TotalCare® Bed System
University of Cincinnati Hospital, Cincinnati, Ohio

STUDY RESULTS

SPECIFIC AIMS

The purpose of this study was to evaluate the effect of three body positions (sitting with feet down, semi-Fowler's with feet level, and supine with feet level) on pulmonary function and gas exchange in elderly and obese subjects without lung disease.

SIGNIFICANCE

Alterations in lung volume, pulmonary compliance, frequency dependence of dynamic compliance, and ventilation-perfusion relationships during changes in body position have been the subject of numerous investigations over the years[1]. Elevating the head of bed for patients who can tolerate that positioning has been reported to be an effective prophylactic measure[4]. While these studies have contributed to the current medical knowledge surrounding respiratory function and body position, these reports did not specifically address body position and its affect on the measurement of arterial blood gases and pH.

Current hospital practice is to care for patients in a head of bed elevated position ranging from 30 to 60 [1, 2, 3, 5]. This is done in an attempt to improve lung function, reduce the risk of pulmonary aspiration of gastric contents, and improve patient comfort. Another practice is to place the patient in a chair to promote mobilization of fluid and pulmonary secretions and to encourage lung inflation[1]. This movement, however, requires several personnel, significant preparation time, and is not without risk.

Two studies were conducted to re-evaluate the effect of posture on lung function in volunteers at risk for early airway closure. Volunteers over age 50 years and those greater than 150% of their ideal body weight were studied. The TotalCare® Bed was used to move patients from supine to a full, leg down, sitting position. Simultaneous measurements of blood gases and pulmonary function were made to these subjects at risk for posture-related derangements in gas exchange.

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EFFECT OF BODY POSITION (BP) ON PULMONARY MECHANICS, GAS EXCHANGE, AND LUNG VOLUMES IN ELDERLY SUBJECTS WITHOUT LUNG DISEASE.

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PURPOSE Evaluate the effect of three BP (sitting with feet down (ST), semi-fowlers with feet level (SF), supine with feet level (SP)), available on a prototype hospital bed (TotalCare, Hill-Rom) on pulmonary function and gas exchange in elderly subjects (SUB) without lung disease (LD).

METHODS Ten SUB older than 50 (mean age 59) were enrolled. Mean height was 65 inches, 6 females and 4 males were studied (all Cauc). SUB were randomly placed in each BP for a 30" acclimation period, after which the following measurements were made: deadspace to tidal volume ratio (V_D/V_T), arterial blood gas on 21% and 100% O_2, closing volume (CV), lung volumes (LV) and subdivisions (TLC, VC, V_T, FRC, RV), and forced expiratory volume in 1 second (FEV_1). Values for each BP were compared using ANOVA.

RESULTS Table 1 shows mean (SD) values for FEV_1, TLC, FRC, RV, CV, PaO_2, on 21% and 100% O_2, and V_D/V_T at each BP tested.

Table 1	ST	(75)	SF	(45)	SP	(0)
TLC (L)	5.26	(.98)‡*	5.03	(1.0)*	4.85	(1.1)
FRC (L)	2.1	(.35)‡*	1.84	(.41)	1.72	(.47)
RV (L)	1.87	(.27)*	1.56	(.35)	1.43	(.35)
CV (L)	0.543	(.16)	0.519	(.18)*	.0581	(.19)
PaO_2-.21	88.6	(7.3)	87.1	(11.9)	84.4	(10.1)
PaO_2-1.0	542	(33)*	530	(30)	514	(38)
V_D/V_T (%)	30.7	(2.4)	30.9	(1.6)	32.2	(3.2)
FEV_1 (L)	2.7	(.52)*	2.58	(.55)	2.53	(.55)

*=p<0.05 vs. SP,‡=p<0.05 vs. SF

CONCLUSIONS Pulmonary mechanics and gas exchange are best when ST at 75 with feet down. CV was highest in the SP BP, all other LV were best when ST.

CLINICAL IMPLICATIONS Elderly patients may benefit from a bed capable of ST BP with feet down in terms of improved pulmonary mechanics and oxygenation. Differences may be greater in elderly patients with LD. Risks to patients and hospital staff associated with changing BP may be lower with use of this bed.

Johannigman JA, Campbell RS Branson RD, et al. Effect of body positioning (BP) on pulmonary gas mechanics, gas exchange, and lung volumes in elderly subjects without lung disease. American College of Chest Physicians, New Orleans, LA, 1997.

EFFECT OF BODY POSITION (BP) ON PULMONARY MECHANICS, GAS EXCHANGE, AND LUNG VOLUMES IN OBESE SUBJECTS WITHOUT LUNG DISEASE.

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PURPOSE Evaluate the effect of three BP (sitting with feet down (ST), semi-fowlers with feet level (SF), supine with feet level (SP)), available on a prototype hospital bed (TotalCare, Hill-Rom) on pulmonary function and gas exchange in obese subjects (SUB) without lung disease (LD).

METHODS Ten SUB weighing > 175% ideal body weight (mean weight 247 lbs.) were enrolled. Mean age was 35 yrs., mean height was 66 inches, 7 Blacks, 3 Cauc., 8 females, and 2 males were studied. SUB were randomly placed in each BP for a 30" acclimation period, after which the following measurements were made: deadspace to tidal volume ratio (V_D/V_T), arterial blood gas on 21% and 100% O_2, closing volume (CV), lung volumes (LV) and subdivisions (TLC, VC, V_T, FRC, RV), and forced expiratory volume in 1 second (FEV_1). Values for each BP were compared using ANOVA.

RESULTS Table 1 shows mean (SD) values for FEV_1, TLC, FRC, RV, CV, PaO_2, on 21% and 100% O_2, and V_D/V_T at each BP tested.

Table 1	ST	(75)	SF	(45)	SP	(0)
TLC (L)	4.35	(.68)*	4.29	(.78)	4.17	(.68)
FRC (L)	1.57	(.47)*	1.54	(.58)	1.46	(.52)
RV (L)	1.19	(.55)	1.18	(.61)	1.13	(.60)
CV (L)	0.371	(.1)*‡	0.334	(.1)	0.328	(.1)
PaO2-.21	89.7	(9.2)*	86.9	(8.4)	81.5	(7.7)
PaO2-1.0	519	(45)*	514	(39)	490	(33)
VD/VT (%)	30.3	(5.9)*	32.0	(5.4)	33.8	(7.1)
FEV1 (L)	2.57	(.56)*	2.55	(.55)	2.40	(.55)

*=p<0.05 vs. SP,‡=p<0.05 vs. SF

CONCLUSIONS Pulmonary mechanics, gas exchange, and LV are best when ST at 75 with feet down. Differences between ST and SF were small.

CLINICAL IMPLICATIONS Obese patients may benefit from a bed capable of ST BP with feet down in terms of reduced atelectasis, improved pulmonary mechanics and oxygenation. Differences may be greater in obese patients with LD. Risks to patients and hospital staff associated with changing BP may be lower with use of this bed.

Branson RD, Campbell RS, Johannigman JA, et al. Effect of body positioning (BP) on pulmonary gas mechanics, gas exchange, and lung volumes in obese subjects without lung disease. American College of Chest Physicians, New Orleans, LA, 1997.

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