

DOGMA DETECTIVES Case # 03-03-13-01: THE CHEST SEAL CONUNDRUM

From day one, military and civilian basic practitioners are taught to seal open chest injuries, particularly "sucking chest wounds." We are encouraged to use three-way dressings or chest seals, but ultimately the emphasis is placed on securing an occlusive dressing to a compromise of the chest wall.

Are chest seals and/or three-way occlusive dressings effective in the treatment of open chest wounds? Are there subpopulations where they may be more or less effective? What are we really doing when we slap a seal on an open wound?

The Dogma Detectives are on the case...

Pneumothoraces involve introduction of air into the intrathoracic cavity. In Emergency Medical Services, these are frequently recognized as open pneumothoraces following penetrating trauma. In particular, the "sucking chest wound" is one found throughout the pre-hospital literature, and is largely defined as a wound in the chest wall greater than 2/3-3/4 the diameter of the trachea, which is large enough that air will preferentially flow through the wound and into the chest cavity. Application of an occlusive dressing in injuries such as this is taught for two reasons—1) to maximize respiratory physiology. And 2) to prevent the development of tension pneumothorax.

The latter justification seems the more important, and gets to the root of EMS—that is, to keep the patient alive and provide the best chance at survival until arrival at definitive care. But is this justified?

1) An open pneumothorax will not develop into a tension pneumothorax. When we perform needle decompression to relieve a tension, we are, in fact, creating an open pneumothorax. By allowing free flow of air between the outside world and the compromised hemichest, we are ensuring that pressure will not rise above atmospheric, thus preventing the mediastinal shift so feared.

2) Application of a chest seal converts a chest wound to a closed pneumothorax, with a "flutter valve" for escape of air in the event of over pressurization. The justification for closing the wound invariably centers around the hypothetical "skin flap" that allows air to enter but not escape, thus creating tension elements. The chest seal will prevent air from entering, but if this skin flap exists, the chest seal will not create a mechanism for pressurized air to exit the chest. The pneumothorax is converted to a closed pneumothorax.

3) If damage has been done to the lung parenchyma, there still exists a route for air to enter the chest cavity—through the compromised lung tissue. If an occlusive dressing has been placed or the "skin flap" exists, the stage is set for development of a tension pneumothorax.

4) In the hectic pre-hospital environment and particularly in the setting of polytrauma, a sealed chest wound or occluded flutter valve can go unnoticed by a practitioner as the patient decompensates.

All of this being said, application of occlusive dressings to open chest wounds does improve physiology in the setting of pure chest wall compromise with adequate air outflow through the one-way valve, and, in the case of a chest wound with a "skin flap," the occlusive dressing will prevent additional air from entering the thoracic cavity.

So, in conclusion, the Dogma Detectives deem the evidence on the use of Chest Seals in pneumothorax

to be...inconclusive.

We believe that there could be a paradigm shift to that of ensuring patency of chest wounds (that is, maintaining an open pneumothorax) until more definitive care (placement of needle or tube thoracostomy) can be completed. Research into the feasibility of such an approach is warranted.

At the current time, our clinical practice is to use chest seals when damage to the lung parenchyma is less likely, and the presence of the soft tissue skin flap is more likely---that is, in stab and shrapnel wounds. For gunshot wounds and other penetrating trauma with distinct and patent chest wounds, as well as a higher chance of damaging the lung parenchyma, we do not recommend placement of occlusive dressings unless the EMS provider can be 100% attentive to the possible development of tension elements---a luxury rarely encountered in pre-hospital polytrauma. Chest seals should be placed only after thoracostomy to ensure free air flow.

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