

## **EDITORIAL**

### **AEROSOL THERAPY: THE MAINSTAY OF RESPIRATORY CARE**

Inhalational treatment has been practiced since ages in form of smoking drugs, such as Dhatura. Use of inhaled Adrenaline for asthma was reported as early as 1929 in England. Earlier use of Penicillin dust was precursor of modern day dry powder inhaler (DPI) while Wright's hand held atomizer was precursor of portable nebulizers.

During the last few years significant changes has occurred in aerosol therapy(1). Newer devices are available to deliver a variety of drugs which include, bronchodilators, anti-inflammatory drugs, hormones, peptides, analgesics, vasodilators and antibiotics. Modern era of aerosol therapy began with the introduction of first Metered Dose Inhaler (MDI) in 1956 on the suggestion of a teenage asthmatic whether her medication could be used in the form of a hair spray. Since than advances in technology has made the delivery of drugs highly convenient as well as efficient.

MDI with or without spacing chambers or DPIs are considered ideal mode of administering aerosolized medication for routine use in children as well as adults (2). In acute conditions when inspiratory flow is too low aerosol can be administered through a nebulizer For many patient an MDI with a spacing device can suffice even in acute asthma.. For children spacing devise may have well fitted masks

Inhaled drugs are delivered directly to the targeted organ, which allows much lower dosages than systemic intake and thus fewer side effects (3). Quick delivery results in rapid onset of action. The three types of Inhalational devices i.e.; MDIs, DPIs and Nebulizers, are clinically equivalent, though prescribed (Nominal) dosages may be different. Improved technology within the devices have achieved improved delivery within the lung (Lung Dose) through introduction of Hydrofluoro Alkane (HFA) gas and breath actuated synchronization. An increasing variety of Inhalational devices and drug formulation is being introduced, which is resultant of impending total ban on Chloro Fluoro Carbon (CFC) gas. At one time when ban on CFC was announced a setback to the Inhalational therapy looked imminent (4). At present proliferation of devices is resulting in confusion and ambiguity in the use of devices by patients as well as caregivers. Improper inhalational technique is common which is partly the consequent of inadequate clinicians knowledge in the use of devices and ability to teach patients how to use correctly (5).

Inhalational route of drug administration is not only a preferred method in obstructive airway disease but is also valuable mode of delivery in situation like Cystic Fibrosis, Pneumocystis pneumonia, RSV infection in children, adult Influenza virus infection, Primary Pulmonary Hypertension, Diabetes Mellitus, Fungal Pneumonia or Aspergillosis and even to give Morphine.

**CLINICAL EFFICASY:** No single device is ideal or perfect as all of them have merits and limitations. The ultimate efficacy of a device depends upon the amount of aerosol delivered within the airways (Delivered or Lung Dose) . Any device

which generates more Respirable aerosol is more efficient than another device which produces large particles with non uniform size. A less potent drug may be clinically more effective when delivered properly through an HFA carrier and inspiratory adapted actuation.

#### LUNG DOSE:

Efficacy of inhaled drug is directly dependant on the amount of drug deposited within the lung particularly smaller airways. Lung deposition can be measured by inhaling radioactive aerosol using Gamma camera. An MDI without a spacer generally delivers 10-15% of ejected aerosol (6). This is frequently reduced due to inadequate coordination between actuation and inhalation. Aerosol delivery can be doubled by attaching a spacing chamber, or using breath actuated device. DPIs cannot be used with a spacer and result in comparatively reduced delivery. Dose delivery of DPI also varies depending on the inspiratory flow generated by the patient, however a Turbo or Twist haler will deliver more drug than a Disk or Diskus inhaler or a Rotahaler.

#### PARTICLE SIZE:

An aerosol composed of more small size particles will have higher Respirable Fraction. Aerosol with highly volatile CFC carrier, quickly change their size and become non respirable if inhalation is delayed. With exception of Turbohaler, temperature and humidity will effect most of the powder inhalers by changing the size of particles. Particles of  $<5 \mu\text{M}$  size flow freely (Diffusion) and do not get deposited, whereas  $> 15 \mu\text{M}$  size are trapped in nasopharynx and larger airways. When used correctly DPIs or gas inhalers are equally effective. Relative efficacy may not be compared as metered and delivered dosages may be different depending upon technology to produce uniform particle size. Semi synthetic steroids delivered with HFA gas produce much more respirable fraction than (Beclomethasone) MDI with CFC gas. In comparison Fluticasone MDI is found twice as effective as Budesonide (7), while Fluticasone Diskhaler, Budesonide Easyhaler, and Turbohaler or Twist halers were equally effective.

#### NEBULIZERS:

The nebulizers use either O<sub>2</sub> or air under high pressure (Jet Nebulizer) or Ultrasound to breakup liquid or a vibrating Mesh to release uniform size particles. The pressure of flow and density of gas determines the output of drug as aerosol. In a jet nebulizer the ultimate amount of respirable fraction depend upon the volume of solution, the design of baffle, period of nebulization, the atmospheric humidity or temperature and characteristics of nebulizing solution. Ultrasonic nebulizer use high frequency waves to break liquid and produces more aerosol of uniform size in a shorter period of time. Handy and hand held nebulizers with on demand actuation (Adaptive Aerosol Delivery Devices) releasing aerosol through a valve and devices using inbuilt computer card for a structured release of aerosol are available (AKITA smart card). A hybrid of MDI and nebulizer which releases metered dose of a respiratory solution has been introduced. (e.Flow) (8). Electronic devices using Vibrating Mesh technology (Aeroneb) has revolutionized drug delivery not only for respiratory but nonpulmonary conditions.

Drug delivery in the form of aerosol has been revolutionized. A variety of spacing chamber of different sizes with an option of well fitted mask has made it easier

for young as well as elderly patients to use MDI (9). Semi synthetic steroids with HFA make them safer to use for a longer period due to better delivery and low dosages. Breath actuation and Turbohalers technology result in higher output of aerosol. Handheld battery operated nebulizers, spring loaded MDIs (Respimat) and devices using ultrasound or electronic vibrating mesh have all resulted in much improved quality of life and point toward a promising future for the patient.

Prof. Syed Nazim Hussain Bokhari  
MD(Chest), FCCP  
Professor of Pulmonology  
Sheikh Zayed Federal PGMI Lahore

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