Clinical question.
What is the optimal position for a person in shock? Does elevating the legs improve outcome? (Question Nr. 1601)

Does leg elevation improve the outcome of persons in shocks?

Is this question addressing an intervention/therapy, prognosis or diagnosis? - Intervention
State if this is a proposed new topic or revision of existing worksheet: New

Conflict of interest specific to this question
Susanne Schunder-Tatzber has no intellectual or financial conflicts of interest.

Search strategy (including electronic databases searched).
MEDLINE -Current (1970 - Current ) MESH words Trendelenburg position (T) and text word shock yielded 30, T and hemodynamic effects 37, passive leg elevation 51, body position and hemodynamic effects 84, body position and orthostatic regulation 259, autotransfusion & First Aid 5, autotransfusion and hemodynamic effects 11.
All EBM Reviews – Cochrane Library (Cochrane Database of Systematic Reviews (CDSR))
Relevant article were also searched for other citations and via hand search

• State inclusion and exclusion criteria
- Studies included, which specifically deals with the question of physiological/pathophysiological cardiological and/or circulatory effects of positioning a patient and/or shock. Besides this studies on other effects – especially on intracranial pressure were included related to body position, (passive) elevation of legs and/or (modified) Trendelenburg position.

- Studies excluded that gave only anectodial evidence or are related to the term were hits related “shock” due to defibrillation and/or cardioversion..

• Number of articles/sources meeting criteria for further review:
31 studies and review were included in this review process. 20 studies and reviews were considered for inclusion.
## Summary of evidence

### Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Good: Wong 1989 E
- Poor: 1, 2, 3, 4, 5
## Evidence Neutral to Clinical question

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Evidence Neutral to Clinical question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>Terai 1996E&lt;br&gt;Defreme 2005E</td>
</tr>
<tr>
<td>Poor</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of evidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Evidence Opposing Clinical Question

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Evidence Opposing Clinical Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of evidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A = Improved Cardiac Output   C = Improved Systemic Vascular Resistance   E = Other endpoint
B = Improved Mean Arterial Pressure   D = Improved Systolic Blood Pressure   Italics = Animal studies
**REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:** (please include implementation considerations including at a minimum training, environment and availability):

Although the recommendation to First Aid providers to elevate the legs of a suspected victim of shock with the idea to return blood volume to the patient’s central circulation by raising cardiac output, systemic vascular resistance, mean arterial pressure and/or stroke volume leading to improve survival, we do not find no study, which could give evidence for an improved patient outcome (survival of event).

In the literature we find some studies – which comes from other research fields like physiological and physio-therapeutical which demonstrated mixed effects of leg elevation (passive leg raising or modified Trendelenburg)- eg. Wong 1989. One the other hand there are studies available which failed to show that the leg elevation ot Trendelenburg position had a sustained effect (Gaffney 1982, Ostrow 2004).

Many studies had limitations as they were conducted using healthy volunteers or normotensive patients, or patients under anesthesia were investigated.

The literature (Bosone 2004, Naylor 2005,2006) does highlight several concerns with the practice of the Trendelenburg or similar position and its negative effects on patients mainly on increased pressure in the chest, respiratory compromise and increased intracranial pressure. – Which might increase other medical problems shocked patients may have – e.g. shock plus cerebral trauma or shock plus cardio vascular diseases.
Citation List

1: 
Crit Care Med. 2003 Apr;7(2):164-70

Influence of passive leg elevation on the right ventricular function in anaesthetized coronary patient
Bertolissi M., Da Broi U., Soldano F., Bassi F.;
Second Department of Anesthesia and Intensive Care Medicine, Azienda Ospedaliera S Maria della Misericordia, Udine, Italy
LOE: 5
Quality of Evidence: fair
Publication Types: Comparative Study; Journal Article
PMID: 12793877 [PubMed – indexed for MEDLINE]

2: 

Cerebral haemodynamic response to acute intracranial hypertension induced by head-down tilt.
Bosone D; Ozturk V; Roatta S; Cavallini A; Tosi P; Micieli G
Neurovascular Unit, IRCCS C. Mondino Institute of Neurology, Pavia, Italy.
LOE 4: good
Publication Type: Clinical Trial; Comparative Study; Journal Article; Research Support, Non-U.S. Gov't
PMID: 0015212114 [PubMed - indexed for MEDLINE]

3: 

Changes in BP induced by passive leg raising predict response to fluid loading in critically ill patients.
Boulain T, Achard JM, Teboul JL, Richard C, Perrotin D, Ginies G.
Service de Réanimation Médicale, Hôpital de Bicêtre, Faculté de Médecine Paris-Sud, Paris, France.
LOE 4:good
PMID: 11948060 [PubMed - indexed for MEDLINE]

4:

**Use of the Trendelenburg Position as the Resuscitation Position: To T or not to T?**

Bridges N., Jarquin-Valdivia A.

The Neurointensive Care Unit, Vanderbilt University Medical Center, Nashville, TN, USA.

LOE: 5/ good
Publication Types: Review
PMID: 16120887 [PubMed - indexed for MEDLINE]

5:


**Hemodynamic effects of passive leg raising: an echocardiographic study in patients with shock.**

Caille V, Jabot J, Belliard G, Charron C, Jardin F, Vieillard-Baron A.

Medical Intensive Care Unit, Centre Hospitalier Universitaire Ambroise Paré, 9, Avenue Charles-de-Gaulle, 92104, Boulogne Cedex, France.

PMID: 18351322 [PubMed - as supplied by publisher]

6:


**Functional hemodynamic monitoring and dynamic indices of fluid responsiveness.**

Cavallaro F, Sandroni C, Antonelli M.

Department of Emergency Medicine, Unit of Anesthesia and Intensive Care, Cattolica del Sacro Cuore University, Policlinico Universitario 'Agostino Gemelli', Rome, Italy. fabio_cavallaro@yahoo.it

PMID: 18212731 [PubMed - in process]

7:


**Variations in pulse oximetry plethysmographic waveform amplitude induced by passive leg raising in spontaneously breathing volunteers.**


8:

**Passive leg raising does not produce a significant or sustained autotransfusion effect.**

Gaffney FA, Bastian BC, Thal ER, Atkins JM, Blomqvist CG.

LOE: 4/ good
Publication Types:
  - Research Support, U.S. Gov't, Non-P.H.S.
  - Research Support, U.S. Gov't, P.H.S.
PMID: 7069801 [PubMed - indexed for MEDLINE]

9:

**Effect of body inversion on hemodynamics determined by two-dimensional echocardiography;**

Jennings T., Seaworth J., Howell L., Tripp L. et al.

LOE: 4/poor
Publication Type: Journal Article
PMID: 4028772 [PubMed - indexed for MEDLINE]

10:

**Myth: The Trendelenburg position improves circulation in cases of shock**

Johnson S., Henderson S O.;

Department of Emergency Medicine, Keck School of Medicine of the University of Southern California, Los Angeles, California, USA.

LOE: 5
Quality of Evidence:  good

No Abstract in Medline available.

Publication Type: Journal Article
PMID: 0017433146[PubMed - indexed for MEDLINE]

11:

**Body position change and its effect on hemodynamic and metabolic status**
Jones, A.Y. and Dean, E.;

Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Kowloon, Hong Kong.

Publication Type: Journal Article
PMID: 0015454907 [PubMed - indexed for MEDLINE]

12:

**Ability of pleth variability index to detect hemodynamic changes induced by passive leg raising in spontaneously breathing volunteers.**

Keller G, Cassar E, Desebbe O, Lehot JJ, Cannesson M.

Hospices Civils de Lyon, Groupement Hospitalier Est, Department of Anesthesiology and Intensive Care, Louis Pradel Hospital and Claude Bernard Lyon 1 University, INSERM ERI 22, 28 avenue du doyen Lépine, 69500 Bron-Lyon, France.

PMID: 18325089 [PubMed - as supplied by publisher]

13:
Int J Cardiolog 1994, May 44(3): 288-93

**Does passive leg raising increase cardiac performance? A study using Doppler echocardiography.**

Kyriakides ZS Koukoulas A et all:

Athens General Hospital, Greece.

LOE 4: fair
Publication Type: Journal Article
PMID: 0008077076 [PubMed - indexed for MEDLINE]

14:
AANA J 1995 Feb;63(1):29-36

**The Trendelenburg position: a review of current slants about head down tilt.**

Martin JT

Publication Type: Journal Article; Review
PMID: 0007762369 [PubMed - indexed for MEDLINE]

15:

**Diagnosis of central hypovolemia by using passive leg raising.**
Maizel J, Airapetian N, Lorne E, Tribouilloy C, Massy Z, Slama M.
Unite de Reanimation Medicale, Service de Nephrologie, CHU Sud, 80054 cedex 1, Amiens, France.

Publication Types: Research Support, Non-U.S. Gov't
PMID: 17508202 [PubMed - indexed for MEDLINE]

16:

Passive leg raising predicts fluid responsiveness in the critically ill.

Monnet X, Rienzo M, Osman D, Anguel N, Richard C, Pinsky MR, Teboul JL.
Service de réanimation médicale, Centre Hospitalier Universitaire de Bicêtre, Assistance Publique-Hôpitaux de Paris, Université Paris 11, Le Kremlin-Bicêtre, France.

Publication Types: Evaluation Studies, Research Support, N.I.H., Extramural
PMID: 16540963 [PubMed - indexed for MEDLINE]

17:

Passive leg raising.

Monnet X, Teboul JL.
Service de réanimation médicale, Hôpital de Bicêtre, AP-HP, 78 rue du Général Leclerc, 94270, Le Kremlin-Bicêtre, France, xavier.monnet@bct.aphp.fr.

PMID: 18214429 [PubMed - in process]

18:

Volume responsiveness.

Monnet X, Teboul JL.
Medical Intensive Care Unit, Bicêtre University Hospital, Paris-11 University, Le Kremlin-Bicêtre, France.

Publication Types: Review
PMID: 17762234 [PubMed - indexed for MEDLINE]

19:
Cardiovascular responses to short-term head-down positioning in healthy young and older adults;

Naylor J., Chow C. et al.

School of Exercise and Sport Sciences, University of Sydney, NSW, Australia.

Publication Type: Journal Article
PMID: 0015991485

20:

A modified postural drainage position produces less cardiovascular stress than a head-down position in patients with severe heart disease: A quasi-experimental study

Naylor J., McLean A. et al;

Whitlam Joint Replacement Centre, Fairfield Hospital, Sydney, NSW, Australia

Publication Type: Clinical Trial; Comparative Study; Journal Article; Research Support, Non-U.S. Gov't
PMID: 0016942455

21:

The Effect of Trendelenburg and modified Trendelenburg Positions on Cardiac Output, Blood Pressure and Oxygenation: A Preliminary Study

Ostrow L., Hupp E., et al.;

LOE: 4
Quality of Evidence: good

22:

Use of the Trendelenburg position by critical care nurses: Trendelenburg survey.

Ostrow CL.

Department of Health Restoration, School of Nursing, West Virginia University, Morgantown, USA.

PMID: 9131195 [PubMed - indexed for MEDLINE]

23:
Trendelenburg position and passive leg raising do not significantly improve cardiopulmonary performance in the anesthetized patient with coronary artery disease.

Reich DL, Konstadt SN, Raissi S, Hubbard M, Thys DM.

Department of Anesthesiology, Mount Sinai Medical Center, New York, NY 10029.

LOE: 4  
Quality of Evidence: fair  
Publication Types: Clinical Trial, Randomized Controlled Trial  
PMID: 2702840 [PubMed - indexed for MEDLINE]

Trendelenburg Positioning to Treat Acute Hypotension: Helpful or Harmful?

Shammas A., Clark A.;  
University of Texas at Austin School of Nursing, Red River, Austin, TX 78701, USA.

LOE: 5  
Quality of Evidence: good  
Comments on Study: This is a very nice recent meta-analysis, which analysed 5 studies dealing with the question of the usefulness of Trendelenburg. At the end they concluded that the research findings do not provide strong support for the use of Trendelenburg position as intervention for hypertension especially adverse effects could be described in such a position - and they recommend avoiding this position for hypotension/shock.

Publication Type: Revision  
PMID: 17622805 [PubMed - indexed for MEDLINE]

The Trendelenburg position: hemodynamic effects in hypotensive and normotensive patients.

Sibbald W, Paterson N et al,

LOE: 3  
Quality of Evidence: good  
Publication Type: Journal Article  
PMID: 467083 [PubMed - indexed for MEDLINE]

24.
Clin Nurse Spec, Vol. 21, No. 4, 2007

25.
Crit Care Med., 7 (5) 218-224, May 1979
Trendelenburg position and oxygen transport in hypovolemic adults.

Sing RF; O'Hara D; Sawyer MA; Marino PL
Department of Surgery, Graduate Hospital, Philadelphia

LOE 4/fair
Publication Type: Journal Article
PMID: 0008135435 [PubMed - indexed for MEDLINE]

Prediction of volume responsiveness in critically ill patients with spontaneous breathing activity.

Teboul JL, Monnet X.

LEO: 5/fair
PMID: 18467896 [PubMed - in process]

Effects of Trendelenburg versus passive leg raising: autotransfusion in humans.

Terai C, Anada H, Matsushima S, Kawakami M, Okada Y.

LOE: 4
Quality of Evidence: fair
Comments on Study: This Japanese research group investigated the effects of a 10° head-down tilt on central hemodynamics and flow through the internal jugular vein (IJV) by examining ten healthy volunteers. Left ventricular enddiastolic volume (LVEDV) and cardiac output (CO) were calculated from two-dimensional echocardiograms. The mean arterial pressure at the heart level did not change during the manoeuvre. The IJV velocity decreased whereas the IJV cross-sectional area increased at 1 minute after tilting, but both factors returned to control level at 10 minutes after tilting. As a result, calculated IJV blood flow was unchanged throughout the period of tilt. Therefore, the mild Trendelenburg position produces an autotransfusion effect in normovolemic patients. Our data also suggest that the Trendelenburg produces no adverse effect on cerebral circulation in patients with normal cerebral autoregulation. The problem with this study is that they only investigated 10 men and they are aware of the limitation that patients with head injuries often show a severe disturbance of cerebral autoregulation, which might lead to an increase in intracranial pressure.

Publication Type: Comparative Study; Letter
PMID: 0008814487

Effects of mild Trendelenburg on central hemodynamics and internal jugular vein velocity, cross-sectional area, and flow.

Terai C; Anada H; Matsushima S; Shimizu S; Okada Y

Department of Traumatology and Emergency Medicine, National Defense Medical College, Saitama, Japan.

Publication Type: Journal Article
PMID: 0007755812 [PubMed - indexed for MEDLINE]

30:

Acute cardiovascular response to passive leg raising.

Wong DH, Tremper KK, Zaccari J, Hajduczek J, Konchigeri HN, Hufstedler SM.

Department of Anesthesiology, University of California, Irvine Medical Center, Orange.

PMID: 3342623 [PubMed - indexed for MEDLINE]

31

Changes in cardiac output after acute blood loss and position change in man.

Wong DH, O'Connor D, Tremper KK, Zaccari J, Thompson P, Hill D.

Department of Anesthesiology, University of California, Irvine.

LOE: 4
Quality of Evidence: fair

PMID: 2791582 [PubMed - indexed for MEDLINE]