

# EFFECT OF FLUID IMMERSION SIMULATION\* OR TABLE PADS ON PRESSURE ULCER PREVENTION IN CARDIAC SURGICAL PATIENTS: EARLY RESULTS

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## ABSTRACT

**Problem:** Between 9/2012 and 6/2013, our quarterly pressure ulcer (PU) prevalence surveys demonstrated that one (4.3%) to five (23%) patients with PU per quarter had undergone cardiac surgery (CS). Length of surgery ranged from three to cumulative 16 hours during multiple surgical procedures.

**Background and Significance:** Our results are consistent with published reports of higher PU incidence for CS patients of up to 29.5%.<sup>1</sup> Risk factors include duration of immobilization on the OR table, older age, temperature manipulation, vasoactive drugs, hypotensive periods, and reduced hemoglobin and hematocrit levels.<sup>1-2</sup> Novel approaches to prevent PU from prolonged immobilization include Fluid Immersion Simulation (FIS) OR Pad – a pressure redistribution surface pad that uses a patented microprocessor and dynamic waveform analysis software to adjust internal air density based on mass and surface area. The end result is a support medium with less molecular density than the supported body, maintaining normal tissue symmetry. Studies demonstrate preservation of 87% of baseline microvascular blood flow on FIS Pad versus 16% on static OR table pads.<sup>3</sup>

**Objective:** To determine whether the FIS OR Pad reduces PU incidence following CS

**Implementation:** From 9/1/2013 to 11/30/2013, FIS OR Pads were placed continuously on the four CS OR tables

**Results:** 398 patients underwent CS on the FIS OR Pad, including 230 men (58%). Ages ranged from 24 years to 88 years (mean: 63 years.) Surgeries included coronary artery bypass graft [CABG] (28%), aortic valve replacement [AVR] (13%), mitral valve replacement (8%), thoracic aortic procedures (7.2%), CABG plus VR (4.5%), lung transplant (1%), heart transplant (0.5%). Duration of the procedures was shortest for CABG and longest for thoracic aortic repair. In the series, the incidence of new pressure ulcers was 0%.

**Conclusion:** The FIS OR Pad is effective at preventing tissue deformation and deep tissue injury (DTI) in a subset of patients who are at very high risk of PU.

**Implications for Practice:** Use will be expanded to other patients at high risk of perioperative DTI.

\*Dolphin Mat Fluid Immersion Simulation (Clearwater, FL: Biologics, Inc.)

## BACKGROUND AND SIGNIFICANCE

### Driving Forces – National

#### 2006:

- Estimated cost of Stage 3 and 4 pressure ulcers (PU) in the United States – \$11 billion/year<sup>4</sup>
- Managing a single full-thickness PU may cost ≥\$70,000<sup>5</sup>

#### 2007:

- Centers for Medicare and Medicaid Services (CMS) identified Stage 3 and 4 PU as “never events”

#### 2008:

- CMS implemented nonpayment for treatment<sup>6</sup>

### Driving Forces – Institutional

- HAPU ≥ Stage II above goal of 0% - < 1%\*\*

Survey Date	Patients Surveyed (N)	Hospital-Acquired Pressure Ulcers (HAPU) (N)	HAPU ≥ Stage 2 (%)	Patients Surveyed in CSICU (N)	Patients with HAPU in CSICU (N)	Stage	% of Total Patients with HAPU in CSICU (%)
09/2012	800	18	1.9%	7	1	DTI (1)	1/18 ( 5.5%)
12/2012	791	22	2.7%	14	5	II (3) DTI (2)	5/22 (23.0%)
03/2013	777	25	3.0%	14	1	DTI (1)	1/25 ( 4.0%)
06/2013	786	26	3.2%	12	4	II (2) DTI (2)	4/26 (15.3%)

Legend:  
HAPU: Hospital-acquired pressure ulcers  
CSICU-Cardiac Surgical Intensive Care Unit  
DTI – Deep Tissue Injury

\*\* No Stage III or Stage IV HAPU reported in these quarterly surveys

## RISK FACTORS FOR PU DEVELOPMENT IN CARDIAC SURGICAL PATIENTS

- Extended time/immobilization on the OR table
- Older age
- Extracorporeal circulation
- Temperature manipulation
- Vasoactive drugs
- Hypotensive periods
- Reduced hemoglobin and hematocrit levels.

Questions? Contact [vcapasso@partners.org](mailto:vcapasso@partners.org)

*This project was undertaken as a Quality Improvement Initiative at Massachusetts General Hospital, and as such was not formally supervised by the Institutional Review Board per their policies.*

## PERFORMANCE IMPROVEMENT PROJECT

### Objective:

Determine whether novel pressure-relieving Fluid Immersion Simulation (FIS) OR Table Pads reduce the incidence of perioperative HAPU among patients undergoing cardiac surgery (CS)

### Timeline:

September 1, 2013 through November 30, 2013

## IMPLEMENTATION

- FIS OR Table Pad placed continuously on the table in all four cardiac surgical operating rooms (OR)
- Skin inspected by OR nurse before surgery and at end of case
- Skin inspected daily by nurse in CSICU and/or progressive care unit, if patient's condition permitted repositioning
- Safety report filed if evidence of new PU ≥ Stage 2

### Fluid Immersion Simulation (FIS) O.R. Table Pad



### Fluid Immersion Simulation™ (FIS)<sup>7</sup>



- A state of the art pressure redistribution technology
- An advanced microprocessor-driven system
  - analyzes the pressure waveform generated by the patient while sinking into the mattress surface
  - then, precisely adjusts air density in the mattress to simulate immersion in a fluid medium.
- Mimics floating in water and dynamically reduces undesired soft tissue deformation.

## RESULTS (N=398)

Gender	Age
Male 230	Range 24 years – 88 years
Female 168	Mean 63 years

Type of Surgery	Percentage
Coronary Artery Bypass Graft (CABG)*	28.0%
Aortic Valve Replacement (AVR)	13.0%
Mitral Valve Replacement	8.0%
Thoracic Aortic Procedure**	7.2%
CABG plus VR	4.5%
Lung Transplant	1.0%
Heart Transplant	0.5%

**Incidence of HAPU: 0%**

\* Shortest duration of surgery  
\*\* Longest duration of surgery

## CONCLUSION

This patient series suggests that the FIS OR Pad is effective at preventing tissue deformation and consequent deep tissue injury in a subset of patients who are at very high risk of PU.

## IMPLICATIONS

- **Practice**
  - Expand use of FIS OR Table Mat to other patients at high risk of perioperative deep tissue injury
- **Research**
  - Conduct comparative effectiveness trial(s) comparing the FIS OR Table Pad with other pressure relieving OR table pads/products/strategies

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