Surgical Site Infection Reduction With a Pre-Surgical Bundle Including Nasal Photodisinfection

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BACKGROUND

Surgical site infections (SSIs) are among the most common healthcare-associated infections, resulting in significant global morbidity and mortality. SSIs are the leading cause of readmissions to hospital following surgery, and approximately 3% of patients who develop an SSI die as a consequence.[1] Post-operative infections occur in up to 300,000 patients per year in the United States and cost healthcare systems worldwide billions of dollars a year.[2]

AIMS

To reduce SSIs, Vancouver General Hospital (VGH) adopted an evidence-based, presurgical SSI-prevention bundle: utilization of antimicrobial photodisinfection therapy (aPDT) for nasal decolonization in combination with 2% chlorhexidine gluconate (CHG) body wash cloths as standard presurgical practice, unless contraindicated.

VGH evaluated the overall efficacy of use of aPDT in surgical patients by measuring post-surgery SSI development between aPDT and non-aPDT treated patients.

METHODS

This retrospective, observational study included patients who underwent both elective and non-elective cardiac, orthopaedic, vascular, spinal, or neurological surgeries between January 3, 2017 and May 1, 2019.

We included two groups: (1) patients given aPDT prior to surgery and (2) those who did not receive aPDT prior. Patients who had the aforementioned surgeries with clean, contaminated clean, or missing wound types with specific procedures were included.

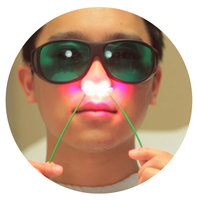
Significant differences were tested and proportions of SSIs among aPDT treated and non-aPDT treated patients were reported overall and by surgery type.

All models were controlled for demographic and clinical information of the patients.

Fig. 1 aPDT process

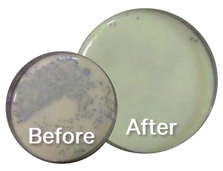
1. Application

Apply photosensitizer to target area. The photosensitizer binds to microbes.



2. Activation

Illuminate the area. The light activates the photosensitizer.



MRSA 4+ patient swab

3. Results

Rapid antimicrobial and anti-inflammatory results. Reactive oxygen species destroy microbes.

RESULTS

The proportion of patients who developed SSIs was approximately half (0.8% vs 1.5%, $p < 0.01$) among those who received aPDT before surgery compared to those who did not. Controlling for potential confounders, the greatest reduction occurred in orthopaedic patients (0.3% vs 2.1%, $p < 0.07$, N=331).

Additionally, descriptive analyses indicated that aPDT-treated patients had lower all-cause crude mortality rate (13.2 vs 32.2 per 1,000 patients, $p<0.001$) and length of stay (LOS, 11.4 vs 15.4 days, $p<0.001$) in hospital compared with non-aPDT treated patients.

Table 1. Demographics, mortality rate, length of stay (days)

Demographics	Total (n=6112)	PDT treated patients (n=2729)	Non-PDT treated patients (n=3383)	p*
Age				
Mean (SD)	61.4 (16.3)	62.1 (15.8)	60.9 (16.6)	-
Median (Range)	64.0 (9-100)	64.0 (13-100)	63.0 (9-100)	
Mortality				
Number	145	36	109	<0.001**
Rate/1000	23.7	13.2	32.2	
Length of stay (days)				
Mean (SD)	13.6 (19.4)	11.4 (16.1)	15.4 (21.6)	<0.001*
Median (Range)	8 (1-391)	7 (1-236)	9 (1-391)	

*Chi-square test
**Independent sample t-test

Table 2. SSIs: PDT treated patients vs. non-PDT treated patients

	PDT treated patients			Non-PDT treated patients			
Surgeries	SSIs (n)	Surgeries (n)	SSI proportion %	SSIs (n)	Surgeries (n)	SSI Proportion %	p*
All surgeries	21	2708	0.8	51	3332	1.5	0.01
Cardiac	5	749	0.7	17	772	2.2	0.02
Ortho	1	331	0.3	7	332	2.1	0.07
Vascular	4	246	1.6	4	314	1.3	-
Spinal	9	851	1.1	18	1037	1.7	-
Neuro	2	552	0.4	5	928	0.5	-

*Surgery types reaching significance listed. Chi-square test or Fisher exact test

Table 3. Association between SSI and PDT using logistic regression

	PDT-treated patients		
Surgeries	Odds Ratio	95% Confidence Interval	P-value*
All surgeries	0.52	0.30-0.86	0.01
Cardiac	0.40	0.13-1.08	0.09
Ortho	0.10	0.005-0.60	0.03
Vascular	1.13	0.25-5.03	-
Spinal	0.73	0.30-1.67	-
Neuro	0.55	0.07-2.77	-

*Surgery types reaching significance listed.

CONCLUSION

This retrospective, observational study over a twenty-eight month period included over 6,000 surgical patients. Adding nasal decolonization by aPDT to a presurgical bundle including CHG body wipes was shown to significantly reduce post-operative SSIs, mortality, and length of stay. Larger studies with a mix of surgery types and presurgical interventions are warranted.

REFERENCES

1. "Surgical Site Infections. PSNet Patient Safety Network, AHRQ. 2019.
2. "Surgical site infections are the most common and costly of hospital infections." ScienceDaily. 2017.

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