

LETTER TO THE EDITOR

EFFECT OF SOME β -BLOCKERS AND PROCAINE ON ADRENALINE - INDUCED PULMONARY EDEMA AND LUNG SURFACTANT ACTIVITY IN RATS

Sir,

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Pulmonary surfactant is essential for normal lung function. It maintains the structural stability of alveolar lining. Loss of pulmonary surfactant system would favour pulmonary edema (1, 2). Respiratory distress syndromes of newborn is due to deficiency of pulmonary surfactant (3).

Alveolar membrane stability can be studied by finding out pulmonary surfactant activity (4, 5). Local anaesthetics possess the membrane stabilizing activity. Protective effect of propranolol against adrenaline induced pulmonary edema (APE) has been reported (6, 7). It has been proposed that it may be due to its local anaesthetic activity (7), but no experimental evidence was provided. Hence, present study was undertaken to assess the effect of β -blockers with or without local anaesthetic activity and of procaine on APE and pulmonary surfactant activity (PSA).

Adult albino rats of either sex ranging from 140-160 g were used. Animals were divided into different groups each group comprising of 6 rats. Intravenous injections were given via a tail vein. Saline treated animals served as negative control. Animals received adrenaline (2 mg/kg, iv, 1:10,000 w/v) served as positive control. Other groups received either isoprenaline (4 mg/kg, iv, 1:10,000 w/v) or procaine (200 mg/kg, iv, 1:100 w/v) to assess about the production of pulmonary edema. Adrenaline, isoprenaline and procaine treated groups were compared with saline treated (Negative control) group. In addition separate groups, pre-treatment with propranolol (20 mg/kg, iv, 1:1000 w/v), practolol (30 mg/kg, im, 1:1000 w/v), sotalol (40 mg/kg, im, 1:1000 w/v) or procaine (200 mg/kg, iv, 1:100 w/v) was given 20 min prior to injection of adrenaline (2 mg/kg, iv, 1:10,000 w/v;8). These groups were compared with adrenal-

ine treated (Positive control) group. Animals which died within 1 hr were sacrificed immediately while the surviving animals of all the groups were sacrificed 60 min later. Both the lungs, along with trachea, were dissected out of all experimental animals whether died within 60 min or survived after 60 min to assess (1) the pulmonary edema and (2) PSA as follows:

1. Pulmonary edema was assessed by calculating the lung body weight index (LBI) as

$$LBI = \frac{\text{Weight of lungs}}{\text{Body weight}} \times 100$$

2. PSA : The lung surfactant was washed using 10 ml normal saline and maximum (Tmax) and minimum (Tmin) surface tensions were measured using a Whillhelmy type of balance, modified by Krishnan et al (9). Further, an index called as extract stability index (ESI) was calculated using the formula (10).

$$ESI = \frac{2 (T_{max} - T_{min})}{(T_{max} + T_{min})}$$

One hour mortality has not been used as a parameter in the present study as it has been shown that 1 hr mortality is not a standard parameter for assessing APE (11).

Results were analysed with 't' test, using suitable groups for comparison (Table I). Group B, C and D were compared with group A (Saline control) while drug treated groups (E to H) with Group B (positive control).

Our results (Table I) show that adrenaline produced pulmonary edema with significant reduction in PSA as compared to saline control. Isoprenaline did not produce pulmonary edema and PSA remained unaltered. This suggests that β -receptors

TABLE I : Pulmonary Oedema induced by some drugs and effect of pre-treatments on adrenaline induced pulmonary Oedema.

Group	Surface tension (Dynes/CM)		ESI	LBI
	Maximum	Minimum		
A. Saline (Negative control)	30.08 ± 0.73	17.50 ± 1.17	0.52 ± 0.09	0.71 ± 0.04
B. Adrenaline (Positive control)	35.00 ± 2.16	25.25 ± 2.31	0.31 ± 0.03*	1.26 ± 0.11*
C. Isoprenaline	29.50 ± 2.43	18.17 ± 2.32	0.48 ± 0.07	0.70 ± 0.02
D. Procaine	28.40 ± 0.95	18.16 ± 1.70	0.43 ± 0.07	0.70 ± 0.03
E. Propranolol+ Adrenaline	30.17 ± 1.03	18.60 ± 1.96	0.43 ± 0.06*	0.81 ± 0.09*
F. Practolol+ Adrenaline	42.60 ± 1.24	33.80 ± 1.70	0.30 ± 0.02*	1.22 ± 0.07*
G. Sotalol+ Adrenaline	41.40 ± 1.76	33.30 ± 1.60	0.29 ± 0.03*	1.21 ± 0.09*
H. Procaine+ Adrenaline	28.50 ± 1.50	17.80 ± 1.78	0.45 ± 0.05*	0.82 ± 0.06*

*P<0.001 as compared to negative control.

*P<0.001 as compared to positive control.

ESI, extract stability Index. LBI, lung body weight index. Values are mean ± SEM (n = 6 rats)

are not involved in APE which is in agreement with earlier reports (11). Propranolol pre-treatment protected against APE, and PSA was restored to control level (group A), indicating that structural stability of alveolar lining was maintained. Procaine alone did not produce pulmonary edema and PSA remained near to the control value (group A). Pre-treatment of procaine showed similar results as propranolol against APE and PSA. On the other

hand, pre-treatment with practolol and sotalol, the β -blockers without local anaesthetic activity, failed to protect against APE and PSA was significantly reduced (compared to group A) which shows that structural stability of alveolar lining was disturbed. The present study confirms that protection offered by propranolol and procaine against APE is due to their ability to maintain structural stability of alveolar lining due to their local anaesthetic activity.

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