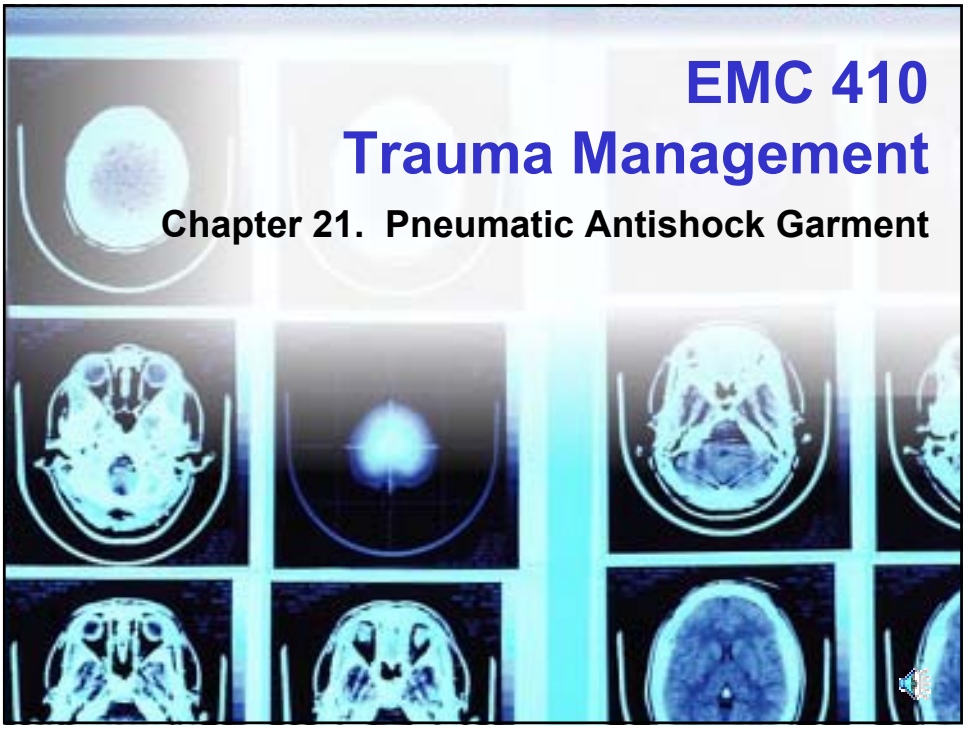


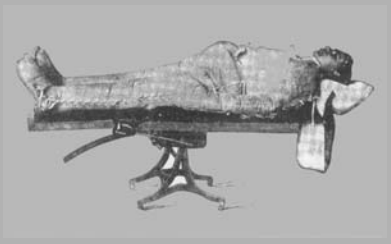
EMC 410
Trauma Management
Chapter 21. Pneumatic Antishock Garment

Unit Objectives

- **Upon completion of this chapter, you should be able to:**
  - Describe the 3 key events in the development of the PASG.
  - Explain the physiological principles that account for the ability of the PASG to raise blood pressure.
  - Explain the physiological principles that account for the ability of the PASG to control hemorrhage.
  - List the indications and contraindications for the use of the PASG in trauma.
  - Demonstrate three methods of application of the PASG.
  - Demonstrate the appropriate method of deflation and removal of the PASG.

History of the Garment

- **Developed in 1903 by George Crile**
  - Laced, rubber suit
  - Abandoned the suit to pursue work in blood transfusion
  - Renewed interest following plane crash in 1941
  - Developed the anti-gravity or G-suit
  - Military adapted the G-suit to control hemorrhage in Vietnam
  - First use of PASG in Miami in 1973



PASG Controversies

- Mattox, et al found no advantage to MAST application in hypotensive urban patients with mostly penetrating injuries to the chest with rapid transport times.
- Removal of PASG from ambulances is probably premature.
- After almost a century of study, still no consensus on the use of PASG.

Biomechanics of the PASG

- **Cardiac Output and Blood Pressure**
  - Poiseuille's law
    - Flow (F) is dependent on the pressure difference between the ends of the vessel (ΔP), the vessel length (L), radius of the vessel (r), and the viscosity (n) of the blood.
    - Blood flow varies directly with the fourth power of the radius of the vessel.
    - $F = \Delta P \times \pi/8 \times 1/n \times r^4/L$
    - If the PASG reduces the size of the vessel by one-half, the flow of blood through the vessel is reduced to 1/16th of the original flow.
  - Autotransfusion
    - Negligible effect, only 250cc to 300cc

Biomechanics of the PASG continued

- **Cardiac Output and Blood Pressure continued**
  - Increased SVR increases blood pressure and flow to vital organs
  - Concerns
    - C.O. declines over time with PASG (baroreceptors and afterload)
    - Increased BP may accentuate bleeding

Biomechanics of the PASG continued

- **Control of Hemorrhage**
  - Bernoulli's law
    - Rate of loss (Q) is directly proportional to transmural pressure (T)
    - $Q = A \times (2T/P + V^2)^{1/2}$
    - If external pressure lowers transmural pressure, the rate of hemorrhage would also slow
  - Laplace's law
    - $T = PR$
    - Tension in the vessel wall (T) is equal to the transmural pressure (P) times the radius of the vessel (R)
    - Vessel wall tension tends to force open a laceration
    - Anything that would decrease vessel wall tension would decrease the size of the laceration and thus, bleeding

Biomechanics of the PASG continued

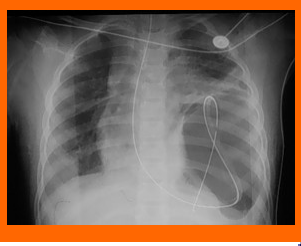
- **Control of Hemorrhage continued**
  - Concerns
    - Hemorrhage above the level of the garment increases because of increased transmural pressure of the uncovered vessels
- **Immobilization of fractures**
  - Effective air splint
  - Reduces tissue damage and bleeding

Use of the PASG

- **Acceptable when hypotension is present and there is a need to:**
  - Control hemorrhage from vessels which can be compressed by the garment including the abdominal aorta and femoral artery
  - Stabilize a pelvic fracture
  - Raise blood pressure in severe traumatic hypotension and refractory anaphylactic shock
- **PASG may be helpful and probably not harmful in:**
  - Penetrating injury to the abdomen
  - Urologic and gynecologic hemorrhage including ruptured ectopic pregnancy
  - Pelvic fracture without hypotension

Use of the PASG continued

- **Contraindications**
  - Known or suspected bleeding or injury above the level of the garment including diaphragmatic rupture, penetrating thoracic injury, and cardiac tamponade
  - Pulmonary edema
  - Lower extremity trauma without hypotension
  - Abdominal evisceration



Use of the PASG continued

- **Complications of use**
  - Limits diaphragmatic excursion
  - Nausea, vomiting, urination and defecation from compression of abdominal organs
  - Compartment syndrome (application > 2 hours)
  - Inadvertent deflation

Use of the PASG continued

- **Application**

Diaper Method

Trouser Method

Log-roll Method

Use of the PASG continued

- **Environmental effects**
  - Temperature
  - Pressure
- **Deflation procedure**
  - Release 10 mm Hg of pressure from abdominal compartment.
  - Reassess vital signs. If heart rate increases by 5-10 bmp or if BP decreases by 5 mm Hg, discontinue deflation. Provide 200-250 cc fluid challenge. If ineffective re-inflate section.
  - Repeat until abdominal section is deflated.
  - Repeat procedure for each leg separately.