

Title: PULMONARY EDEMA INDUCED BY ACID ASPIRATION IS NOT ALTERED BY HYPOPROTEINEMIA

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**Introduction.** Factors regulating tissue fluid accumulation are pressure (hydrostatic and oncotic) and capillary permeability. Previous studies confirmed that hypoproteinemia promoted pressure edema in undamaged lungs.<sup>1</sup> The purpose of the present study was to assess the influence of hypoproteinemia on the extent of permeability edema induced by acid aspiration in rabbits.

**Methods.** Albumin and water distribution in skin muscle and lung were measured after acute reduction of plasma protein and oncotic pressure in five male white New Zealand rabbits (wt.=2.3-3.3kg). At the start of each study, rabbits were lightly restrained. After local anesthesia, cannulae were placed in ear arteries and veins. Each rabbit was plasmapheresed by removal of 90cc of whole blood in three increments from the arterial cannulae, removal of plasma by centrifugation and replacement of red blood cells suspended in saline equal in volume to discarded plasma. To assess organ interstitial water, a bolus of 99m-technetium labelled DPTA was given and followed by a constant infusion. Over the final three hours of the study, normal saline containing sodium bicarbonate (5.12meq/L) was infused (10cc/kg/hr) to allow for redistribution of crystalloid after plasmapheresis. After plasmapheresis, each rabbit was anesthetized with ketamine (10mg/kg). Light anesthesia was then maintained with halothane (.5-1%) in oxygen. After insertion of a tracheostomy cannulae, each rabbit aspirated hydrochloric acid (pH=1.5, 290mosm/L, 4ml/kg). Half the acid dose was delivered in each lateral decubitus position. Mechanical ventilation was then begun to maintain PaCO<sub>2</sub> at 35±5 torr. A 2½ hour period was then allowed for organ redistribution of albumin and water. Ten minutes before the end of the study, 51-chromium labelled rabbit red blood cells and 131-iodine labelled human albumin were infused for later assessment of organ blood and plasma. Immediately before death, blood samples were drawn for blood gas and oncotic pressure measurement. The rabbits were then killed. Skin muscle and lung samples were analyzed for extracellular and interstitial water content, plasma, and red blood cell volumes. All above measurements were also made in a second group of five rabbits managed identically but not plasmapheresed. Significant differences (p<.05) were determined using student's t-test for paired data.

**Results.** Mean results are shown in the table. Plasma total protein and oncotic

pressure decreased significantly in the plasmapheresed group. Though extravascular water content of lungs in both groups was elevated, (normal=2.5-3.5ml/gm dry lung) there was no significant difference in extravascular water accumulation or distribution between groups. No significant differences were noted in skin or muscle, nor were there differences in P(A-a)DO<sub>2</sub> between groups.

**Discussion.** Acute changes in plasma oncotic pressure do not affect tissue fluid formation when capillary permeability is normal.<sup>1</sup> This study suggests that acute albumin depletion has little effect on pulmonary edema formation following capillary injury. We suggest that the distinction between pressure and permeability edema is an important determinant when considering use of albumin for plasma volume expansion.

#### References.

- Guyton AC, and Lindsey AW: Effect of elevated left atrial pressure and decreased plasma protein concentration on the development of pulmonary edema. *Circ Res*, 7:649-657 1959

Group	Tissue water content (ml/gm dry)	Interstitial water content (ml/gm dry)	Interstitial water (% of total extra-vascular water)	Plasma Oncotic Pressure (torr)	A-aDO <sub>2</sub>
Control: (n=5)	Mean 8.07 SE .61	2.79 .72	.44 .09	14.3 .86	569 22
Plasmapheresis: (n=5)	Mean 9.34 SE 1.04	3.94 .36	.59 .05	9.62* .71	577 6

\*Significant difference from control (p<.05)