

# Case Series to Investigate the Hemodynamic Impact of the Non-Pneumatic Anti-Shock Garment (NASG) in Post-Partum Women

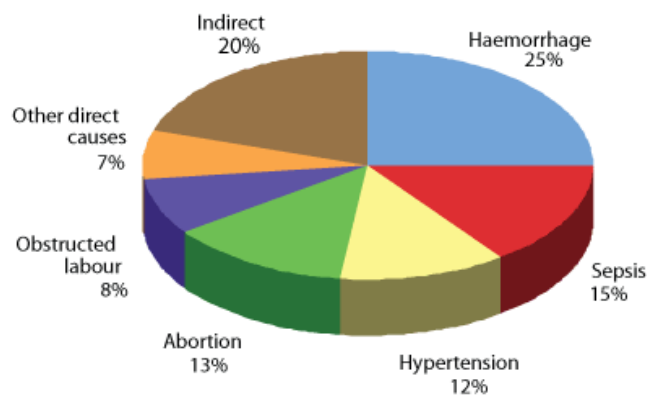
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## Maternal Mortality

>530,000 maternal deaths annually; 54 million develop long-term disability

- A woman dies every minute from pregnancy-related cause
- Three delays:
  1. Recognizing problem
  2. Transport
  3. Care once at facility

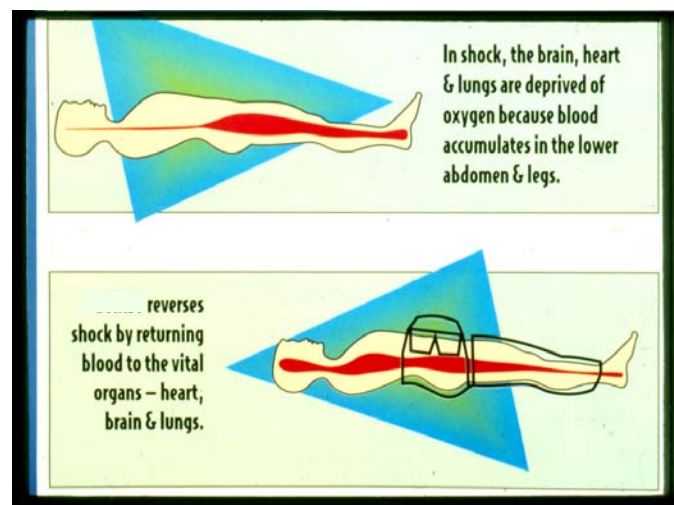
Figure 1  
Causes of Maternal Mortality in the African Region



Source: African Health Report 2006

## Non-Pneumatic Anti-Shock Garment

- Stabilize women's condition, allow survival through period of transport *and* during delays in the hospital
- Simple, easy to use, limited training
- Resuscitation of central circulation
- Decreased blood loss in lower body



## Hemodynamic Case Series

### Objective

To use non-invasive monitoring to understand the impact of the different segments of the NASG on blood flow to the uterus and hemodynamic status of the subject

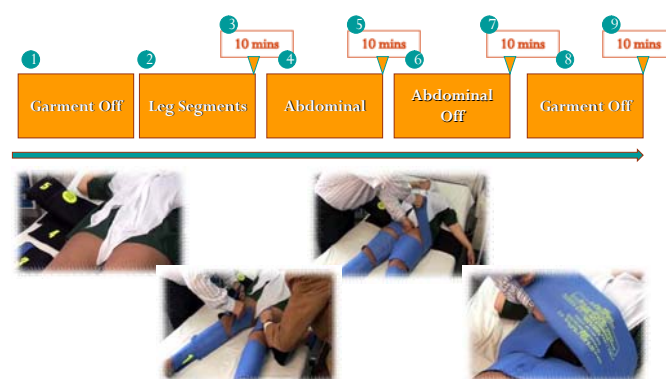
### Hypothesis

Blood flow to the uterus will decrease with the garment in place

## Study Design/Methods

- Case series of 10 healthy postpartum women enrolled within 24 hours of delivery at SFGH
- Doppler ultrasound of the uterine and hypogastric arteries performed at 9 time points as NASG sequentially placed
- Vital signs and side effects recorded

### 9 Time Points of Data Collection



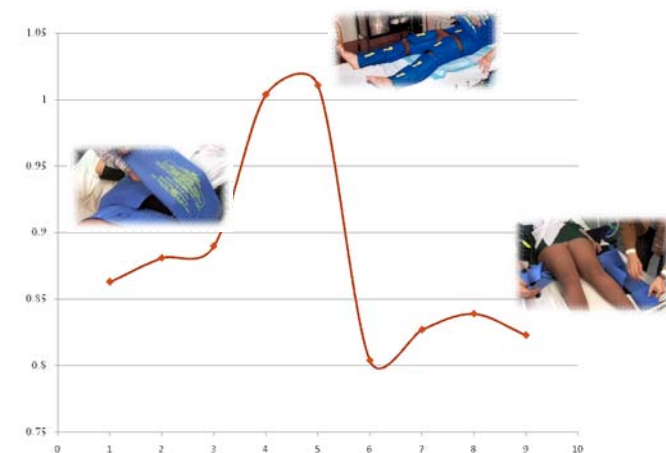
### Resistive Index (RI)

$$RI = \frac{\text{peak systolic velocity} - \text{end diastolic velocity}}{\text{peak systolic velocity}}$$

The higher the RI, the higher the resistance in the system

- RI of <1.0 indicating forward flow
- RI >1 indicating no flow or reverse flow

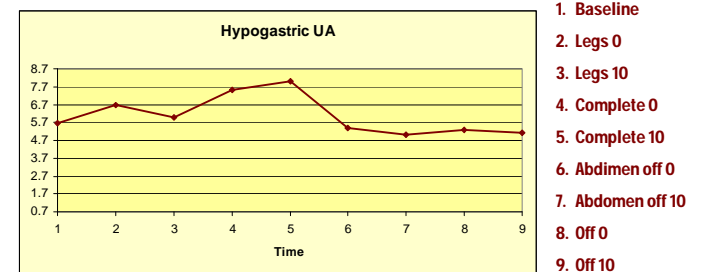
### Mean RI at 9 Time Points



### Mean Hypogastric RI

- Time 1: Baseline
  - 0.84 (0.76-1.13)
  - 20% RI  $\geq$  1
- Time 4: Completely placed
  - 1.004 (0.79-1.18)
  - 60% RI  $\geq$  1
- Time 5: Complete x 10 min
  - 1.011 (0.76-1.28)
  - 70% RI  $\geq$  1
- Time 6: Removal of abdominal segment
  - 0.80 (0.73-0.84)
  - None RI  $\geq$  1
- Time 9: Completely removed x 10 min
  - 0.82 (0.73-1.0)
  - 10% RI  $\geq$  1

## Hypogastric S:D



## Results

- No impact on vital signs
- No reported side effects
- Trend toward increased resistance in Hypogastric artery when garment is applied

## Limitations

- Small case series – hard to draw conclusions
- Technically difficult to measure uterine artery blood flow, thus inconclusive results for uterine artery
- Imperfect model: healthy post-partum women who are not in shock and have intact cardiovascular physiology
  - Vital signs prove to be an inadequate parameter by which to assess response to relatively small changes in peripheral vascular resistance

## Implications

- Trend towards increased resistance in the hypogastric artery with the garment in place indicates decreased blood flow to the uterus
- Provides physiologic rationale for the findings from other studies that post-partum blood loss is decreased with the garment in place

## Future Directions

- Use ultrasound machine capable of blood flow velocity and volume in hypogastric artery
- Use ultrasound to measure venous return by assessing IVC diameter
- Conduct trials to assess impact on blood loss in cases of obstetric hemorrhage



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