

# The Impact of TEE Monitoring in Critical Care

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## Introduction

The purpose of this study was to determine the impact of a miniaturized TEE probe (the ImaCor ClariTEE™ (approximately NG tube size) upon hemodynamic management in a variety of critical care settings (cardiac surgery as well as general ICU patients). The ImaCor Zura™ TEE monitoring system uses a miniaturized, detachable, single-use TEE probe to obtain a variety of cardiac images, including the trans-gastric short axis view. In contrast to conventional TEE probes, the ImaCor system was designed and cleared by the FDA for episodic hemodynamic monitoring over a time period of up to 72 hours.

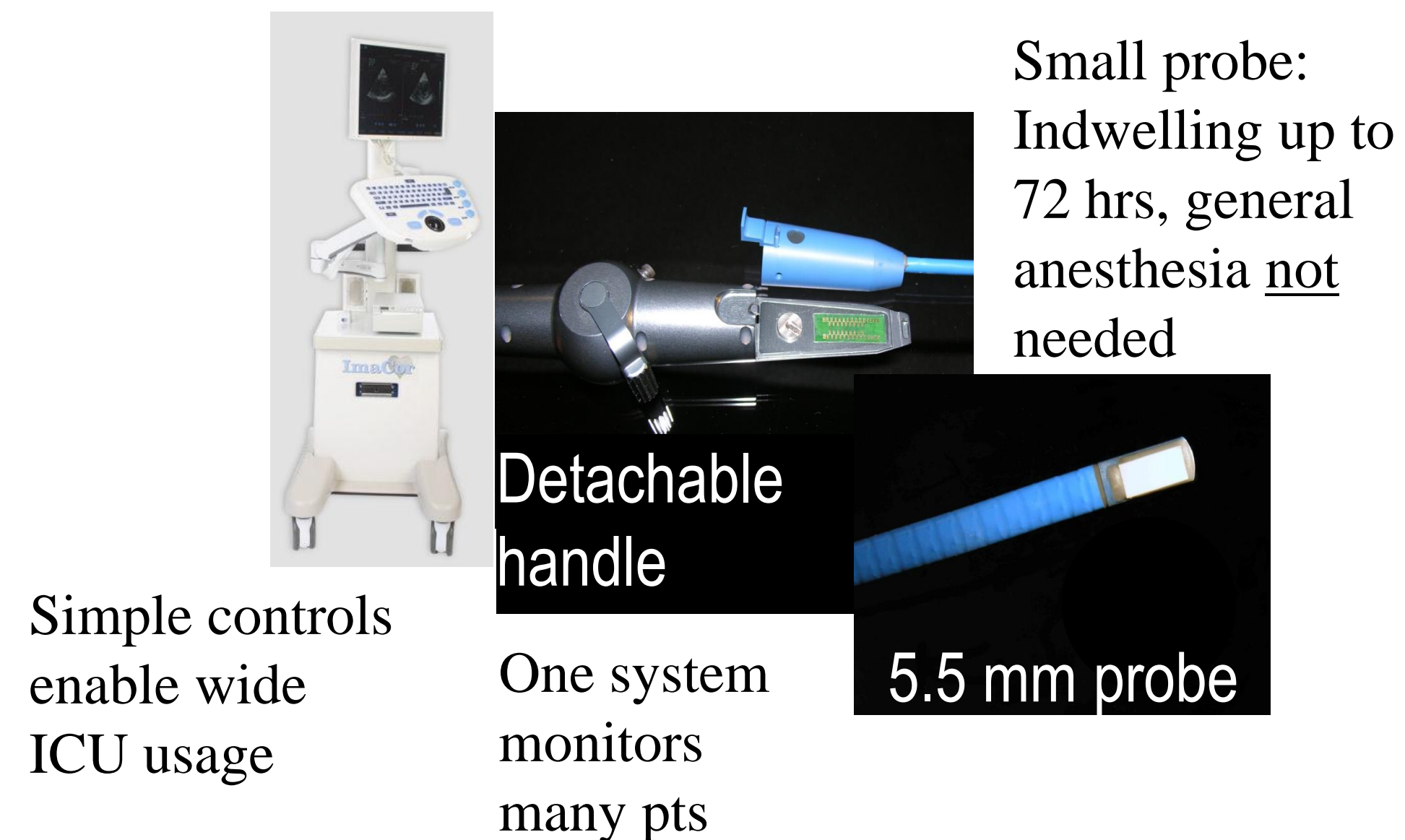
## Hypothesis

The ImaCor Zura imaging system has a significant impact upon hemodynamic management in critical care, including cardiac surgery and general ICU patients.

## Methods

- Retrospective case review.
- 101 patients monitored with the ImaCor Zura TEE monitoring system
  - 33 post cardiac surgery
  - 68 general ICU
- Images were assessed for cardiac function, and changes in patient management were recorded.

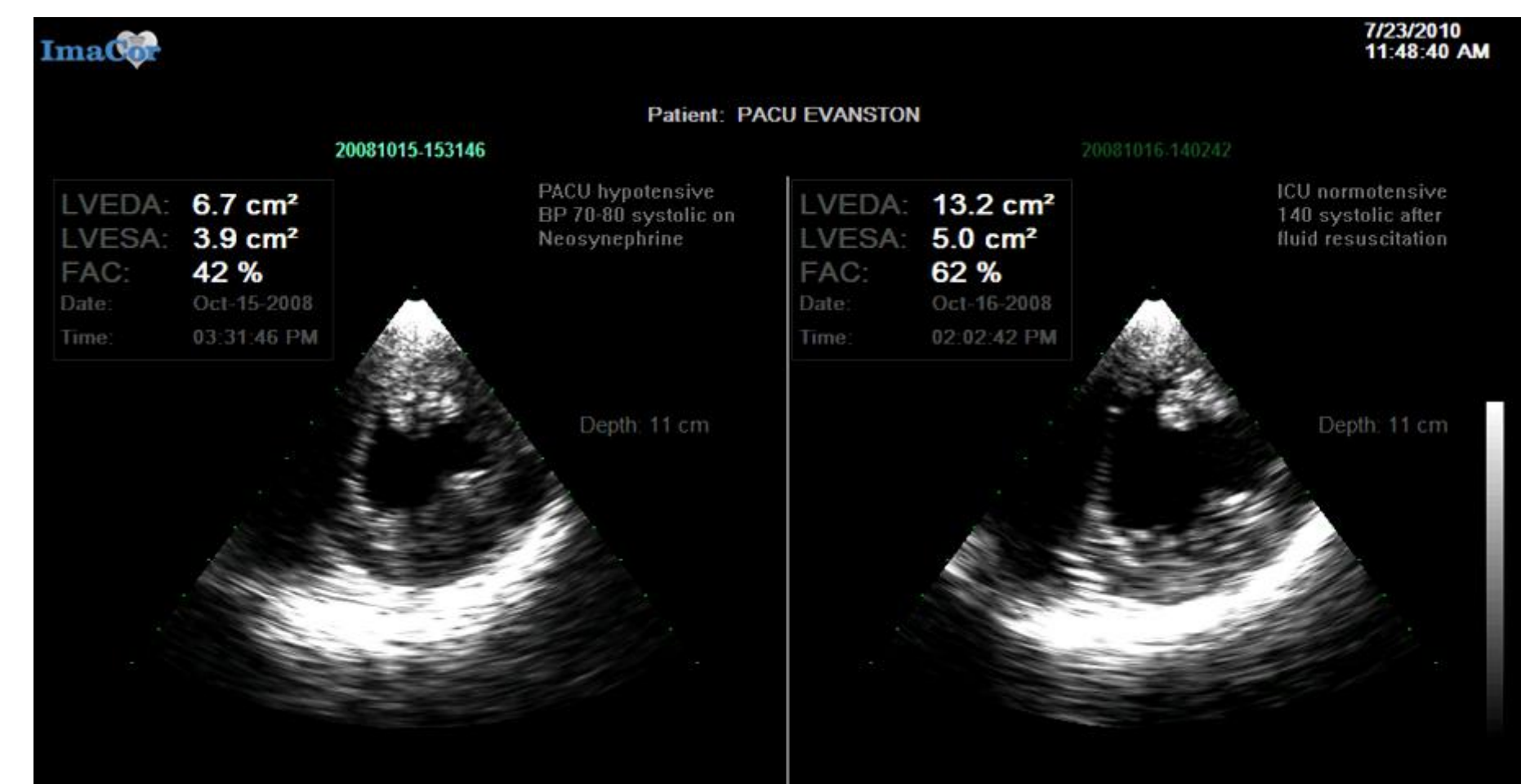
## ImaCor TEE Monitoring System



## Results

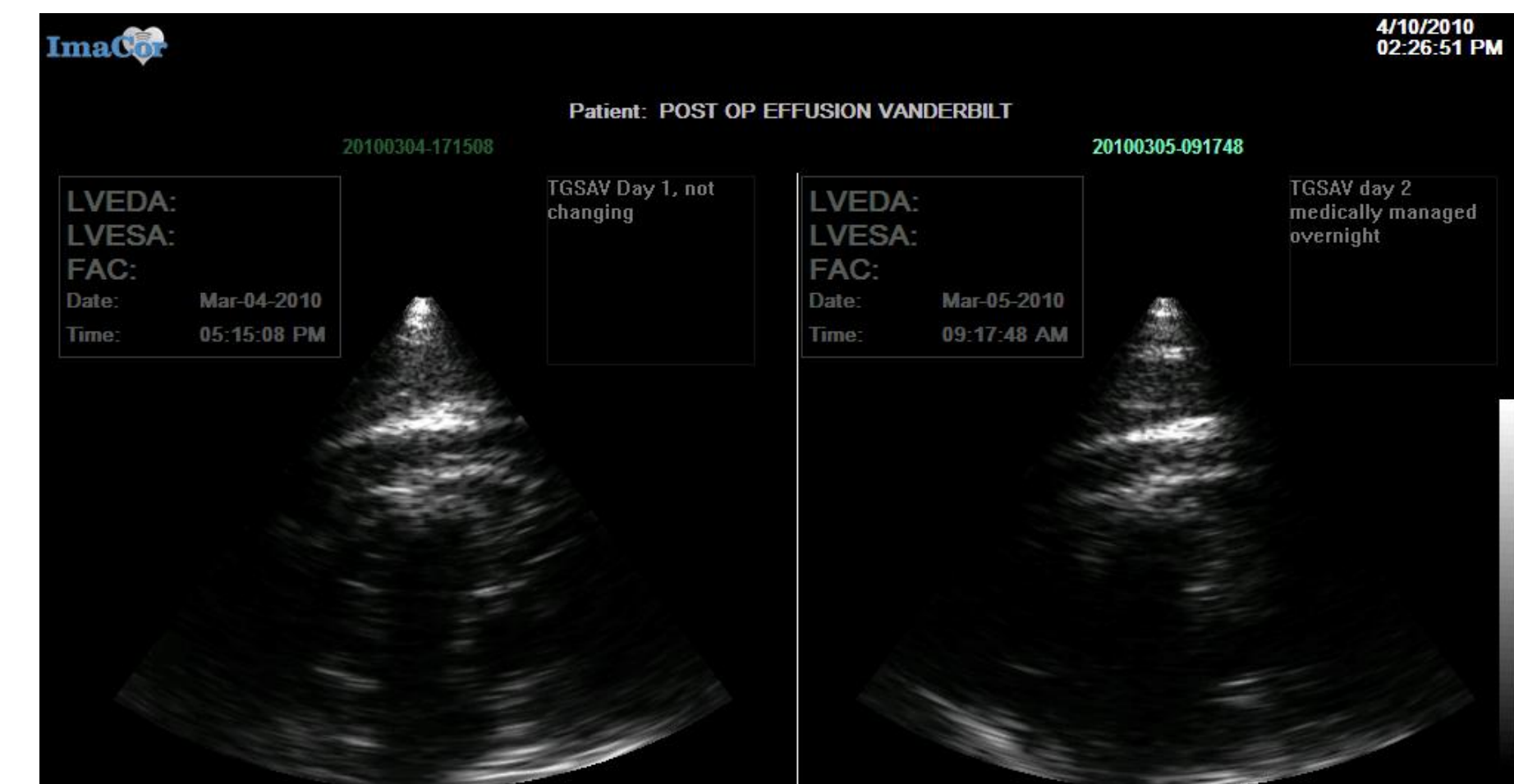
### Case 1: TEE monitoring detected unsuspected hypovolemia (J Marymont, Evanston Hosp)

- 77 YO, 48 kg female post spinal surger. Blood loss 1700 mL, UO 400 mL. received 4500 mL fluids, 4 PRBC, 250 mL Hespan.
- Hypotensive in PACU after 750 mL fluid and neosynepherine.
- TEE monitoring revealed hypovolemia, ventricular hypertrophy, and abnormal wall motion.
- Additional fluids aggressively administered, pressors titrated and subsequently discontinued upon achieving normotensive blood pressure.



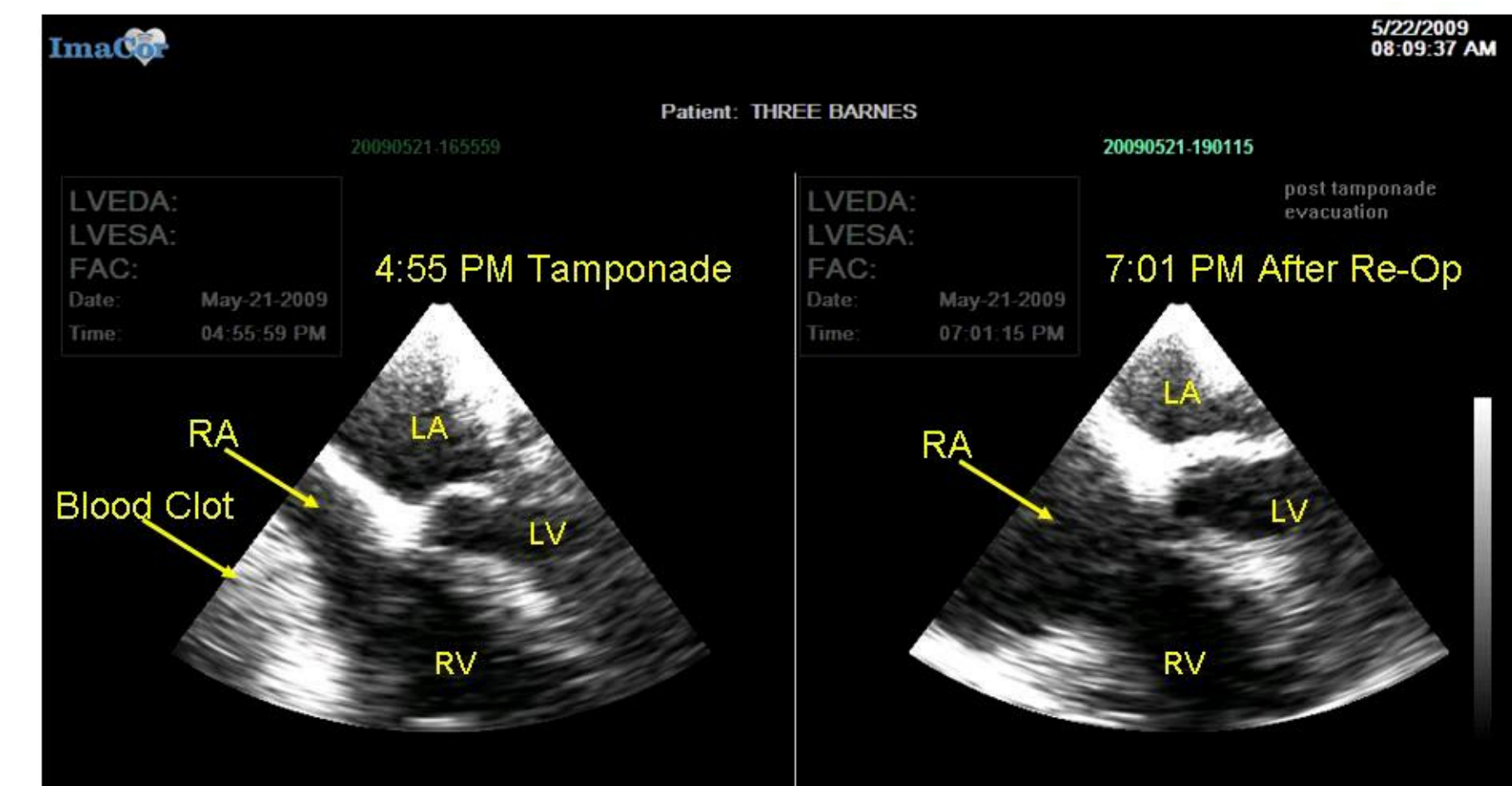
### Case 2: Pericardial effusion medically managed, re-operation avoided (Chad E Wagner, Vanderbilt)

- 66 YO male, AVR + CABG x 2. Significant bleeding and hemodynamic instability required blood, vasopressin, factor VIIa to stabilize.
- Hemodynamically unstable in CVICU: CI 1.5, BP 81/45.
- TEE monitoring showed posterior lateral pericardial effusion with inadequate left ventricular end diastolic area despite high filling pressures. Continued volume resuscitation → LV volume increased despite small increase in pericardial fluid, hemodynamics began to stabilize.
- After 10 hours of monitoring, effusion continued to resolve, hemodynamics stable CI: 2.6, BP 115/65  without surgery. Vasoactive infusions weaned.



### Case 3: TEE detected tamponade as cause of instability, rapid re-operation (M Wall, Barnes Jewish, St. Louis)

- 86 YO male unstable after elective CABG.
- Tamponade detected with TEE monitoring, followed rapidly by guided re-operation



## Clinical Impact

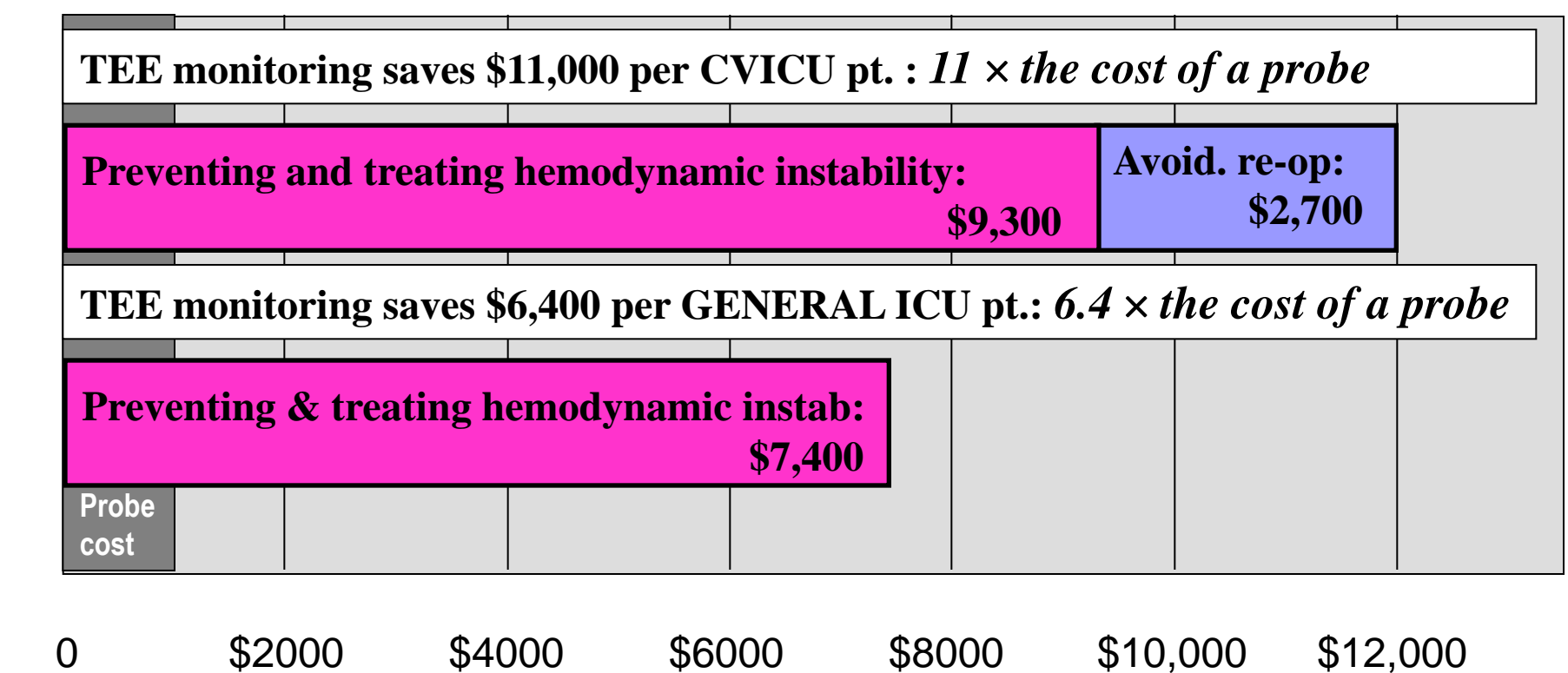
TEE monitoring with the miniaturized ClariTEE probe influenced clinical management in 51 of 101 pts (50%) in line with Hüttemann's (1) large meta-analysis of TEE in critical care: 36% (range 10% - 69%). TEE monitoring detected underlying causes for hemodynamic instability not detected by other monitoring modalities, thus improving hemodynamic management.

### CVICU: 33 pts, 23 management changes (70%)

- 3 avoided re-operations (9%)
- 17 changes in fluids and pressors (51%)
- 3 other changes, e.g., VAD adjustment

### General ICU: 68 pts, 28 changes in fluids & pressors (41%)

## Economic Impact



Using the above clinical data combined with economic studies from the literature (2-5) – note – we are not including the cost of complications such as AKI due to limited data.

## References

1. Hüttemann E.: Minerva Anesthesiol 2006 72: 891-913.
2. Speir AM et al.: Ann Thorac Surg 2009; 88: 40-5
3. Trzeciak S et al.: Chest 2006; 129: 225-32
4. Shorr AF et al.: Crit Care Med 2007; 35: 1257-62
5. Hravnak M et al.: Intens Care Med 2010; 36: S163 (and presentation at 23rd ESICM)