

European Respiratory Society Annual Congress 2012

Abstract Number: 2896
Publication Number: P1142

Abstract Group: 9.1. Respiratory Function Technologists/Scientists

Keyword 1: Lung function testing **Keyword 2:** No keyword **Keyword 3:** No keyword

Title: Rate and depth of breathing affect multiple-breath N₂ washout (MBNW) indices

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Body: Introduction: MBNW requires little cooperation beyond steady breathing, but some subjects (eg. children) may breathe irregularly. Historical studies examining the effect of changing respiratory rate and depth on ventilation distribution indices^{1,2} have contradictory findings. We aimed to examine the impact of rate and depth of breathing on Lung Clearance Index (LCI), and 2 indices of ventilation inhomogeneity (S_{cond} and S_{acin}). Methods: Each subject performed at least 3 MBNW tests at each of 3 breathing patterns (BP). A visual signal provided a frequency target and an auditory signal guided tidal volume (Vt). We compared mean LCI, S_{cond} and S_{acin} between the different BP using repeated measures ANOVA. Sensitivity analyses were performed with and without outliers for validation. Results: We studied 19 healthy adults but excluded 2 for technical reasons. There were significant differences in LCI and S_{acin} with BP (p<0.01), but no significant differences in S_{cond} (p=0.117). Increasing Vt from 0.6 to 1.0L reduced LCI and S_{acin}. Increasing frequency from 15 to 30bpm increased LCI and S_{acin}.

Table: Mean (SD) for indices of ventilatory inhomogeneity

BP(Vt, f(bpm))	LCI	Scond	Sacin
1.0L, 15	7.29(0.80)	0.011(0.015)	0.088(0.037)
1.0L, 30	7.95(0.66)	0.016(0.013)	0.115(0.056)
0.6L, 15	8.18(1.00)	0.021(0.016)	0.241(0.208)

Discussion: We confirmed an earlier report on 4 adults that increasing Vt reduces ventilation inhomogeneity within acinar airways¹; in contrast we found no effect on S_{cond}. Frequency also influenced some indices of ventilatory homogeneity. We recommend that both Vt and frequency are controlled. (1)Crawford A et al1986.RespirPhysiol;66(1):11-25. (2)Bouhuys AA et al1961.JApplPhysiol;16:1039-1042.