

## DOGMA DETECTIVES CASE #05-09-13-01: TIPPING THE SCALE.

Does placing patients in Trendelenburg position (flat with feet raised to 30 degrees) have any outcomes benefit for hypovolemic shock or cardiac arrest? Does it have any risks of causing harm?

The Trendelenburg position was originally used during urologic surgery, and was popularized in the 1860s by the German urologic surgeon Friedrich Trendelenburg. The original position was with the trunk and legs of the patient raised with the body itself placed in an oblique position of 45 degrees. This was also known as the “high pelvic position.” It was not until World War I that it was suggested that it might play a role in the treatment of shock. It has undergone a metamorphosis over the years, and now most people associate Trendelenburg’s position as the legs raised with the head tilted down at a 15-30 degree angle.

<http://www.anesthesia-analgesia.org/content/67/6/574.short>

Walter Cannon, the American physiologist that popularized the use of the Trendelenburg position to treat shock, reversed his opinion a decade after he first suggested it, though he did not discourage its widespread use.

<http://www.cjem-online.ca/v6/n1/p48>

While its use as an adjunct to the treatment of shock has persisted for decades, there is no evidence that this modified Trendelenburg position (legs raised to 15-20 degrees or body and head tilted at 15-20 degrees) has any beneficial hemodynamic effects. This article from 1979 in Critical Care Medicine studied the position in both normotensive patients, and in hypotensive patients with acute cardiac illness or sepsis. The findings show that in normotensive patients, preload and cardiac output improved slightly, and there was decreased systemic vascular resistance, with no change in mean arterial pressure. The decrease in SVR was likely due to baroreceptor stimulation. In hypotensive patients, Trendelenburg position had no effect on preload, increased afterload, and decreased cardiac output. This is exactly opposite the desired effect.

[http://journals.lww.com/ccmjournal/Abstract/1979/05000/The\\_Trendelenburg\\_position\\_hemodynamic\\_effects\\_in.2.aspx](http://journals.lww.com/ccmjournal/Abstract/1979/05000/The_Trendelenburg_position_hemodynamic_effects_in.2.aspx)

The lack of any type of autotransfusion effects was also reflected in a study of normal volunteers published in Annals of Emergency Medicine in 1985. Using radionuclide scanning, there was only a mean difference of 1.8% of the circulating blood supply moved centrally as a result of placing the volunteers in the Trendelenburg position. This is not a large enough blood volume shift to likely have an important clinical effect.

<http://www.ncbi.nlm.nih.gov/pubmed/4014811>

Another study in the journal of Intensive Care Medicine in 1996 studied 8 normal volunteers and showed a modest improvement in cardiac output, but it was transient, and the cardiac output returned to baseline within 10 minutes. There was no sustained benefit, and the study lacked test subjects that were hypotensive, and had a very small sample size.

<http://www.cjem-online.ca/v6/n1/p48>

A prospective study published in 1967 in the Surgical Journal of Gynecological Obstetrics evaluated the position in 6 patients in clinical shock, and 5 normotensive controls. In 9 of the 11 patients, Trendelenburg position lead to impaired hemodynamics, and did not have any beneficial effects. The authors of this article were also concerned about the possible risks of cerebral edema, and impaired pulmonary function from the pressure exerted on the lungs by the viscera.

<http://www.ncbi.nlm.nih.gov/pubmed/6022475?dopt=Abstract>

In a study published in the Journal of Clinical Anesthesia in 1996, the authors studied the Trendelenburg position in anesthetized patients using pressure transducers. They found that there was a significant increase in lung and respiratory impedance in the Trendelenburg compared to supine positioning. There was no change in chest wall impedance. This implies an increased effort to expand the lungs, without an increased effort to expand the chest wall --- compromising normal respiratory physiology. The higher the BMI, the greater the effect --- meaning this was more significant in obese patients. It was hypothesized that this was due to atelectasis (collapse) of the lower alveoli, and pressure on the lungs exerted by the visceral contents.

<http://www.ncbi.nlm.nih.gov/pubmed/8703461>

<http://commons.pacificu.edu/cgi/viewcontent.cgi?article=1197&context=pa&sei-redirect=1&referer=http%3A%2F%2Fwww.google.com%2Furl%3Fsa%3Dt%26rct%3Dj%26q%3Dtrendelenburg%2520position%2520during%2520cardiopulmonary%2520resuscitation%26source%3Dweb%26cd%3D6%26sqi%3D2%26ved%3D0CFgQFjAF%26url%3Dhttp%253A%252F%252Fcommons.pacificu.edu%252Fcgi%252Fviewcontent.cgi%253Farticle%253D1197%2526context%253Dpa%26ei%3DyBmQUaLiCKu30AGDj4DoBA%26usq%3DAFQjCNFM40TKI95N7YqwqQRmfUbeWzg6hA#search=%22trendelenburg%20position%20during%20cardiopulmonary%20resuscitation%22>

So does this signal the end of the Trendelenburg position? It should not be used in the treatment of shock – there is no evidence of benefit, and possible risk of respiratory compromise. It still shows benefit in the placement of central lines and external jugular IV lines, and the original Trendelenburg position, with the pelvis raised at 45 degrees, is still used during gynecological and urological surgery. There was also a recent study that the modified Trendelenburg position increases cerebral blood flow in a porcine model during CPR, though this has not been followed up by human studies.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2672278/>

There are also two separate meta-analysis reviews that suggest that the passive leg raise (elevating the legs but keeping the body supine) may have a mild benefit in improving cardiac output. There are original research articles that also reflect this. This effect only persists for at most 7-10 minutes, however. Physiologically this should have less of a negative effect on the respiratory system, and in theory could provide a few minutes of time in order to establish other interventions. It also is suggestive that the patient would benefit from fluid resuscitation.

While it does not represent a long-term solution, it may be considered as a short term bridge while initiating other interventions, especially fluid or colloid resuscitation, based on the clinical presentation.

[http://journals.lww.com/jtrauma/Abstract/1982/03000/Passive\\_Leg\\_Raising\\_Does\\_Not\\_Produce\\_a\\_Significant.3.aspx](http://journals.lww.com/jtrauma/Abstract/1982/03000/Passive_Leg_Raising_Does_Not_Produce_a_Significant.3.aspx)

[tp://journals.lww.com/ccmjournal/Abstract/2006/05000/Passive\\_leg\\_raising\\_predicts\\_fluid\\_responsiveness.16.aspx](http://journals.lww.com/ccmjournal/Abstract/2006/05000/Passive_leg_raising_predicts_fluid_responsiveness.16.aspx)

<http://link.springer.com/article/10.1007/s00134-008-1293-3>

<http://link.springer.com/article/10.1007/s00134-010-1929-y>