under real clinical conditions, corresponding to a 3.36-log reduction of the initial contamination load.

The protocol demonstrated robust performance under variable clinical conditions and may help reduce reliance on repeated manual brushing, supporting more standardized, automatized and reproducible reprocessing workflows for complex robotic surgical instruments in Central Sterile Service Departments.

5. Acknowledgements

Bellvitge University Hospital
MATEC Test Center

Operating Room Team
RUMED Team