ARTICLES

Dependence of surfactant function on extracellular pH: mechanisms and modifications

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Abstract

We investigated alterations in pH on the surface properties of natural lung surfactant and the calf lung surfactant extract (CLSE), suspended in 10 mM N-2-hydroxyethylpiperazine-N'-2-ethanesulfonic acid, using a pulsating bubble surfactometer. Increasing the pH value of the medium to > 7.4 decreased the ability of CLSE, but not of natural lung surfactant mixtures (2 mg phospholipid/ml), to achieve a low minimum surface tension during dynamic compression and enhanced their sensitivity to albumin inactivation. These detrimental effects on surface tension were reversed by addition of surfactant protein A (SP-A; 3% by weight) or by increasing the lipid concentration to 4 mg/ml. SP-A-induced lipid aggregation at pH 10 was not different than at pH 7.4. Alkalinization impaired the ability of CLSE to restore normal lung mechanics in excised surfactant-deficient rats lungs. These results indicate that cooperation between SP-A and the hydrophobic surfactant proteins has an important role in achieving low minimum surface tension at pH > or = 7.6.