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# DETERMINATION OF PULMONARY COMPLIANCE IN DIVERS: A METHODOLOGICAL CRITIQUE.

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The criterion method for measuring pulmonary compliance in man is the static pressure-volume relaxation manoeuvre. This manoeuvre requires considerable subject training and co-operation, and is technically difficult to perform underwater. Thus, non-static manoeuvres (the quasi-static and dynamic compliance methods) have been employed by research groups when assessing pulmonary mechanics in divers. This report analyses technical and physiological differences between statically and dynamically derived pulmonary compliance, and their significance to underwater physiology.

Total respiratory, lung tissue (pulmonary) and chest wall compliance of ten subjects was measured using the static pressure-volume relaxation manoeuvre. Pulmonary compliance was also determined dynamically from transpulmonary pressure at points of zero airflow, during spontaneous respiration. Trials were performed in air (control) and during total, upright immersion. Dynamic compliance was determined while subjects breathed air supplied at four hydrostatic pressures: mouth pressure, lung centroid pressure ($P_{LC}$: +1.33kPa relative to sternal notch pressure), $P_{LC}$ -0.98kPa, and $P_{LC}$ +0.98kPa.

Control static ($C_{st(l)}$) and dynamic compliances ($C_{dyn(l)}$) were not significantly different (3.24 & 2.91 $l.kPa^{-1}$ respectively). Immersion, with air supplied at mouth pressure, caused a 43.8% reduction in $C_{dyn(l)}$ to 1.63 $l.kPa^{-1}$ ($p<0.5$). The total respiratory compliance curve shifted positively an average of 1.19kPa with immersion, in agreement with previous $P_{LC}$ determinations by the current authors. However, immersion produced no significant changes in total respiratory, pulmonary or chest wall compliances ($p>0.05$). When air was supplied at elevated pressures, $C_{dyn(l)}$ returned to levels equivalent to control $C_{dyn(l)}$, and $C_{st(l)}$ obtained during immersion ($p>0.05$).

Differences between $C_{st(l)}$ and $C_{dyn(l)}$, when immersed divers were supplied with air at mouth pressure, were interpreted to indicate a non-linear dynamic pressure-volume relation over the lung volume studied. Alinearity may result when alveolar and mouth pressures are not equivalent at points of zero airflow, or when transpulmonary pressures reflect flow-resistive changes. It is suggested that during immersion studies, $C_{dyn(l)}$ may reflect changes in mechanical status other than, or in addition to changes in pulmonary compliance. It is recommended that the static pressure-volume manoeuvre be adopted for determining pulmonary compliance during immersion.