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Q What are the practice guidelines for prone positioning of acutely ill patients? Specifically, what are the recommendations related to hemodynamic monitoring and tube feeding?

A Kathleen M. Vollman, RN, MSN, CCNS, CCRN, replies:

Most studies to date that examined hemodynamic measurements obtained with patients supine and prone found no clinical or statistically significant difference between measurements obtained with patients in the 2 positions (see Table). Most of these studies, however, did not mention how the zero reference point was established for the prone position. Only 2 studies[8,12] clearly outlined the methods used to establish the zero reference point. Pelosi et al[12] examined 16 critically ill patients receiving mechanical ventilation in the supine and prone position. The investigators measured heart rate, cardiac index, mean pulmonary artery pressure (MPAP), pulmonary capillary wedge pressure (PCWP), and central venous pressure (CVP); they used the midaxillary line as the reference point for both the supine and the prone positions. Pelosi et al detected a significant increase in MPAP, PCWP, and CVP measurements obtained while patients were prone that returned to baseline levels when the patient was returned to the supine position. Pelosi et al attributed the difference in hemodynamics to the fact that the midaxillary reference point was used as the zero reference level when the patient was prone. The minimal change could be due to a shift of the real zero pressure level because of the ventral movement of the heart in the prone position. Vollman and Bander,[8] however, used the phlebostatic axis, releveling, and recalibrating with each position turn to measure heart rate, mean arterial blood pressure (MAP), MPAP, PCWP, CVP, and cardiac index in 15 critically ill patients receiving mechanical ventilation and found no significant difference between measurements obtained with subjects supine versus prone. The researchers established interrater reliability for measurement of MPAP, PCWP, and cardiac index to ensure accuracy of values. Correlations ranged from 0.94 to 1.0, with $P < .001$.

When hemodynamics are assessed in prone patients, establishing the correct zero reference point is essential for accuracy of measurements. Although a large randomized trial examining this question is needed, most results of published studies suggest that use of the phlebostatic axis provides reliable reproducible data in both prone and supine patients.

The question of whether it is appropriate to tube feed prone patients has not been studied. A few published studies[13,14] discuss feeding prone patients. Voggenreiter et al[13] held the tube feeding for an 8-hour period that the patient was placed prone on a daily basis, stating that previous observation of prone patients revealed a retardation of stomach emptying. Other clinicians, however, have had success feeding prone patients. A number of factors are important to consider. Patients are at most risk for aspiration during the turning process. Holding tube feeding for 1 hour before the turn may ensure adequate emptying of the patient's stomach.[15,16] This step is important to reduce the risk of aspiration. Feeding is then restarted when the patient is prone. Additionally, tubes placed distal to the pyloric valve also reduce the risk of aspiration. Some clinicians place the patient's bed in a reverse Trendelenburg position to simulate the 30° elevation of the head of the bed that is used when a patient is supine to reduce the risk of aspiration. Positioning the patient's bed in a reverse Trendelenburg position while the patient is prone places the trachea and esophagus

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Studies comparing measurements obtained with patients supine vs prone

Study (year)	No. of subjects	Study type	Variables measured	Reference point noted	Difference between positions
Albert et al[1] (1987)	20	Animal (dogs)	PAP, PCWP, CO	No	None
Langer et al[2] (1988)	13	Human	PAP, CI	No	None
Mutoh et al[3] (1992)	6	Animal (pigs)	CVP, PAP, PCWP	Mid chest and recorded at end-expiration	None
Brussel et al[4] (1993)	10	Human	CVP, MPAP, PCWP, CO	No	None
Pappert et al[5] (1994)	12	Human	MPAP, PCWP, CO	No	None
Lamm et al[6] (1994)	8	Animal (dogs)	MPAP, PCWP, CO	Mid chest	None
Fridrich et al[7] (1996)	20	Human	MPAP, CI	Midaxillary	None
Vollman and Bander[8] (1996)	15	Human	PAP, MPAP, PCWP, CO	Phlebostatic axis and recorded at end-expiration	None
Blanch et al[9] (1997)	23	Human	CVP, MPAP, PCWP, CO	Position of catheter checked on chest radiograph	None
Jolliet et al[10] (1998)	19	Human	CVP, MPAP, PCWP, CO	No	None
Mure et al[11] (1997)	8	Animal (pigs)	MPAP, PCWP, CO	No	Difference in CO and PCWP when abdomen distended. No difference with normal abdomen
Pelosi et al[12] (1998)	16	Human	CVP, MPAP, PCWP, CI	Mid chest	Significant difference in MPAP, PCWP and CVP; no difference in CI
Voggenreiter et al[13] (1999)	22	Human	MPAP, CI	No	Significant difference in MPAP and CI

CI indicates cardiac index; CO, cardiac output; CVP, central venous pressure, MPAP, mean pulmonary artery pressure; PAP, pulmonary artery pressure; PCWP, pulmonary capillary wedge pressure.

in an anatomic position that increases the risk of aspiration. Positioning the bed flat or with the prone patient's head down promotes the use of gravity in the event of evacuation of the patient's stomach contents.

A number of articles[15-19] outline the details on procedures that can be used to turn critically ill patients prone. Only one procedure to date has been tested for safety and effectiveness within a research study.[20]

The science of prone positioning is in its infancy, and a number of questions have yet to be answered. For more information and a detailed policy and procedure for prone positioning, visit www.vollman.com. ✣

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