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Role of Nebulized Magnesium Sulfate Versus Nebulized Budesonide In treatment of Acute Bronchiolitis and Its Outcome

H.A.El Ghaiaty, Y.M.Ismael, E.H.Assar and A.M.Elsayed
Pediatrics, Clinical Pathology, Dept., Faculty of Medicine, Benha Univ., Benha, Egypt
E-Mail: samuraidarwish23@gmail.com

Abstract

Bronchiolitis is an infection of the bronchial tubes that results in inflammation and swelling (most commonly respiratory syncytial virus and human metapneumovirus). Newborns between the ages of two and six months are more likely to suffer from this illness. This research looked at babies who had acute brochiolitis to see whether treatment technique was more effective: budesonide or magnesium sulphate. The results were unexpected. Sources of Data: There were 60 children with moderate to severe bronchiolitis who participated in the research. Only one of the three groups received magnesium sulphate and the B-2 agonists, whereas the others were given both. Following a thorough medical history and examination, each patient received a CBC with differential, CRP, ABG, and a chest X-ray. As far as sex and age were concerned, the three groups were similar (p-value 0.935, 0.985 respectively). When it came to the most common complaint, prior history, family history, and length of sickness, there were no significant differences among the three groups (p-values of 0.891, 0.934, 0.926, and 0.998, respectively). However, following treatment group B exhibited a much better improvement than the other two treatment groups (p-value 0.001) when it came to respiratory rate (p-value 0.864) on admission. Heart rate differences between the three groups on admission (p-value 0.952) were minor but following therapy, group B exhibited a notable improvement over the other two groups (p-value 0.001). (p-value 0.001). In comparison to the other groups, patients in group B showed the greatest increase in O2 saturation (p-value 0.001) and the highest reduction in respiratory distress (p-value 0.001). In infants with acute bronchiolitis, nebulized magnesium sulphate seems to be superior than nebulized budesonide in terms of efficacy.

Key word: Versus nebulized budesonide in treatment of acute bronchiolitis

1. Introduction

Seasonal bronchiolitis is related with a lack of general-purpose therapies and a lot of unneeded medical care. Despite the fact that bacterial infection is uncommon in the majority of viral lower respiratory tract infections, some children may present with symptoms suggestive of bacterial pneumonia and need a chest x-ray [1].

Respiratory virus infections are the most frequent cause of bronchitis. Half to 90% of all cases are caused by the respiratory syncytial virus (RSV). It gets more difficult to breathe as a consequence of these factors. Neonatals with acute respiratory failure are the most common patients in paediatric intensive care units in the United Kingdom [2].

The term "bronchiolitis" has a variety of meanings in Europe and the United States. The symptoms of an upper respiratory tract infection (URTI), often known as colic in the UK, include respiratory pain, coughing, wheezing, air trapping, and bilateral crepitations. Infants and toddlers under the age of two in the United Kingdom are more often referred to as having "viral-induced wheeze" than "bronchitis" in the United States. It may be difficult to assess the findings of clinical studies due to the wide range of demographics that are represented [3].

2. Materials and Methods

In this randomised controlled study, 60 neonates with bronchiolitis from Al-Fauomy, Naser, and Banha Hospitals University participated. There are a number of symptoms that might indicate the presence of this condition. These include a lack of energy, a history of apnea and a high respiratory rate of more than 70 breaths per minute, as well as nasal flaring and/or grunting.

Inclusion criteria

- All patients with bronchiolitis aged between 2 months to 2 years (31 males and 29 females).

Exclusion criteria

- Patients aged above 2 years or below 2 months, cardiac causes of wheezy chest and heart failure, patients with pneumonia or upper respiratory tract infection and patients with congenital thoracic anomalies.

Methods

All the patients were subjected to

1. **Full history:** Including main complain, history of present illness (duration of illness) and past history (previous similar attacks) and family history (family history of atopy).
2. **Complete physical examination:** Observation of general appearance including presence of cyanosis or pallor, work of breathing and vital signs (respiratory rate, heart rate) on time of admission and daily observation of clinical improvement or deterioration.
3. **Initially date of admission:** Radiological examination: Chest x-ray and laboratory examination: CBC, CRP, Electrolyte, ABG, SO2, degree of RD.
4. **Patients were randomly assigned into three groups (20 patients in each group) (computer generated randomization): Group A):** 20 cases (11 male and 9 female) were treated with nebulized budesonide (0.5 mg/day divided every 12 hours) plus

nebulized B-2 agonist (0.2 mg/kg/dose every 6 hours). **Group B)** 20 cases (10 male and 10 female)were treated with nebulized magnesium sulfate 40 mg/kg/dose plus nebulized B-2 agonist (0.2 mg/kg/dose every 6 hours). **Group C) (control)** 20 cases (10 male and 10 female) were treated with nebulized B-2 agonist alone (0.2 mg/kg/dose every 6 hours).

5. Complications, contraindications and drug interaction of magnesium sulfate and budesonide were recorded.

6. Length of hospital stay and duration of manifestations were recorded

Primary outcome parameter: Measurement the length of hospital stay in each group.

Secondary outcome parameters: Efficacy of magnesium sulfate as an inhaled treatment for bronchiolitis and efficacy of budesonide as an inhaled treatment for bronchiolitis.

Statistical analysis:

The statistical analysis was conducted out using the SPSS version 22 software. Chi Square tests were used to compare the frequency and proportion of nominal data. The t test was used to perform a comparison between the mean and standard deviation of numerical data. Non-parametric data's median and range were computed and shown. Pearson's correlations, as well as sensitivity, specificity, and the Odds ratio, were used to investigate numerical relationships and possible risk variables. If the P-value was less than 0.05, it was considered statistically significant.

3. Results

Table (1) Demographic and clinical data of studied patients with bronchiolitis

		Group A	Group B	Group C
Age in months median		14.5 ms	14.6 ms	14.4 ms
Sex (m/f) ratio		1.2:1	1:1	1:1
Main complaint	**Breathing difficulties**	70%	60%	50%
	Cough	20%	30%	35%
	Cyanosis	10%	10%	10%
Positive past history		55%	60%	60%
Positive family history		35%	30%	30%
Respiratory rate /min (median)	**On admission**	77	76	75.5
	After treatment	76	58	75
Heart rate /min (median)	**On admission**	154.5	154.5	154.5
	After treatment	151.5	140	150
O2 saturation (median)	**On admission**	91	94	94
	After treatment	91	95	94
Degree of RD	**On admission**			
	G2	60%	60%	60%
	G3	40%	40%	40%
	After treatment			
	G1	10%	35%	0%
	G2	55%	65%	60%
	G3	35%	0%	40%
Chest radiological findings	**Normal**	0%	0%	5%
	Consolidation	25%	15%	20%
	Atelectasis	15%	20%	30%
	Hyperinflation	60%	65%	45%
Length of hospital stay in hours (median)		80 hours	70 hours	80 hours

The three groups were comparable regarding age and sex, with only insignificant differences. Male/Female ratio in Group A was 1.2:1, in Group B was 1: 1 and in the control, group was 1: 1 respectively. Table (2)

Table (2) Demographic data

	Group A (n = 20)		Group B (n = 20)		Control (n = 20)		Test of Sig.	p
	No.	%	No.	%	No.	%		
Sex								
Male	11	55.0	10	50.0	10	50.0	X^2=0.133	0.935
Female	9	45.0	10	50.0	10	50.0		
Male/Female ratio	1.2:1		1:1		1:1			
Age (months)								
5 - 10	6	30.0	5	25.0	6	30.0	X^2=0.827	^{MC}p=0.985
11 - 20	10	50.0	10	50.0	11	55.0		
>20	4	20.0	5	25.0	3	15.0		
Min. - Max.	6.0 - 24.0		6.0 - 24.0		6.0 - 24.0		$^{KW}X^2$=0.030	0.985
Mean ± SD. Median	14.5 ± 5.64 13.0		14.65 ± 5.51 13.0		14.45 ± 5.26 13.0			

The three groups were comparable as regard main complaint, past history, family history and duration of illness (p -value 0.891, 0.934, 0.926, 0.998 respectively).. Table (3)

Table (3) Comparison of clinical data between the three studied groups

	Group A (n = 20)		Group B (n = 20)		Control (n = 20)		Test of Sig.	p
	No.	%	No.	%	No.	%		
Main Complain								
Breathing difficulties	14	70.0	12	60.0	11	55.0	X^2=1.455	^{MC}p=0.891
Cough	4	20.0	6	30.0	7	35.0		
Cyanosis	2	10.0	2	10.0	2	10.0		
Past History								
No	9	45.0	8	40.0	8	40.0	X^2=0.137	0.934
Yes	11	55.0	12	60.0	12	60.0		
Family History								
No	13	65.0	14	70.0	14	70.0	$_X^2$=0.154	0.926
Yes	7	35.0	6	30.0	6	30.0		
Duration of Illness(hrs.)								
Min. - Max.	6.0-	40.0	6.0-	40.0	6.0-	40.0		
Mean ± SD.	16.4 ± 8.18		16.35 ± 8.20		16.35 ± 8.20		X^2=0.004	0.998
Median	12.50		13.0		13.0			

There was insignificant differences between the three groups as regard respiratory rate on admission (p-value 0.864) and after 6 hours of treatment (p-value 0.570) but after 24 hrs and 48hrs of treatment group B showed a significant improvement compared to group A and control group with significant differences between the three groups as regard respiratory rate after treatment (p-value <0.001). Table(4)

Table (4) Comparison of respiratory rate before and after treatment between the three studied groups.

Respiratory Rate	Group A (n = 20)	Group B (n = 20)	Control (n = 20)	F	p
On Admission					
Min. - Max.	70.0 - 80.0	70.0 - 80.0	70.0 - 80.0	0.146	0.864
Mean ± SD.	75.95 ± 3.73	75.8 ± 3.55	75.35 ± 3.67		
Median	77.0	76.0	75.5		
After treatment after 6hr					
Min. - Max.	71.0 - 80.0	70.0 - 80.0	70.0 - 80.0	0.567	0.570
Mean ± SD.	75.75 ± 2.77	74.85 ± 3.23	74.85 ± 3.23		
Median	76.0	75.0	75.0		
After 24hrs	70.0 - 82.0	65.0 - 70.0	70.0 - 80.0		
Min. - Max.	75.50 ± 4.35	67.25 ± 1.62	74.85 ± 3.23	39.497*	<0.001*
Mean ± SD.	74.50	67.0	75.0		

Median					
Sig. bet. Grps.	p1<0.001*, p2= 0.531, p3<0.001*			1	
After 48hrs					
Min. - Max.	70.0 - 82.0	52.0 - 66.0	70.0 - 80.0	145.378*	<0.001*
Mean ± SD.	75.85 ± 3.41	58.6 ± 3.83	75.35 ± 3.67		
Median	76.0	58.0	75.0		
Sig. bet. Grps.	p1<0.001*, p2= 0.666, p3<0.001*				
Sig. bet. Periods	0.818 <0.001* 1.000			1	

*P1: relation between group A and respiratory rate before and after treatment *P2: relation between group b and respiratory rate before and after treatment *P3: relation between group c and respiratory rate before and after treatment.

There was insignificant differences between the three groups as regard heart rate on admission (p-value 0.952) and after 6 hours of treatment (p-value 0.952) but after 24 hours and 48 hours of treatment group B showed significant improvement compared to group A and control group, with significant differences between the three groups as regard heart rate after treatment (p-value 0.003, 0.001 respectively). Table (5)

O2 saturation on admission in group A, B, and control group was 91.05%, 93.15%, and 93.15% respectively. O2 saturation after 48 hours of treatment in group A, B, and control group was 90.95 %, 95.10 %, 93.30 % respectively, which revealed that patients in group B had the higher improvement in O2 saturation after 24 hours, and 48 hours of treatment with significant differences between three groups (p-value 0.009,<0.001 respectively). Table (6)

Table (5) Comparison of heart rate before and after treatment between the three studied groups

Heart Rate	**Group (n = 20)**	**A Group (n = 20)**	**B Control (n = 20)**	**F**	**p**
On Admission					
Min. - Max.	135.0 - 164.0	135.0 - 164.0	135.0 -164.0	0.049	0.952
Mean ± SD.	153.35 ± 7.13	152.75 ± 6.92	152.75 ± 6.92		
Median	154.5	154.5	154.5		
After treatment					
After 6 hr					
Min. - Max.	136.0 - 163.0	133.0 - 160.0	136.0 - 163.0	0.404	0.952
Mean ± SD.	149.90 ± 8.49	147.95 ± 6.65	149.90 ± 8.49		
Median	149.50	148.0	149.50		
After 24hrs					
Min. - Max.	137.0 - 165.0	133.0 - 155.0	135.0 - 158.0	6.462*	0.003*
Mean ± SD.	152.90 ± 10.01	143.55 ± 7.66	145.65 ± 8.03		
Median	152.50	140.50	145.0		
Sig. bet. Grps.	p1=0.001*, p2= 0.010*, p3= 0.445				
After 48hrs					
Min. - Max.	136.0 - 164.0	130.0 - 153.0	130.0 - 155.0	8.471*	0.001*
Mean ± SD.	152.35 ± 6.96	142.7 ± 7.63	146.85 ± 7.7		
Median	151.5	140.0	150.0		
Sig. bet. Grps.	p1<0.001*, p2= 0.023*, p3= 0.083				
Sig. bet. Periods	0.096	<0.001*	<0.001*		

*P1: relation between group A and heart rate before and after treatment *P2: relation between group b and heart rate before and after treatment *P3: relation between group c and heart rate before and after treatment

Table (6) Comparison of O2 saturation before and after treatment between the three studied groups.

O_2 saturation	**Group (n = 20)**	**A Group (n = 20)**	**B Control (n = 20)**	**F**	**p**
On Admission					
Min. - Max.	86.0 - 95.0	85.0 - 96.0	85.0 - 96.0	4.386*	0.017*
Mean ± SD.	91.05 ± 2.35	93.15 ± 2.70	93.15 ± 2.70		
Median	91.0	94.0	94.0		
Sig. bet. Grps.	p1= 0.013*, p2= 0.013*, p3= 1.000			1	
After treatment					

After 6hrs					
Min. - Max.	86.0 - 94.0	86.0 - 96.0	86.0 - 96.0	0.641	0.530
Mean ± SD.	89.90 ± 3.11	90.95 ± 3.25	90.10 ± 2.97		
Median	90.0	91.50	89.0		
After 24hrs					
Min. - Max.	87.0 - 95.0	89.0 - 97.0	85.0 - 96.0	*5.171	0.009*
Mean ± SD.	91.05 ± 2.63	93.10 ± 2.94	90.20 ± 3.21		
Median	90.50	93.50	90.0		
Sig. bet. Grps.	p1=.031*, p2= 0.363, p3= 0.003*			1	
After 48hrs					
Min. - Max.	87.0 - 95.0	90.0 - 98.0	85.0 - 96.0		
Mean ± SD.	90.95 ± 1.82	95.10 ± 1.65	93.30 ± 2.49	21.194*	<0.001*
Median	91.0	95.0	94.0		
Sig. bet. Grps.	p1<0.001*, p2= 0.001*, p3= 0.007*				
Sig. bet. Periods	0.748	0.001*	0.267		

*P1: relation between group A and o2 saturation before and after treatment *P2: relation between group b and o2 saturation before and after treatment *P3: relation between group c and o2 saturation before and after treatment

Table (7) Comparison of the degree of RD before and after treatment between the three studied groups.

Degree of RD	**Group A**		**Group B**		**Control**		x^2	p
	(n = 20)		**(n = 20)**		**(n = 20)**			
	No.	**%**	**No.**	**%**	**No.**	**%**		
On Admission								
G2	12	60.0	12	60.0	12	60.0	0.000	1.000
G3	8	40.0	8	40.0	8	40.0		
After treatment								
After 6hr								
G2	12	60.0	12	60.0	12	60.0	0.000	1.000
G3	8	40.0	8	40.0	8	40.0		
After 24hrs								
G1	1	5.0	5	25.0	0	0.0		
G2	11	55.0	11	65.0	12	60.0	7.386	^{MC}p 0.098
G3	8	40.0	4	20.0	8	40.0		
After 48hrs								
G1	2	10.0	7	35.0	0	0.0		
G2	11	55.0	13	65.0	12	60.0	17.632	^{MC}p<0.001*
G3	7	35.0	0	0.0	8	40.0		
Sig. bet. Grps.	^{MC}p1= 0.006*, ^{MC}p2= 0.588, ^{MC}p3<0.001*							
Sig. bet. Periods	0.317		0.003*		1.000			

*P1: relation between group A and degree of RD before and after treatment *P2: relation between group b and degree of RD before and after treatment *P3: relation between group c and degree of RD before and after treatment

The degree of RD on admission in group A 60% were G2, and 40% were G3; in group B 60% were G2, and 40%were G3; and in control group 60% were G2, and 40% were G3, with no significant difference between three groups as regard degree of RD (p-value 1.000). The degree of RD after treatment in group A 10% of patients were G1, 55% were G2, 35% were G3; in group B 35% were G1,65% were G2; and in control group 60% were G2,40% were G3. This demonstrates that group B had the best improvement as regard respiratory distress after 48 hours of treatment compared to group A and control group with significant differences between the three groups (p-value <0.001). Table (7)

The mean length of hospital stay in groups A, B, and control group was 77.9 hrs, 68.0 hrs, and 77.7 hrs respectively with the shortest period in group B with significant differences between three groups as regard length of hospital stay (p-value 0.002). Table (8)

Table (8) Comparison of the length of hospital stay between the three studied groups

	Group (n = 20)	A Group (n = 20)	B Control (n = 20)	F	p
Length of Hospital stays (hrs.)					
Min. - Max.	50.0 - 89.0	45.0 - 80.0	52.0 - 89.0	7.290*	0.002*
Mean ± SD.	77.9 ± 9.3	68.0 ± 10.01	77.7 ± 8.78		
Median	80.0	70.0	80.0		
Sig. bet. Grps.	p1= 0.001*, p2= 0.946, p3= 0.002*			1	

4. Discussion

It is defined by the American Academy of Pediatrics and the European Respiratory Society as "a constellation of clinical signs and symptoms including a viral upper respiratory prodrome followed by increased respiratory effort and wheezing in children younger than 2 years of age," according to a statement. Up to 60% of lower respiratory infections and 32% of hospitalizations occur during the first year of life because of this. Coryza, a little cough, a mild temperature, tachypnea, wheezing, and other signs of respiratory distress characterise acute bronchiolitis caused by the respiratory syncytial virus (RSV). (4).

The research found that 70%, 60%, and 55% of the patients in the three groups analysed experienced breathing problems, followed by cough and cyanosis. 55% of patients in group A had a favourable prior history, whereas 60% of patients in both groups B and the control group had a good past history. In the three groups, 35 percent, 30 percent, and 30 percent of participants in group A, B, and the control group had a good family history. Group A had a mean sickness duration of 16.4 hours, group B a mean illness duration of 16.35 hours, and group C a mean illness duration of 16.35 hours. There were no significant differences between the three groups in terms of their primary complaint, prior history, family history, and length of illness (p -value 0.891, 0.934, 0.926, 0.998 respectively).

Research by Kose et al., [5] showed that difficulty breathing and cough were the most prevalent symptoms in their study groups, which is in line with our findings.

In addition, Chen et al. [6] found that 46 children under the age of two had been diagnosed with a serious lung infection (28 patients in group A and 18 in group B). After a severe respiratory infection, the patient's symptoms included a chronic cough, wheezing, and shortness of breath. Wheezing and low-pitched rales are common in children's lungs. Budesonide, montelukast, and zithromax were administered three times a week to Group A. Group B got just budesonide and montelukast for the first three days of each week, as well as 5 mg/kg zithromax. Both groups received prednisone and montelukast in addition to the experimental drugs that had previously been prescribed for participants in Group A. Patients in Group B received budesonide or prednisone on an as-needed basis since their parents were opposed to long-term use of glucocorticoids.

A research by Sathya Priya, [7] found that 21 (19.1 percent), 80 (72.7 percent), and 9 (8.1 percent) of the children treated with hypertonic saline had illnesses lasting more than five days. Nearly a quarter (25.5%) of the children who had magnesium sulphate nebulized had illnesses lasting from one to five days, three to five days, or more than one week.

This sickness is best treated with fluids, antipyretics, and oxygen. For individuals with bronchiolitis, bronchodilators are often recommended. According to Kellner et al thorough evaluation, bronchodilators such as inhaled short-acting 2-agonists or nasal epinephrine increase clinical ratings very little in the near term and have little influence on the frequency or duration of hospitalisation. However, despite the fact that several studies have been published on the treatment of bronchiolitis, the evidence supporting this medicine is not particularly solid and its efficiency is questioned [8].

According to the results of the present research (p-value 0.001) compared to the group A and the control group, the treatment group exhibited a substantial improvement (p 0.001).

RR was considerably lower in group A (24.724.04) than in group B (27.304.13) (P=0.03), in accordance with the findings of Chen et al. [6].

When it comes to respiratory rates, however, Modaresi et al. [9] found no statistically significant changes between the research groups.

There were no statistically significant variations in respiratory rates between the groups tested by Debbarma et al. [10]

Mean heart rate on admission in groups A, B, and control was 153.35, 152.75, and 152.75 bmin, respectively, in the research we conducted. Group B exhibited considerable improvement compared to the control group and group A after 24 and 48 hours of therapy, with significant differences between the three groups as regards heart rate following treatment.

Group B demonstrated the greatest improvement in O2 saturation after 24 and 48 hours of therapy compared to group A and the control group, with significant differences across the three groups.

Kose and colleagues [5] found that the heart rates of magnesium sulphate and salbutamol/magnesium sulphate groups were considerably lower at 4 h when

compared to baseline values. Magnesium sulphate and salbutamol/magnesium sulphate groups showed no statistically significant changes in heart rate at 4 h.

Despite our findings, the research of Modaresi et al. [9] found no statistically significant variations in heart rate and oxygen saturation between the groups tested. There may be a discrepancy in inclusion criteria between their research and ours, which might explain the disparity.

After therapy, 10% of patients in group A had G1, 55% had G2, and 35% had G3 RD degrees, whereas in group B, 35% had G1, 65% had G2, and in the control group, 60% had G2, and 40% had G3. For example, after 48 hours of therapy, group B showed a much better improvement in respiratory distress compared to the other two groups (group A and control).

As we found in our research, Sathya Priya [7] found that the RDAI (Respiratory Distress Assessment Instrument) score in children aged 6 months to 1 year was substantially lower 40 minutes and 1 hour after hospitalisation (P 0.05).

Even more strikingly, there was no significant difference in the RDAI score on the first day of admission in Modaresi and colleagues' research [9], but there were substantial differences in scores on the second and third days following admission (P 0.01).

We detected no significant change before therapy, as reported by Song and Li [11]. Prior to treatment, all three were significantly higher than they were afterward

There were substantial variations in duration of hospital stay between groups A, B, and the control group based on our findings (p-value0.002).

Children receiving nebulized magnesium sulphate or nebulized epinephrine were not significantly different in duration of stay in the hospital in the trial by Modaresi and colleagues [9]. (P 0.4).

There was also a little difference in the duration of hospital stays between children who received hypertonic saline and magnesium sulphate for mild bronchiolitis, according to Sathya Priya [7]. The findings, on the other hand, were not significant statistically. The significance level for this study is 0.10.

While the difference was not statistically significant, children who received salbutamol/magnesium sulphate were admitted to the hospital less often than those who received placebos.

The main result (BSS) was not substantially different between the control and study groups, according to Debbarma et al. [10] There was a significant difference in the duration of stay between the intervention group and the control group (p = 0.902).

5. Conclusion

In the treatment of children with acute bronchiolitis, nebulized magnesium sulphate is more efficient than nebulized budesonide.

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