Developing An Ideal First Use Agent To Prevent Sepsis In Trauma Wounds During Prolonged Casualty Care (PCC)

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Introduction

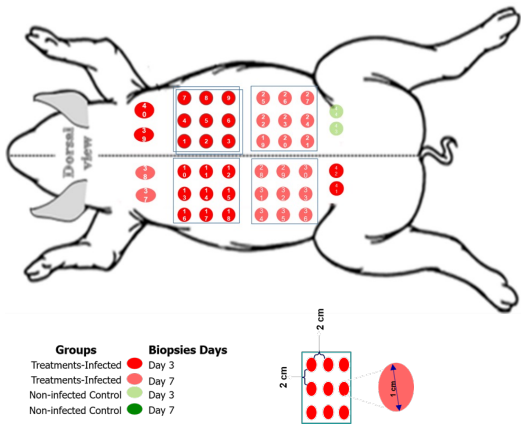
- Infected wounds are a major clinical challenge and a leading cause of preventable complications following traumatic injury.
- Management relies on systemic antibiotics, which may cause systemic adverse effects, or antimicrobials such as topical silver sulfadiazine (SSD), which require frequent reapplication and are associated with pain, scarring and delayed healing
- During prolonged casualty care, where evacuation may be delayed for 72 hours or longer, maintaining effective local antimicrobial therapy presents added challenges
- Altrazeal® Transforming Powder Dressing (TPD) hydrates to form a breathable, semi-occlusive, extended-wear matrix was evaluated as a platform for localized, sustained antibiotic therapy while maintaining a moist wound healing environment. TPD may prolong local antimicrobial exposure at the wound surface while reducing the need for repeated applications by retaining antibiotics within the matrix,
- By combining TPD with dry-blended antibiotics or FDA-approved ophthalmic antibiotic solutions compatible with prolonged casualty care medical kits, this platform offers the potential to provide extended localized antimicrobial coverage

Objectives

- Evaluate antimicrobial efficacy of antibiotic-loaded (A-TPD) formulations against Pseudomonas aeruginosa (PA) and methicillin-resistant Staphylococcus aureus (MRSA) in a porcine wound infection model
- Assess bacterial clearance and wound healing over 14 days following a single application of A-TPD

Methods

- Yorkshire porcine wound infection model
- 10-mm full-thickness dorsal wounds inoculated with 10^6 CFU of PA or MRSA.
- Wounds treated 15 min later with antibiotic-containing TPD formulations or TPD plus ophthalmic antibiotics
- Infected wound control: TPD | Non-infected wound control: TPD
- Assessments: 6-mm skin biopsies (Days 3, 7, and 14)
- Endpoints: bacterial burden and wound healing



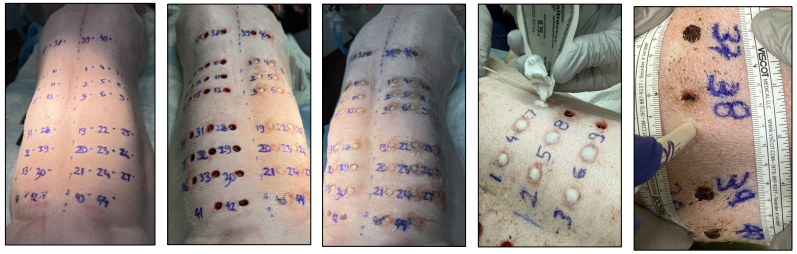
Study Design

Animals Used: Pathogen and Time points

Pig ID	Pathogen	Time Points
YK-753	PA (Pseudomonas aeruginosa)	Day 3, 7, 14
YK-754	PA (Pseudomonas aeruginosa)	Day 3, 7, 14
YK-750	MRSA	Day 3, 7, 14
YK-751	MRSA	Day 3, 7, 14
YK-841	PA (Pseudomonas aeruginosa)	Day 3, 7, 14

- **Total Animals = 5 (PA: 753, 754, 841; MRSA: 750, 751)**

Animal Model



Results

YK-753 & YK-841 Pooled Outcomes: PA efficacy

Single application of Tobramycin- and Ciprofloxacin-loaded TPD fully cleared PA through Day 7 with modest bacterial regrowth by Day 14. All wounds decreased in size with no adverse events.

PA	Treatment	n (D3)	Mean CFU/g (D3)	SEM (D3)	% pos (D3)	p (D3)	Mean CFU/g (D7)	SEM (D7)	p (D7)	n (D14)	Mean CFU/g (D14)	SEM (D14)	p (D14)
Control	Infection Control	4	9.50E+06	7.16E+06	100.00		1.28E+07	4.97E+06		4	3.75E+07	3.52E+07	
Dry blends	Tobramycin	6	0.00E+00	0.00E+00	0.00	**0.0057**	3.29E+04	2.85E+04	**0.0114**	6	2.89E+04	2.85E+04	0.40
	Ciprofloxacin	6	0.00E+00	0.00E+00	0.00	**0.0057**	3.60E+03	3.36E+03	**0.0114**	6	0.00E+00	0.00E+00	0.09
Ophthalmic	Tobramycin - Ophthalmic	6	0.00E+00	0.00E+00	0.00	**0.0057**	0.00E+00	0.00E+00	**0.0057**	6	3.53E+04	3.24E+04	0.40
	Ciprofloxacin - Ophthalmic	6	0.00E+00	0.00E+00	0.00	**0.0057**	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	0.09
Negative Control	No Infection - Control	0								4	0.00E+00	0.00E+00	0.19

*Note: YK-754 excluded — negative controls showed positive bacterial burden at Day 14

YK-750 & YK-751 Pooled Outcomes: MRSA efficacy

Single application of Vancomycin- and Ciprofloxacin-loaded TPD achieved complete bacterial clearance at all time points through Day 14. All wounds decreased in size with no adverse events

MRSA	Treatment	n (D3)	Mean CFU/g (D3)	SEM (D3)	p (D3)	n (D7)	Mean CFU/g (D7)	SEM (D7)	p (D7)	n (D14)	Mean CFU/g (D14)	SEM (D14)	p (D14)
Control	Infection Control	4	3.07E+06	2.76E+06		4	3.08E+05	1.48E+05		4	1.91E+06	1.18E+06	
Dry blends	Vancomycin	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**
	Ciprofloxacin	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**
Ophtalmic	Vancomycin - Ophthalmic	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**
	Ciprofloxacin - Ophthalmic	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**	6	0.00E+00	0.00E+00	**0.0057**
Negative Control	No Infection - Control	0					0			4	0.00E+00	0.00	**0.0211**

Discussion

PA Efficacy, Long-term (3-14 days)

- Tobramycin and Ciprofloxacin fully cleared PA through Day 7, with modest bacterial regrowth by Day 14
- PA may be more prone to delayed regrowth than MRSA under the same treatment duration, suggesting the potential need for multiple applications for efficacy beyond one week

MRSA Efficacy, Long-term (3-14 days)

- Both dry-blend and ophthalmic prototypes for Vancomycin and Ciprofloxacin achieved complete, sustained clearance through Day 14 with no breakthrough

Conclusions

- Antibiotic-loaded TPD achieved marked reductions in bacterial burden in both MRSA and PA infected porcine wounds
- Single application of all formulations achieved complete bacterial MRSA clearance through Day 14 and demonstrated strong activity against PA
- In this pre-clinical study, TPD provided a simple platform for localized antibiotic therapy over an extended period, supporting bacterial clearance, wound healing and more efficient resource utilization
- These findings support further development of antibiotic-loaded TPD for prolonged casualty care and other resource-limited environments

Military Relevance

- TPD can be incorporated into modular military medical kits, enabling selection of FDA-approved antibiotics based on mission requirements, anticipated pathogens, or regional resistance patterns
- Its lightweight, shelf-stable, single-application design may provide localized antimicrobial therapy during the critical first 72 hours of prolonged casualty care while reducing dressing changes
- The platform is applicable across Role 1–3 care, prolonged field care, special operations, shipboard medicine, humanitarian missions, and other austere environments where IV antibiotics and surgical resources are limited
- The customizable platform may be paired with mission-specific FDA-approved antibiotics, providing a flexible approach to wound management

Acknowledgements | Disclaimers

Research Disclaimer: The antibiotic-loaded TPD combinations described in this poster are investigational, outside the current indications for use, and were evaluated only in preclinical animal models.

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Prime Contract Awardee and Supplier of TPD:
Altrazeal Life Sciences Inc.
Addison, Texas, USA