Vented chest seals for prevention of tension pneumothorax in a communicating pneumothorax.

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BACKGROUND: Tension pneumothorax accounts for 3%–4% of combat casualties and 10% of civilian chest trauma. Air entering a wound via a communicating pneumothorax rather than by the trachea can result in respiratory arrest and death. In such cases, the Committee on Tactical Combat Casualty Care advocates the use of unvented chest seals to prevent respiratory compromise.

OBJECTIVE: A comparison of three commercially available vented chest seals was undertaken to evaluate the efficacy of tension pneumothorax prevention after seal application.

METHODS: A surgical thoracostomy was created and sealed by placing a shortened 10-mL syringe barrel (with plunger in place) into the wound. Tension pneumothorax was achieved via air introduction through a Cordis to a maximum volume of 50 mL/kg. A 20% drop in mean arterial pressure or a 20% increase in heart rate confirmed hemodynamic compromise. After evacuation, one of three vented chest seals (HyFin®, n = 8; Sentinel®, n = 8, SAM®, n = 8) was applied. Air was injected to a maximum of 50 mL/kg twice, followed by a 10% autologous blood infusion, and finally, a third 50 mL/kg air bolus. Survivors completed all three interventions, and a 15-min recovery period.

RESULTS: The introduction of 29.0 (±11.5) mL/kg of air resulted in tension physiology. All three seals effectively evacuated air and blood. Hemodynamic compromise failed to develop with a chest seal in place.

CONCLUSIONS: HyFin®, SAM®, and Sentinel® vented chest seals are equally effective in evacuating blood and air in a communicating pneumothorax model. All three prevented tension pneumothorax formation after penetrating thoracic trauma.