COMPARISON BETWEEN EFFICACY OF MDI+SPACER AND NEBULISER IN THE MANAGEMENT OF ACUTE ASTHMA IN CHILDREN

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Background: Due to changing evidence on efficacy of MDI+spacer as compared to nebuliser, two types of managements were going on in our Day unit, depending on the presence of different medical professionals. We wanted to find out the evidence of the best practice from within our unit, and then to formulate guidelines based on it for the management of paediatric acute asthma. **Methods:** We isolated 54 cases of children suffering from acute asthma attack from admissions during Oct 2004–March 2005 within the age range of 3–14 yrs. We categorised them into four classes of mild, moderate, severe and life threatening acute attack depending on its severity and then separated them in two groups. Group I received salbutamol Via MDI+spacer and Group II received salbutamol via nebuliser. Our outcome measure was time to clinical improvement and duration of hospital stay. **Results:** We didn't find any major difference between the two groups, moreover MDI+spacer was better than nebuliser for the treatment of severe acute asthma attack in children. **Conclusion:** Our study supported and confirmed the evidence that MDI+spacer is least as effective as nebuliser in the management of acute asthma in children.

Keywords: MDI+spacer, Nebuliser, Juvenile Asthma, Salbutamol, Wheeze

INTRODUCTION

Asthma is a major cause of morbidity, hospital admissions and school absences.[1,2] It affects over 100 million people world wide. Its incidence, morbidity and mortality are on the rise for unknown reasons.[3] Management of acute asthma in children presents a particular challenge to Paediatricians. The first line of treatment in the management of acute asthma is inhaled beta2 agonists (salbutamol) and is now the main stay of treatment.[4] The advantage of inhaled beta agonists is effective bronchodilatation and fewer side effects. This method of administration not only reduces the adverse effects as compared to oral or parenteral administration but also avoids patients' discomfort especially in preschool children.[5,6] Beta2 agonists may be administered by MDI+accessory device or nebuliser.

For many years nebuliser has been accepted to be the main therapeutic way of management of acute asthma in Paediatrics. They are however uncomfortable, require 15–20 min to administer the prescribed dose and need O_2 or compressed air to generate spray. The O_2 flow, the distance between face and mask, tidal volume, respiratory rate and patient's inhalation technique result in a variation in deposition of inhaled particles in lower airways ranging from 3–13% of the total particles available as compared to 20% of particles via MDI+spacer.[7,8]

Management of acute asthma has changed from total use of nebulisers to mixed use of MDI+spacer or nebuliser depending upon the presence of different medical and nursing staff. We attempted to standardise the management within our unit after finding evidence from previous admissions.

Because of the changing evidence on the management of acute asthma in children in hospital settings, different medical and nursing professionals were using different strategies for these children in our Day unit. We wanted to find out if there is any difference between these strategies and then to standardize one management plan to treat acute asthmatic children. Nearly a decade ago nebuliser was the main stay of treatment for acute asthma in children, whoever walked into emergency unit with wheeze was offered a nebuliser, but then gradually evidence changed that MDI+spacer could be as affective as a nebuliser in the management of Paediatric acute asthma.

At the time of study both practices were going on in our unit, we wanted to confirm the evidence within our unit. We reviewed case notes of all wheezy children who were admitted during Oct 2004–March 2005 and isolated 54 cases of acute asthma within the age range of 3–14 years. We excluded under 3 years because we were not sure whether they are confirmed and known asthmatics. We also excluded all other causes of wheeze like cystic fibrosis, foreign body inhalation and congenital abnormalities of lung etc.

PATIENTS AND METHODS

We retrospectively reviewed the case notes of all the children who were admitted in the Day unit of RVI from Oct 2004 to March 2005 with wheezing episode and isolated 54 cases of known asthmatic children. We

selected the age range of 3–14 years. Children under 3 year age were excluded who were admitted with wheeze because some of them were not known asthmatics and were admitted for the first time with acute attack. All other causes of wheeze for example Cystic Fibrosis, foreign body inhalation and congenital abnormality of lung etc. were excluded.

These 54 cases were classified into mild, moderate, severe and life threatening acute asthma attack depending on severity of their signs and symptoms which are illustrated in Table-1.

Table-1: British Thoracic Society Guidelines[11]

Signs & Symptoms	Mild	Moderate	Severe	Life threat
General Appearance	Tired	Exhausted	Agitated	Drowsy
Position of Comfort	Can take any position	Sitting upright supporting the chest	Sitting up right	Exhausted. lying
Dyspnoea	Can talk & feed	Can't talk properly or feed	Can't talk	Can't
Speech	Full Sentences	Phrases	Words	Nil
Cyanosis	Absent	Absent	Might be present	Present
Respiratory Rate	Below 40/min	Above 40/min	Above 50/min	Low respiratory effort
Pulse	Above 100/min	Above 120/min	Above 140/min	Above 140 or below 80
O_2 Saturations	95–98%	92–95%	Below 92%	Below 90%
Use of accessory muscles	Some intercostal & subcostal recessions	Marked recessions and use of sterno-mastoids	Marked recessions, use of sterno-mastoids & tracheal tug	As for severe attack or exhaustion
Auscultatory findings	Wheeze	Marked wheeze	Loud wheeze or silent chest	Silent Chest

We then looked at the management they received and divided them into two groups. Group-I received salbutamol via MDI+Spacer (100 g), 4–10 puffs, depending on severity of attack. The dose was repeated after 10–20 min and child was reassessed after 2–4 doses. Group-II received salbutamol nebuliser (2.5–5 mg according to the age of the child) and dose was repeated after 15–45 min, according to severity of the illness. Both groups received high flow O_2 and prednisolone (2 mg/kg in two divided doses, for 3 days) apart from mild cases, as guided by British Thoracic Society Guidelines.[11]

Outcome measure of the study was time to clinical improvement (in terms of improvement in tachycardia, tachypnoea, O_2 saturations, use of accessory muscles, Auscultatory findings and frequency/urgency of next dose); and duration of hospital stay.

RESULTS

We isolated 54 cases of known asthmatic children who were admitted to Day unit at Royal Victoria Infirmary, Newcastle upon Tyne. We chose the age range of 3–14 years. We excluded one child, who had life threatening acute attack and was transferred to ITU straight away.

Ten of the children had mild acute asthma attack, 36 had moderate acute attack and seven children had severe acute asthma attack. Results and number of children receiving MDI+spacer or nebuliser are given in Table-2 as Group-I and II respectively.

Table-2: Results of (MDI+Spacer) and Nebuliser

Category of attack	Number	Tenure to clinical improvement (hours) Mean±SD	Average Hospital Stay (hours)
Group I (MDI+Spacer)			
Mild Acute	5	2.2±0.27	10.3 hours
Moderate Acute	19	3.78±0.75	20.05 hours
Severe Acute	4	6.6±0.94	33.8
Group II (Nebuliser)			
Mild	5	2.5±0.353	10.25 hours
Moderate	17	3.8±0.635	20.41 hours
Severe	3	7.0±1.00	35.6 hours

The average time to clinical improvement of mild cases in Group I was 2.2 hours and duration of hospital stay was 10.3 hours as compared to 2.5 hours and 10.25 hours for Group II respectively. Clinical improvement was apparent in moderate cases of Group I in 3.78 hours while it took 3.8 hours for respective cases of Group II. Average hospital stay in moderate case of Group I was 20.5 hours as compared to 20.41 hours for similar cases in Group II. Average time to clinical improvement in severe cases of Group I was 6.6 hours, while for Group II it was 7 hours. Average hospital stay for severe cases in Group I was 33.8 hours and for Group II was 35 hours. The results are statistically not significant ($p>0.05$) after applying *t*-test and severity of symptoms.

DISCUSSION

Outcome of our study was, time taken to clinical improvement, (in terms of improvement in heart rate, Respiratory rate, O_2 saturations, use of accessory muscles, chest auscultation and frequency/urgency of next dose) and duration of hospital stay.

As it is clear from Table-2 that all results for Group-I and II are comparable. Moreover, results of children suffering from severe acute asthma attack are even better for Group-I as compared to Group-II.

This study confirms and adds to the previous evidence that MDI+spacer is as affective as a nebuliser in treating acute exacerbation of asthma in paediatrics.[8–12] Reasons for this are that the child is used to it, so cooperates well (a new technique might

be frightening); parents can help the child (a nurse can scare and upset a child); and some nebulisers are not O_2 driven, can interrupt high flow O_2 for a considerable time in case of moderate to severe attack.

There are many additional advantages for example to use a nebuliser, an experienced nurse should be available for 15–20 minutes which is quite difficult in busy emergency units. There are fewer side effects with spacers like tachycardia and that spacers are cheaper and portable.[11,12]

Children under 3 year of age were excluded for reasons documented earlier on, but studies have proved that MDI+spacer+mask are equivalent to or better than nebulisers in children as young as 6 months to 24 months.[6,13–15]

Furthermore, in third world countries commercially produced spacers are generally unavailable or too costly. Studies have tested the efficacy of home made spacers (500 ml plastic bottle and polystyrene cup) with conventional spacers for delivery of beta2 agonists via MDI in the management of acute exacerbation of asthma in children and concluded that both these devices are least as effective as a spacer.[16]

This study supported and confirmed the evidence that MDI+spacer is equivalent to nebuliser in the management of acute attack of asthma in children. Overall care strategy of any management guidelines should include evidence on efficacy, ease of use, acceptability and cost of each treatment modality.[17] Rees and Price[18] stated nebulisers are expansive, time consuming and inconvenient. They are often used incorrectly at home and a child should not be discharged from hospital until he is taking the treatment that he will be taking at home.

CONCLUSION

We conclude that MDI+spacer is as effective as nebuliser in the management of acute asthma in children.

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