To compare efficacy of 3% saline administered by pressure driven nebuliser Vs ultrasonic nebuliser in patients of Bronchiolitis

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Abstract

OBJECTIVE: To compare efficacy of pressure driven nebuliser vs ultrasonic nebuliser in management of Bronchiolitis using 3% saline as nebulising solution.

DESIGN: Prospective randomised control trial.

SETTING: Tertiary care teaching hospital in Pune.

PARTICIPANTS: 75 children with clinical diagnosis of Bronchiolitis.

PROCEDURE: Children were randomly administered 3% saline nebulisation through either pressure driven nebuliser or ultrasonic nebuliser. RDAI score, RR, HR, SPo2, were recorded before and one hour after nebulisation. Parameters were statistically analysed.

RESULTS: Baseline characteristics of both were comparable (P > 0.05). 3% saline administered with either of the two nebulisers was effective in management of Bronchiolitis (P < 0.001). When efficacy of both nebulisers was compared, it was found that observed parameters showed significant more improvement with ultrasonic nebuliser than pressure driven nebuliser (P < 0.001).

CONCLUSION: Ultrasonic nebuliser is better than pressure driven nebuliser in management of Bronchiolitis when 3% saline is used as nebulisation solution.

Introduction

Bronchiolitis is the most common acute lower respiratory tract infection during first 2 years of life (1). Bronchiolitis is a clinical diagnosis, based on typical history and examination (2). Clinical manifestations occur due to airway inflammation and air trapping. It is a self-limiting disease and less than 1% progress to severe disease. There is lack of evidence based management and supportive treatment remains the mainstay therapy in Bronchiolitis. Inhalation therapy with nebuliser is widely used and effective therapy.

The principle of nebulisation is generation of aerosol particles. The lung deposition and efficacy of an aerosol depends on particle size. Particles larger than 10 micron get deposited in the mouth and nasal cavity. 5 to 10 micron particles reach peripheral bronchi. Particles less than 5 micron reach distal most bronchioles but may be exhaled out without deposition (3).

Two types of nebulisers are available 1:- pressure driven 2:- ultrasonic. The pressure driven nebuliser generates aerosol with smaller mass (diameter of 5 micron) as compared to 6 micron diameter aerosol generated by ultra-sonic nebuliser (4). Particle size around 5 micron have better deposition at bronchioles while those less than 5 micron are exhaled out without deposition (4). But pressure driven nebuliser is cheap and hence widely used.

Purpose of this study is to compare efficacy of both nebulisers in treatment of Bronchiolitis. Very few such comparative studies are available.

Methods

The study was conducted at D. Y. Patil medical college Pune from July 2011 to September 2013. After ethical committee approval 70 children between 6 weeks and 2 years with clinical diagnosis of Bronchiolitis were enrolled. Bronchiolitis was defined as first episode of wheezing along with prodromal symptoms of URI which may progress to dyspnea (5). It was a randomised controlled single blind study. Children with recurrent wheezing, associated systemic diseases, and already on bronchodilator were excluded from the study.

Patients were allotted two groups randomly. Group A - children who received hypertonic 3% saline with pressure driven nebuliser.

Group B - children who received hypertonic 3% saline with ultrasonic nebuliser.

Heart rate, Respiratory rate, Respiratory distress assessment index score, SPo2, were recorded before and one hour after nebulisation. RDAI score was used in this study, it scores wheeze and retraction and maximum score is 17.

Children
with higher score have severe disease, score above 15 indicates very severe disease (6). Statistical analysis was done by EPI info.

Results

OBSERVATION AND RESULTS: During study period 75 patients fulfilling eligibility criteria were enrolled. 5 patients were excluded. Out of 70 patients studied 47 were male 23 were female. Both groups were comparable with similar baseline characteristics P > 0.05. All patients receiving hypertonic saline nebulisation showed significant improvement after nebulisation over baseline parameters. Both nebulisers, pressure driven and ultrasonic nebuliser, were effective in management of patients with Bronchiolitis. Analysis of patients in group A and group B was done and it was observed that patients who received hypertonic saline through ultrasonic nebuliser had significantly more improvement in RR, RDAI, HR, than those who received it through pressure driven nebuliser P < 0.001. Change in SpO2 was similar in both groups P > 0.05.

Discussion

Bronchiolitis is the commonest cause of LRTI in children less than two years. 1 to 3 percent of infants are hospitalised with Bronchiolitis annually. Treatment of Bronchiolitis is largely supportive. Nebulised drugs as aerosol are effective in its treatment. Hypertonic saline (3%) is the currently investigated effective therapy for Bronchiolitis. Nebulised hypertonic saline is also widely used in management of cystic fibrosis. It hydrates mucus, mucosa, sub mucosa and releases the obstruction. Studies done to demonstrate efficacy of 3% saline have not mentioned the type of nebuliser used. None of the studies have compared the efficacy of Pressure driven nebulisers and ultrasonic nebuliser in patients receiving 3% saline nebulisation. In this study comparing efficacy of both type of nebulisers, 65% of admitted were less than 1 year age. Mean age of children in this study was 9.8 ±6 months which is similar to other studies by Neeraj Gupta et al (7.1 ± 6.58) months (7). Both nebulisers were effective in management of Bronchiolitis. In this study it is observed that patients receiving 3% saline through ultrasonic nebuliser had significantly more improvement in all parameters studied at the end of one hour than patients receiving same drug through pressure driven nebuliser. Difference in RDAI score p < 0.007, respiratory rate p < 0.004, heart rate p < 0.05, were statistically significant, while differences in SpO2 between both groups was statistically not significant p > 0.06. Serious children were not included in study and hence initial SpO2 was not grossly abnormal and change in SpO2 was insignificant.

Conclusion

Ultrasonic nebuliser is better than pressure driven nebuliser in management of Bronchiolitis when 3% saline is used as nebulisation solution.

References

5) Bhagwan S Sharma, Mukesh K Gupta et al. Hypertonic saline vs 0.9% saline nebulisation for acute viral Bronchiolitis: A randomised controlled trial. Indian Paediatrics, Vol 50;15, August 2013: page 743-7.
Illustrations

Illustration 1

Baseline characteristic in the assigned Study groups

<table>
<thead>
<tr>
<th></th>
<th>Group A (n=35)</th>
<th>Group B (n=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male / Female</td>
<td>24/11</td>
<td>23/12</td>
</tr>
<tr>
<td>Mean Age-months (+/-SD)</td>
<td>10.97(7.21)</td>
<td>8.12(5.78)</td>
</tr>
<tr>
<td>Mean duration of illness (+/-SD)</td>
<td>5.12(1.73)</td>
<td>3.82(1.42)</td>
</tr>
<tr>
<td>Malnutrition according to IAP classification/total no.</td>
<td>18/35</td>
<td>16/35</td>
</tr>
<tr>
<td>Mean RDAI score (+/-SD)</td>
<td>5.82(1.51)</td>
<td>5.65(1.22)</td>
</tr>
<tr>
<td>Mean RR (+/-SD)</td>
<td>53.29(9.4)</td>
<td>66.70(8.09)</td>
</tr>
<tr>
<td>Mean HR (+/- SD)</td>
<td>126(16.43)</td>
<td>123.17(16.58)</td>
</tr>
<tr>
<td>Mean temp (+/- SD)</td>
<td>98.88(1.38)</td>
<td>99.7(1.00)</td>
</tr>
<tr>
<td>Mean SpO2 (+/-SD)</td>
<td>91.53(5.66)</td>
<td>95.76(1.06)</td>
</tr>
</tbody>
</table>
Illustration 2

Comparison of Response to 3% saline administered by pressure driven nebulizer or ultrasonic nebulizer

<table>
<thead>
<tr>
<th></th>
<th>Statistical Data</th>
<th>GROUP A</th>
<th>GROUP B</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RDAI score</strong></td>
<td>Before Nebulisation- Mean (+/- SD)</td>
<td>5.82(1.51)</td>
<td>5.65(1.22)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After Nebulisation- Mean (+/- SD)</td>
<td>4.41(1.28)</td>
<td>3.24(0.83)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>HR</strong></td>
<td>Before Nebulisation- Mean (+/- SD)</td>
<td>126(16.43)</td>
<td>123.18(16.58)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After Nebulisation- Mean (+/- SD)</td>
<td>118(18.92)</td>
<td>109.41(14.91)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>0.002</td>
<td>&lt; 0.001</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td><strong>RR</strong></td>
<td>Before Nebulisation- Mean (+/- SD)</td>
<td>53.92(9.38)</td>
<td>66.71(8.09)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After Nebulisation- Mean (+/- SD)</td>
<td>47.65(8.04)</td>
<td>57.06(5.79)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>SpO2</strong></td>
<td>Before Nebulisation- Mean (+/- SD)</td>
<td>91.53(5.66)</td>
<td>95.76(1.60)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After Nebulisation- Mean (+/- SD)</td>
<td>96.65(2.34)</td>
<td>98.71(0.99)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>0.06</td>
</tr>
</tbody>
</table>