

Use of Trendelenburg Position during Hypotensive Episodes

HISTORY AND CLINICAL PRACTICE

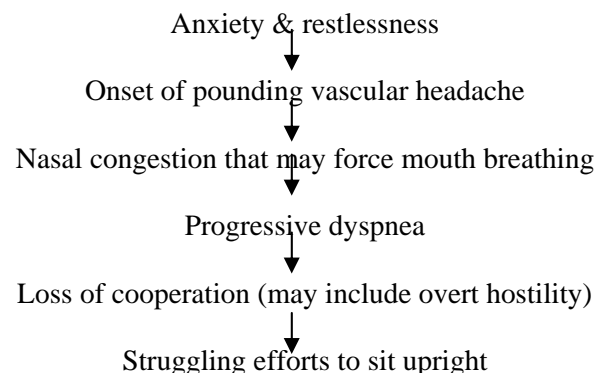
In the middle of the nineteenth century it was recognized that by raising the hips of a supine patient the bulk of abdominal viscera would slide downward toward the diaphragm thereby providing a less cluttered operative field for procedures involving the lower abdomen and pelvis. Friedrich Trendelenburg, a pioneering German surgeon, adopted and popularized this practice in his surgical text of 1873. Then in the early twentieth century, other physicians began advocating the use of Trendelenburg position in the treatment of hemorrhagic shock because of its ability to divert blood from the lower extremities to the central circulation, augmenting cardiac filling by increasing right and left ventricular preloads, stroke volume and cardiac output. Despite leading physicians later questioning the efficacy of this position in the 1950s, Trendelenburg continued as a mainstay of resuscitation in a wide variety of populations.¹

REVIEW OF EVIDENCE

Several studies have measured the effects of Trendelenburg on hemodynamic parameters. These studies have been conducted with healthy and acute/critical care populations using both observational and experimental methods. Specific dependent variables measured include: Heart rate, blood pressure (BP), cardiac output/cardiac index (CO/CI), central venous pressure (CVP), pulmonary artery wedge pressure (PAWP), right and left atrial pressures (RA/LA), right and left end-systolic and end-diastolic ventricular index (RVESVI/LVESVI), circulation time, carotid blood flow, internal jugular vein velocity, segmental arm & leg blood flow, intrathoracic blood volume, and total blood volume displacement. Limitations of these studies are the small sample sizes (N=10-76), lack of homogeneity of populations studied, as well as variations in the angle (10-30°, and modified Trendelenburg with passive leg raising ranging from 45° to 60°) and duration (range 1-30 minutes) of the position.

Fifteen studies from the medical and nursing literature were reviewed from 1964 to 2003. Three studies²⁻⁴ (20%) demonstrated a statistically significant increase in BP and CO/CI in both healthy and critically ill populations (N=10-22). In one study,³ these changes disappeared after 10 minutes. The other 13 studies (80%) did not find that Trendelenburg significantly increased either BP or CO/CI in a variety of samples (animal model, healthy individuals, surgical and critically ill patients).⁵⁻¹⁷ Sample sizes of these studies were also small, ranging from 8-76. Four of these studies showed a slight increase (~8-10%) in CO/CI in a small percentage of patients (7-16 %).^{7-8,12-13} However, these significant changes appeared to be transient and lasted for only 1-7 minutes after the change in position. It is unlikely these changes have clinically significant effects on patients with hypotension or low CO.

The majority of studies on the effects of Trendelenburg position do not lend support that this intervention significantly increases either arterial BP or CO/CI. The level of evidence for this intervention is thought to represent “*Class III*” evidence, indicating that Trendelenburg position is not useful in improving BP or CO/CI in the hypotensive patient. In addition, expert opinion exists with regard to the possible harmful effects associated with this intervention. In a review of physiological changes associated with this position, Martin¹ delineates that the sequence of symptoms* that typically occur after placing a patient in Trendelenburg position include:



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* Hypotensive and mentally obtunded patients may first become transiently more alert and then subsequently lose the will to struggle

The presence of cardiovascular, pulmonary and central nervous system disease can make the position harmful by increasing myocardial oxygen consumption and dysrhythmias; reducing respiratory expansion and promoting hypoventilation and atelectasis, as well as altering ventilation/perfusion ratios from gravitation of blood to poorly ventilated apex; and increasing venous congestion within and outside the cranium leading to increased intracranial pressure. As a result, the Trendelenburg position may have detrimental effects in patients with coronary artery disease and ischemia of the lower limbs, decreased vital capacity such as in the obese, and increased intraocular and intracranial pressure and cerebral edema.¹⁸ Because many of the studies reviewed assessed the effects of 20° or less, the presumption is tenable that steeper angulation could produce greater physiological abnormalities. Similarly, the longer the head down tilt is continued, it is likely the more pronounced the abnormalities might be.

EBP RECOMMENDATION

- A. The evidence supporting the hemodynamic effects of Trendelenburg in treating shock is small and does not reveal significant, beneficial or sustained changes in BP or CO/CI. Overall, the general conclusion from all the evidence is that Trendelenburg is probably not a useful position in resuscitative situations to improve BP or CO/CI. Since Trendelenburg may also be associated with harmful effects to the respiratory, neurological and vascular systems (especially in the presence of pathology) this position should be used with caution.
- B. The available evidence on Trendelenburg position lacks strength due to limitations in scientific rigor. High-quality clinical studies of the risks and benefits of Trendelenburg position in hypotensive patients are warranted. Trials that investigate optimal positions for resuscitation are also needed.¹⁸

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LEVELS OF EVIDENCE

Class of EBP Recommendation	Criteria	Clinical Definition
Class I Definitely recommended	Supported by excellent evidence, with at least 1 prospective randomized, controlled trial.	Class I interventions are always acceptable, safe & effective. Considered definitive standard of care
Class IIa Acceptable & useful	Supported by good to very good evidence. Weight of evidence and expert opinion strongly in favor.	Class IIa interventions are acceptable, safe & useful. Considered intervention of choice by majority of experts.
Class IIb Acceptable & useful	Supported by fair to good evidence. Weight of evidence and expert opinion not strongly in favor.	Class IIb interventions are also acceptable, safe and useful. Considered optional or alternative interventions by majority of experts.
Indeterminate Promising, evidence lacking, immature	Preliminary research stage. Evidence: No harm but no benefit. Evidence insufficient to support a final class decision.	Indeterminate: Describes treatments of promise but limited evidence.
Class III May be harmful; no benefit documented	Not acceptable, not useful, may be harmful.	Class III refers to interventions with no evidence of any benefit; often some evidence of harm