ISW26-231-01 (0844)

NON-INVASIVE SPO_2/FIO_2 RATIO IS AN ACCURATE AND RELIABLE SURROGATE FOR PAO2/FIO2 RATIO IN SWINE WITH SEVERE SMOKE INHALATION/BURN-INDUCED ARDS AND 72-HOURS OF ICU CARE

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Introduction:
Burn patients are high-risk for acute-respiratory-distress-syndrome (ARDS), facing increased morbidity and mortality. Timely ARDS recognition enables appropriate triage and improved patient outcomes. PaO_2/FiO_2 ratio (PFR) is standard for ARDS classification but requires invasive arterial blood gas (ABG) sampling, often unavailable in low-resource or rapidly-evolving critical care settings. The noninvasive SpO_2/FiO_2 ratio (SFR) has shown promise in pediatric burns and in our prior severe injury models. Objective: Evaluate SFR as a continuous, noninvasive surrogate for intermittent PFR in severely burned, smoke-inhaled swine during 72-hr ICU management.

Material and Method:
Anesthetized female Yorkshire swine (50-60kg, N=51) received 40% TBSA, full-thickness burns and smoke inhalation. Animals were randomly assigned to 1) standard-of-care-mechanical-ventilation (MV, n=14), or 2) MV+continuous extracorporeal-carbon-dioxide-removal (ECCO2R, n=17) or mesenchymal-stem-cell(MSC) administration at 0, 24, and 48hrs post-injury(n=20). Continuous SpO_2/FiO_2 monitoring yielded SFR; intermittent ABG provided PFR. Agreement was assessed by linear regression and Bland–Altman; ROC curves evaluated ARDS classification. SFR trends were analyzed over 72hrs, with $p<0.05$ considered significant.

Results:
SFR significantly and strongly correlated with PFR across 583 matched points(Spearman $\rho = 0.71$, $R^2 = 0.69$, $p < 0.0001$). Linear regression(Figure.1A) and Bland–Altman(Figure.1B) analyses confirmed SFR-PFR agreement, while ROC curves(Figure.2) demonstrated excellent discrimination across ARDS classifications. High threshold sensitivity and specificity demonstrated SFR's ability to independently identify clinically relevant oxygenation ranges.

Conclusion:
SFR is a reliable surrogate for PFR in burn-induced ARDS, remaining accurate across treatment effects. Its practicality in settings without ABG access, including resource-limited burn centers, forward surgical units, and preoperative triage, supports its integration into early burn evaluation to enable timely intervention.

A **B**

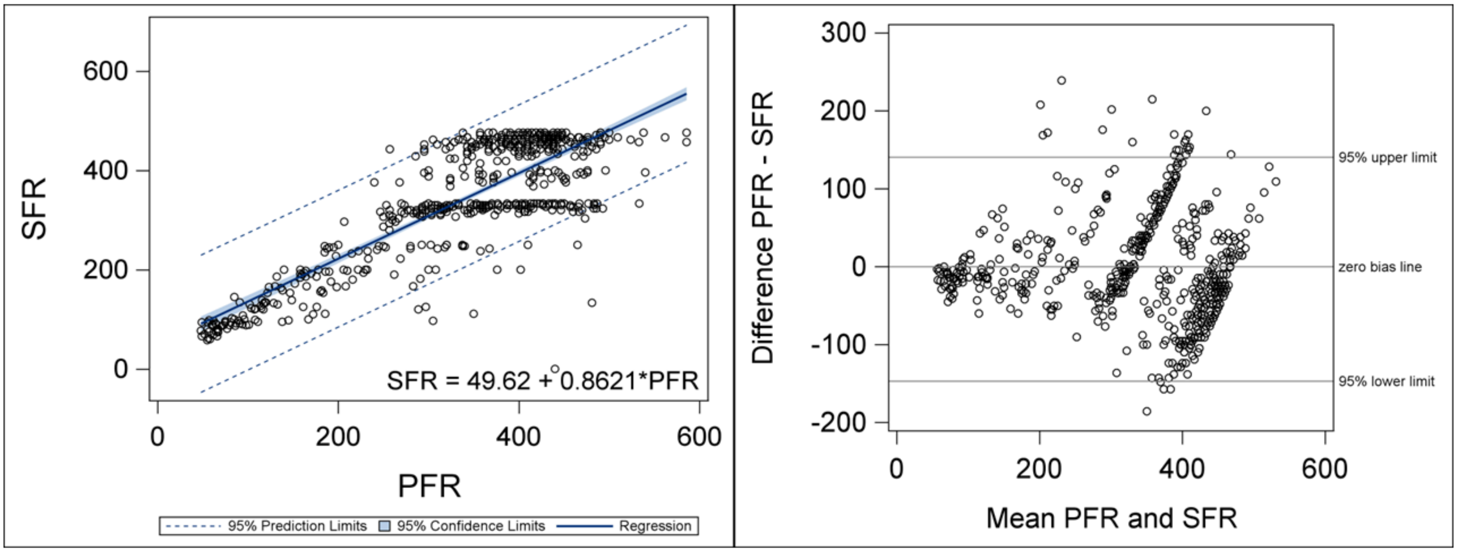

Figure 1. A. Linear Regression Analysis equation: SFR = 49.62 + 0.862 × PFR, with 95% confidence bands. **B.** Bland-Altman Analysis demonstrated mean bias of −3.29, with 95% limits of agreement from −144.2 to +137.6 mmHg.

A **B** **C**

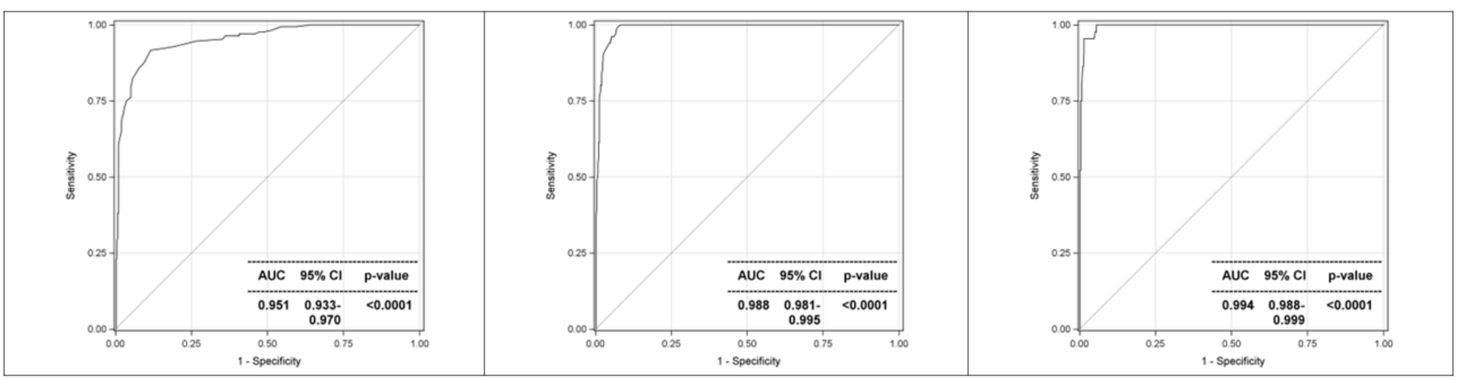

Figure 2. A. AUC = 0.951 for mild ARDS(cutoff ≤ 0.24), **B.** AUC = 0.988 for moderate ARDS (cutoff ≤ 0.16), and **C.** AUC=0.994 for severe ARDS (cutoff ≤ 0.055).

ISW26-231-03 (0641)

THE FUTURE OF BIO-PRINTING SKIN: PRE-CLINICAL AND CLINICAL OUTCOMES OF 3D PRINTING SKIN IN-SITU

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Introduction:
Skin tissue engineered solutions have been adopted into clinical practice to treat all types of wounds ranging from burn injuries to chronic wounds. However, many current cell-based systems have limitations including cellular run-off and complex culturing methods. Due to these limitations, cells and their delivery systems are often adjunct treatment modalities in the management of burns. The use of highly advanced delivery systems to build constructs that represent the native human skin are at the forefront of research and in these studies we evaluate the use of a robotic 3D bio-printer in-situ to promote tissue regeneration and repair.

Material and Method:
LIGO, a surgical robot capable of 3D bio-printing, can produce a cell-based construct directly on a wound, reconstructing the skin in layers in-situ. We assessed the safety and delivery of different autologous cell types derived from split thickness skin grafts on wounds generated in a porcine model and in a clinical trial.

Results:
The results demonstrated an increase in re-epithelisation rate of 3D printed skin compared to healing by secondary intention in the porcine model. The outcomes from this study have enabled the translation to a first in human clinical trial; a safety study to deliver keratinocytes within a biomaterial matrix to a surgically generated wound with promising preliminary findings.

Conclusion:
The results from this pre-clinical and clinical study demonstrated its safety and efficacy in treating controlled and non-complicated wounds. The use of this delivery system in tissue regeneration is a promising step in the advances for skin tissue engineering.

ISW26-231-04 (0642)

THE IMPACT OF MEDICAL ROBOTS: 3D SKIN PRINTING IN SITU AS A PROMISING FUTURE SOLUTION IN TISSUE REGENERATION

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Introduction:
The term "robot" originates from the Czech word robota, meaning labor, first introduced by Josef and Karel Čapek in 1921. Since its first industrial use in 1958 by General Motors, robotics has revolutionized multiple fields, including deep-sea exploration, space travel, and medicine. In 1985, a robotic arm performed the first stereotactic brain biopsy, paving the way for complex surgical systems. The development of the Da Vinci robot in 2000 marked a milestone, enabling precise, minimally invasive surgery. Building on this, the Verb Surgical System, a collaboration between Johnson & Johnson and Google, integrates robotics, advanced visualization, and AI-driven data analytics, signaling the next wave of intelligent surgical automation.

Material and Method:
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Results:
While most surgical robots focus on removing tissue—such as in orthopedic and oncologic procedures—the next frontier is regenerative robotic surgery. We present the world's first robotic 3D bioprinting system capable of fabricating multilayered living skin tissue in situ within a wound. This system integrates high-speed printheads, a computer-controlled robotic arm, and advanced wound visualization for automated task execution. Preclinical studies in animal models with partial- and full-thickness skin defects have demonstrated successful integration of bioprinted tissue. The first human clinical trial is now underway.

Conclusion:
This presentation will highlight the potential of robotic soft tissue creation, automation in wound reconstruction, and the future implications for surgical innovation.

ISW26-231-05 (0609)

RECONSTRUCTIVE STRATEGIES IN PEDIATRIC EXTENSIVE BURNS: A RETROSPECTIVE COHORT ANALYSIS

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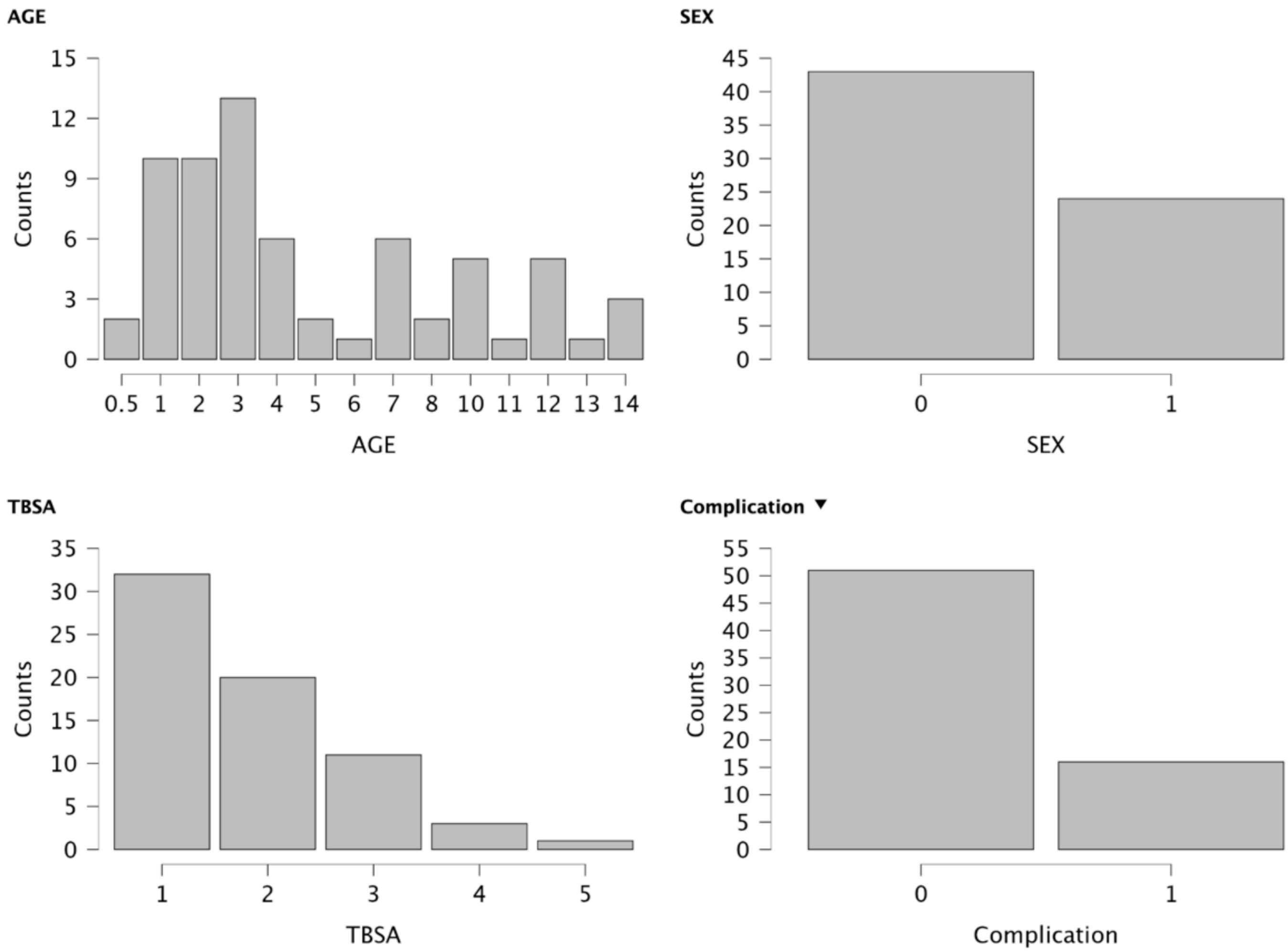
Introduction:
Pediatric extensive burns remain a major cause of morbidity worldwide, often requiring complex reconstructive strategies. The impact of different reconstructive techniques on early postoperative complications remains unclear, particularly in resource-variable settings.

Material and Method:
We conducted a retrospective cohort study of pediatric patients with extensive burns undergoing surgical reconstruction at a tertiary burn center between March 2024 and June 2025. Demographics, total body surface area (TBSA), reconstructive techniques, and early postoperative complications were analyzed. A standardized subgroup of patients with deep second-degree burns (10–59% TBSA) treated with split-thickness skin grafts was evaluated to compare temporary coverage strategies (dermal substitutes vs cadaveric skin). Statistical analysis included Fisher's exact test and odds ratios (OR) with 95% confidence intervals (CI).

Results:
Sixty seven patients underwent 128 reconstructive procedures. The most frequent techniques were debridement (100%), split-thickness skin grafting (38.8%), dermal substitutes (28.3%), and cadaveric skin grafts (17.9%). Complications occurred in 12.5% of procedures (n=16), totaling 25 events, predominantly infections (60%). In the standardized subgroup (n=26), complication rates were comparable between dermal substitutes (14.3%) and cadaveric skin (16.7%), with no significant association (OR≈1.2; 95% CI crossing unity; p=1.000).

Conclusion:
Postoperative complications in pediatric burns appear to be driven primarily by clinical severity rather than the reconstructive technique employed. No clinically meaningful differences were observed between dermal substitutes and cadaveric skin as temporary coverage prior to autologous grafting. Given its wide availability, rapid application, and effectiveness as a biological dressing, cadaveric skin remains a valuable and pragmatic option, particularly in resource-limited settings, supporting a flexible and context-adapted reconstructive approach.

Distribution Plots



Complication	Split-thickness graft (n=26)	Full-thickness graft (n=1)	Cadaveric skin graft (n=12)	Flaps (n=3)	Skin substitute (n=19)	Debridement (n=67)	Total (n)	% of Total Complications
Infection	3	0	2	0	2	8	15	60.0%
Necrosis	1	0	0	0	1	2	4	16.0%
Dehiscence	0	0	0	1	0	0	1	4.0%
Graft loss	2	0	1	NA	NA	NA	3	12.0%
Bleeding > expected	0	0	0	0	0	2	2	8.0%
Cases with 0 complications	23 (88.5%)	1 (100%)	10 (91.6%)	2 (66.7%)	17 (94.7%)	59 (85%)	112	NA
Total complications (n)	**6**	**0**	**3**	**1**	**3**	**12**	**25**	**100%**