ASSESSEMENT OF BRONCHODILATORS USED IN THE MANAGEMENT OF ASTHMATIC CHILDREN BY THE PEAK FLOW METER

THESIS

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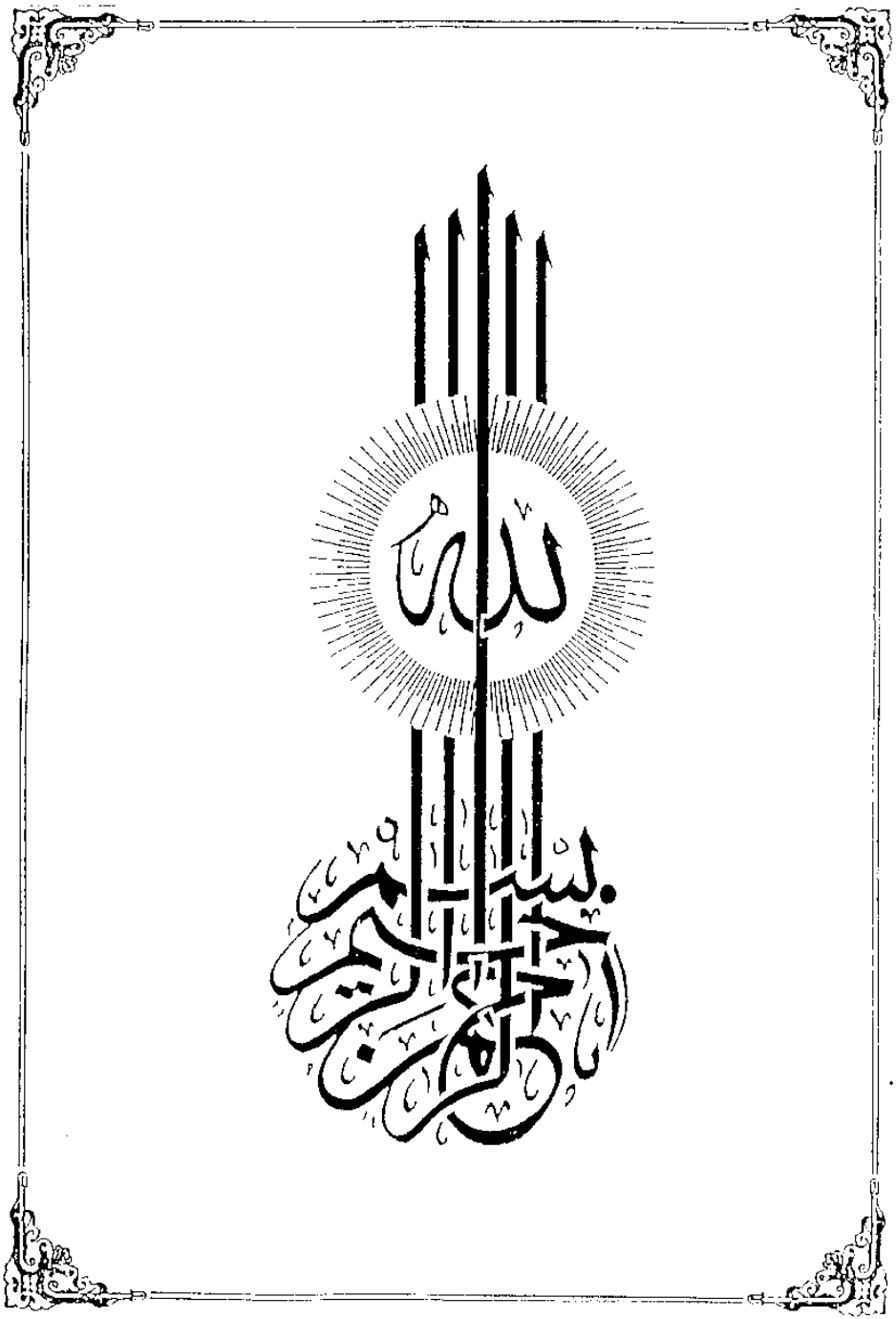

ABREVIATIONS

* A. T. S. : American Thoracic Society
* A. C. C. P. : American College of Chest Physician
* AMP : Adenosine monophosphate
* SRS-A: Slow releasing substances of anaphylaxis
* LT : Leukotrienes
* PG : Prostaglandins
* Tx : Thromboxane
* Ig E : Immunoglobulin E
* TAV : Trapped air volume
* RV : Residual volume
* VC : Vital capacity
* TLC : Total lung capacity
* FEV : Forced expiratory volume
* FVC : Forced vital capacity
* PEFR : Peak expiratory flow rate
* COMT : Catechol-oxy-methyltransferase
* S.E. : Stander error of the mean

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INTRODUCTION

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Bronchial asthma is a reversible obstructive process predominantly of the lower pulmonary tract caused by mucosal edema, increased and unusually viscid secretions and constriction of bronchial tree (Kempe et al., 1984).

Different methods of investigations are available but pulmonary function testing can provide important diagnostic and prognostic information in the management of children with asthma. The pulmonary functions which are affected in bronchial asthma are:

- Total lung capacity (T. L. C.) is increased.
- Functional residual capacity (F. R. C.) is increased.
- Vital capacity (V. C.) is usually decreased.
- Forced vital capacity (F. V. C.) is decreased.
- Forced expiratory volume in one second (FEV_1) is decreased.
- Maximum expiratory flow between 25-75% (M. E. F. 25-75) may be decreased.

The peak flowmeter is a simple mechanical device particularly suitable for pediatric use because most

children are able and willing to do the test. The performance of the test is like blowing out candles on a birth day cake. Children as young as four or five years can understand. The device is used to measure the peak expiratory flow rate to evaluate the effect of our therapy. The aim of this work is to determine the most effective drugs used in pediatric management for bronchial asthma.

This work will be carried on seven groups of asthmatic patients, their age range from five to thirteen years of different sex. Each group will use the following drugs:

- Rimetol hydrobromide (Pulmadil: an aerosol B_2 selective agonists).
- Salbutamol (Ventoline: oral & aerosol B_2 selective agonists).
- Theophylline (aminophylline: oral & suppository direct bronchodilator).
- Terbutaline (bricanyl: oral & aerosol B_2 selective agonists).

The peak expiratory volume will be estimated before and after the administration of each drug. In case of inhalers we estimate it at: 30, 60, 120 minutes after drug administration. As regard oral therapy we evaluate it after one and two weeks.

REVIEW OF LITERATURE

BRONCHIAL ASTHMA

DEFINITION:

Asthma is a chronic disorder of the tracheobronchial tree in which there is recurrent reversible generalized obstruction to airflow. It is commonly manifested by cough, respiratory distress and classically by expiratory wheezing (Pearlman, 1984). The condition is usually reversible either spontaneously or following administration of appropriate therapy (Micheal, 1982).

A joint committee of the American Thoracic Society (A. T. S.) and the American College of Chest Physician (A. C. C. P.)(1978) defined asthma as a disease characterized by an increased responsiveness of the airway to various stimuli manifested by slowing of forced expiration that changes in severity, whether spontaneously or with treatment.

INCIDENCE OF ASTHMA

Phelan et al., (1982) stated that there is a wide difference in the prevalence of asthma among different communities and this difference may be due to the fact that asthma is defined differently by various investi-

gators, so that one includes patients whom another would exclude.

In Egypt, the incidence of asthma among sick children visiting the outpatient clinic of the pediatric Hospital, Cairo University, was found to be 2.2% (El-Hefny et al., 1980).

In the United Kingdom the published figures showed that prevalence of asthma up to the age of 15 years was about 2.3% of boys and 1.25 of girls (Rhyne, 1974).

In United States the prevalence among school children is about 4.9-12.1% (Arbeiter, 1967). So, as a conclusion the true incidence of asthma is unknown and can only be indirectly estimated (Speizer & Heaf, 1968).

PATHOPHYSIOLOGY:

The three elements that contribute to airway obstruction in asthma are spasm of smooth muscles, edema and inflammation of the mucus membranes lining the airways, and intraluminal exudation of mucus, inflammatory cells, and cellular debris (Ellis, 1983). (Fig. 1)

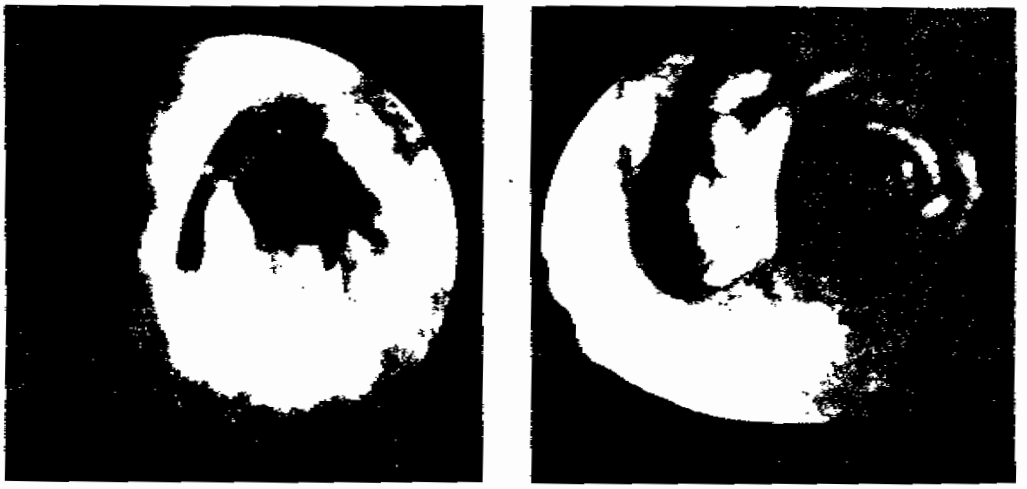

Fig. 1. Bronchoscopic aspect of airway during an asthmatic attack and after application of adrenaline (Herzog, 1981).

I- BRONCHOSPASM:

It is proved now that the pathophysiology of bronchial asthma starts by sensitization of mast cells, basophils and perhaps eosinophils through the interaction of Ig E antibody with specific receptors present on the plasma membranes of these target cells. On re-exposure to a specific antigen degranulation of the mast cells occur resulting in release of many chemical mediators which is modulated by the cellular level of cyclic AMP (Levison et al., 1974).

All of the following mediators are capable of causing bronchial smooth muscle constriction: hista-

mine, bradykinin, slow reacting substances of anaphylaxis (SRS-A) which include leukotrienes C, D and E (LTC, LTD and LTE), Prostaglandins PGF_2 and thromboxane A_2 (Tx A_2)(Thomas & Marom., 1983).

A- Histamine: There are two cellular receptors for histamine designated H_1 and H_2. Histamine induces airway obstruction through either direct stimulation of H_1 receptors on muscle fibers, (Rosenthal et al., 1977), or through a vagally mediated reflex parasympathetic action as well (Yu et al., 1972).

B- Prostaglandins: Products of arachidonic acid metabolism through the cyclo-oxygenase dependent pathway. During the course of human lung anaphylaxis different prostaglandins are generated (Platshon & Kaliner., 1978), PGF_2, PGE, PGD_2 and thromboxane B_2 cause bronchospasm, while PGE_2 and PGI_2 are bronchodilators.

C- Slow reacting substances of anaphylaxis (SRS-A): It is derived from arachidonic acid through lipo-oxygenase pathway. Inspite that it is composed of many leukotrienes yet the studies proved that LTC and LTD are the most potent bronchoconstrictive substances (Weiss et al., 1982).

D- Kinins: It has been recently reported that human mast cells containing a kininogenase which is released during asthma and participate in Ig E mediated reaction leading to the production of Kinins (Proud et al., 1982). Kinins contract bronchial smooth muscle, increase vascular permeability and mediate prostaglandin formation (Wasserman, 1980).

II- MUCOSAL EDEMA AND CELLULAR INFILTRATE:

Edema of the airway mucosa is due to increased capillary permeability with leakage of serum proteins into interstitial areas. This occurs under the effect of histamine, prostaglandin, bradykinin and leukotrienes (Thomas et al., 1983).

The mucosa was found to be mixed with cellular infiltrates consisting of eosinophils, neutrophils, macrophages, monocytes and plasma cells (Kaliner et al., 1976).

III- MUCUS SECRETION:

Examination of bronchi during the attack almost always reveal diffuse secretions of mucus which appear to contribute significantly to the airway obstruction.