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# Protective effect and mechanism of hydrogen treatment on lung epithelial barrier dysfunction in rats with sepsis

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**ABSTRACT.** This study aimed to explore the protective effect of hydrogen and to investigate the underlying mechanism of its preliminary effect on the alveolar epithelial barrier function in septic rats. Forty-five male Sprague-Dawley rats were divided randomly into three groups (N = 15): control [saline injection (intraperitoneal, *ip*), air drawing; SA], acute lung injury group [lipopolysaccharide (LPS) injection (*ip*, 15 mg/kg), air drawing; LA], and acute lung injury combined with hydrogen drawing group [LPS injection (*ip*, 15 mg/kg), 2% hydrogen drawing; LH]. The rats were euthanized after 6 h of treatment, and the extravascular lung water (EVLW), pulmonary alveolar-arterial oxygen pressure (A-aDO2), and respiratory index (RI) of each group were measured. The aquaporin-1 (AQP-1) protein expression in the lung tissues was detected using immunohistochemistry and western blotting, and the correlation between the EVLW and AQP-1 was analyzed. The lung morphology was observed with light and electron microscopy. In the LA group, EVLW (0.87 ± 0.17), A-aDO2 (113.21 ± 13.92), RI (0.65 ± 0.26), and AQP-1 expression increased. Additionally, thickened alveolar walls, significant invasion of inflammatory cells around the vessels, capillary ectasia, hyperemia/hemorrhage in the alveolar space, significantly swollen mitochondria, and increased vacuolar degeneration were observed. A significant negative correlation between AQP-1 expression and EVLW was observed ($R^2$ = 0.8806). Compared with the LA

 

group, EVLW (0.71 ± 0.19), A-aDO2 (132.42 ± 17.39), RI (0.75 ± 0.24), and inflammatory reaction decreased and AQP-1 expression increased in the LH group. The damage to pulmonary epithelial cells improved after hydrogen treatment in rats with sepsis; hydrogen could protect the pulmonary epithelial barrier function by acting on AQP-1.

**Key words:** Hydrogen; Lung; Barrier function; Sepsis; Rat; AQP-1

 