

Pleural pressure levels and sodium retention and redistribution

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Introduction: Increased pleural pressure (P_{pl}) is associated with sodium and water retention. We quantified this phenomenon and estimated the sodium distribution through the body compartments.

Methods: Eighty pigs, were divided in two 40 pigs groups according to the median P_{pl} , measured as the product of airway pressure times the ratio of chest wall/total elastance. We computed, every 6h up to 48h, sodium quantity (Q_{Na}) in extracellular fluid (ECF):

$$Q_{Na} = [Na^+] \times Kg \times 0.2$$

and the net sodium retention:

$$Q_{Na.net} = Na_{input} - Na_{output}$$

Expected end-experiment $[Na^+]_{ee}$ was computed as:

$$[Na^+]_{ee} = \frac{[Na^+]_o \times Kg_o \times 0.2 + Na^+_{net}}{Kg_o \times 0.2 + FB}$$

where Na^+_o is sodium baseline concentration, Kg_o the initial pig weight and FB the fluid balance.

not reach the statistical significance (144.8 [3.83] mmol/L vs. 146.6 [3.38], $p=0.06$). However, if all retained sodium should have been only distributed in the ECF (computed as 20% of the final body weight), the concentration of sodium would have been 245.49 mmol/L [33.69] in group 1 and 277.07 [43.39] in group 2 ($p<0.01$), (fig. 1b).

Fig. 1A: Sodium retention according to pleural pressure

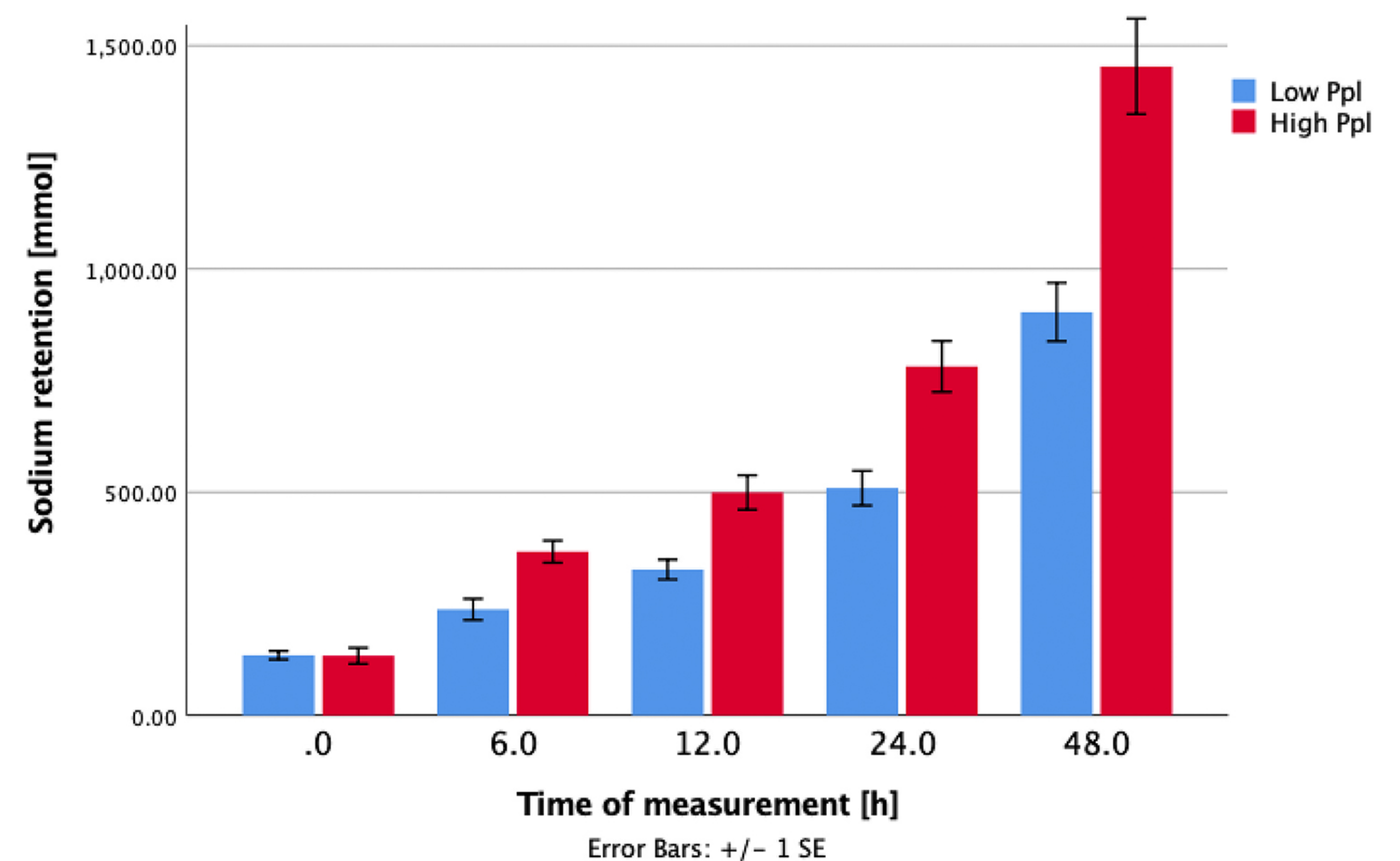
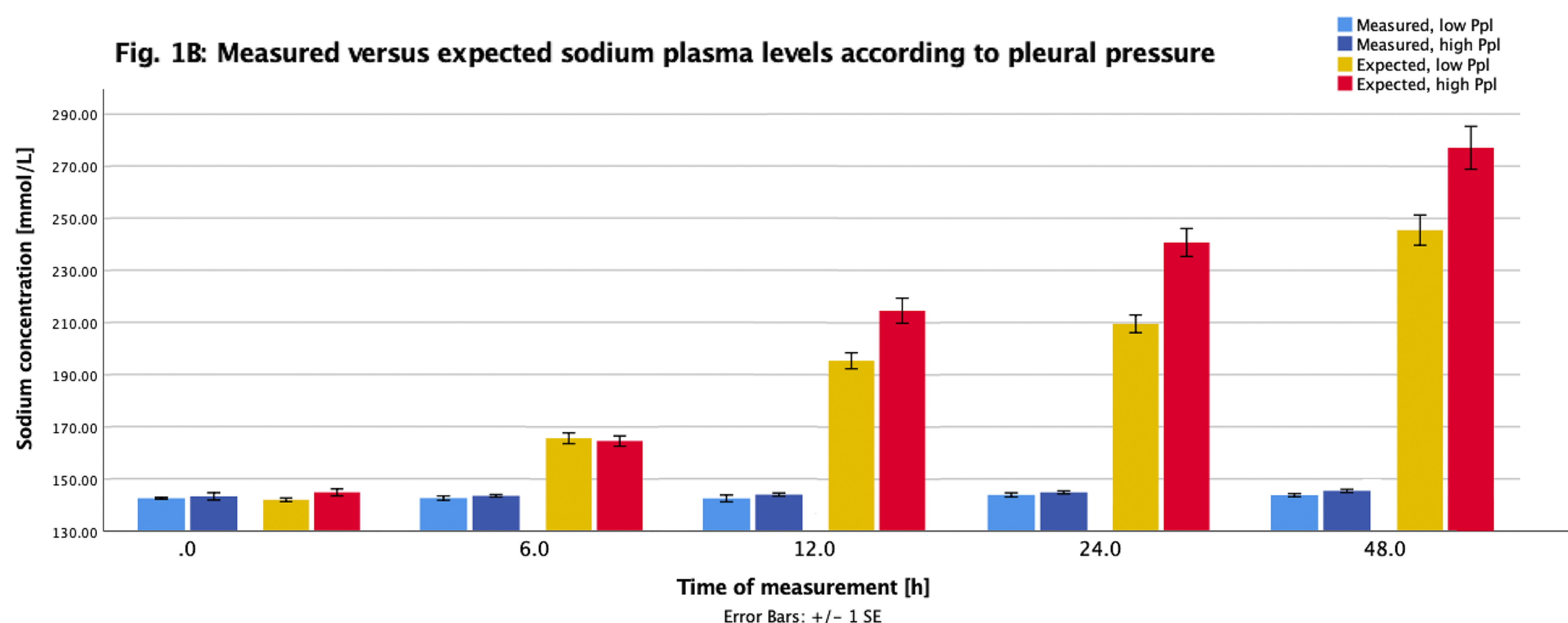


Fig. 1B: Measured versus expected sodium plasma levels according to pleural pressure



Results: Mean P_{pl} of group 1 and 2 were 3.92 cmH₂O [1.30] and 9.18 [2.84], respectively ($p<0.01$). At baseline, the $Q_{Na,0}$ in ECF was similar: 680.5 mmol [60,79] and 689,9 [82,6] ($p=0,64$). $Q_{Na.net}$ at 48h was significantly different between groups (903.35 mmol [381.04] vs. 1453.53 [566.43], ($p<0.01$), (fig. 1a). The difference of $[Na^+]$ at end experiment between the two groups did

Conclusions: Increasing pleural pressure was associated with a significant accumulation of sodium. Our data suggest that to explain the near-normal end experiment sodium concentration either the ECF fraction increase from 0.2 to 0.4 of body weight or part of sodium is distributed in the intracellular fluids or ascites/pleural effusion.