DOI: https://doi.org/10.53350/pjmhs22169278

ORIGINAL ARTICLE

Outcome of Hypertonic Saline Versus Normal Saline in Children with Acute Bronchiolitis

SIDRA SHAHID[1], ASIF JAVEED[2], SABA WAMIQ[3]
[1]*Senior Registrar, Department of Pediatric Medicine, Multan Medical and Dental College/Ibn-e-Siena Hospital and Research Institute, Multan.*
[2]*Associate Professor, Department of Pediatric Medicine, Multan Medical and Dental College/Ibn-e-Siena Hospital and Research Institute, Multan.*
[3]*Assistant Professor, Department of Pediatric Medicine, Multan Medical and Dental College/Ibn-e-Siena Hospital and Research Institute, Multan.*
Correspondence to: Sidra Shahid, Email: Sidra.shahid101@gmail.com, Cell: +92 331 7050762

ABSTRACT

Objective: To compare outcome of hypertonic saline (HS) versus normal saline (NS) among children aged 2 to 24 months with acute bronchiolitis.

Study design: An open label randomized controlled trial.

Place and Duration of the Study: Department of Pediatric Medicine, Ibn-e-Siena Hospital, Multan from 1st September 2021 to 31st March 2022.

Methodology: A total of 220 children (110 in each group) of both genders aged 2 to 24 months reporting to emergency department with acute bronchiolitis with a disease spanning less than 5 days were included. In HS group, children were nebulized with 4 ml of 3% HS while in NS groups, all children were nebulized with 4ml 0.9% saline solution. In both groups, children were given respective treatment with interval gap of 4 hours. Clinical severity score and need for hospitalization after 24 hours was noted.

Results: In a total of 220 children, 126 (57.3%) were males and 94 (42.7%) females. Overall, mean age was 7.9±5.3 months while 170 (77.3%) children were aged between 2 to 12 months. Residential status of 132 (60.0%) children was rural. Monthly family income of 165 (75.0%) children was below 25,000 Pakistani Rupees (PKR). Maternal educational status of 91 (41.4%) children was illiterate. Mean baseline clinical severity score was calculated to 7.28 ± 1.47. HS group, post-treatment mean clinical severity score was 4.29±2.83 in comparison to 5.99±2.64 in NS groups. There were 28 (25.5%) children in HS group who required hospitalization in comparison to 56 (50.9%) in NS group (p=0.0001)

Conclusion: In comparison to nebulization with normal saline, nebulization with hypertonic saline solution was found to be significantly more effective in reducing clinical severity score and need for hospitalization among children aged up to 2 years with acute bronchiolitis.

Keywords: Hypertonic saline, normal saline, acute bronchiolitis, clinical severity score.

INTRODUCTION

Acute bronchiolitis is considered to be the most common cause of hospital admission among infants while at least 10% of children below 2 years of age are estimated to visit pediatrics clinics due to acute bronchiolitis.[1,2] Due to lack of satisfactory therapeutic options, off-labeled intervention options are being used by many clinicians for the treatment of acute bronchiolitis.[3-5] Literature indicates that "acute respiratory illness (ARI)" is a major cause of morbidity and mortality among children aged below 5 years.[6,7] Winter to spring season is labeled as the most predominant time for the peak incidence for acute bronchiolitis causing subsequent need for hospitalization. Some of the other most commonly involved risk factors for acute bronchiolitis are prematurity, low socio-economic status, overcrowded living condition, parental smoking and lack of breast-feeding.[8,9] Acute respiratory distress and/or wheezing are perhaps the most frequent presenting conditions with acute bronchiolitis.[10,11]

The "American Academy of Pediatrics (AAP) does not recommend routine laboratory and radiological investigations but it is often seen that infants with acute bronchiolitis undergo extensive and needless diagnostic assessment.[12] In infants, bronchiolitis is often mild in nature that subsides without much interventions while some children may need hospital admissions. Researchers have estimated between 1 to 2.7% cases of acute bronchiolitis to warrant critical care support.[13] For the treatment of acute bronchiolitis, supportive treatment remains the cornerstone of treatment. Hypertonic saline (HS) administration through nebulizer is considered to be accompanying potential benefits among infants with acute bronchiolitis. One of the first trials published comparing HS and normal saline through revealed that HS results in reduction in clinical scores among 33% cases versus 13% with normal saline (NS) nebulization among acute bronchiolitis cases.[14]

Not much work has been done comparing HS versus normal saline among young children reporting with acute bronchiolitis and there is always a need for an effective treatment option in these children so the present study was planned. This study was done to compare outcome of HS versus normal saline among children aged 2 to 24 months with acute bronchiolitis. We hypothesized that duration of hospital stay will be minimized among children using HS in comparison to normal saline.

METHODOLOGY

This open label randomized controlled trial was conducted at The Department of Pediatric Medicine, Ibn-e-Siena Hospital, Multan from 1st September 2021 to 31st March 2022. Approval from "Institutional Ethical Committee" was taken. Written consents were acquired from parents/caregivers.

A total of 220 children (110 in each group) of both genders aged 2 to 24 months reporting with acute bronchiolitis with a disease spanning less than 5 days were included. Cases with underlying broncho-pulmonary dysplasia, chronic lung disease (as per medical history and record) or having neuromuscular disorders, immune disorders or those having congenital heart defects (as per medical history and record) were excluded. Acute bronchiolitis was labeled as children with clinical severity score > 4 according to "Wang score" along with fever and cough in the past 48 hours.[15]

Children were enrolled from emergency department of pediatric medicine. All cases were randomly assigned to either HS group or normal saline (NS) group through lottery method. At the time of enrollment, demographic information along with clinical data like heart rate, respiratory rate, wheeze and clinical severity scorings were noted. In HS group, children were nebulized with 4 ml of 3% HS while in NS groups, all children were nebulized with 4ml 0.9% saline solution. In both groups, children were given respective treatment with interval gap of 4 hours for a total duration of 24 hours. Rest of the management of children with acute bronchiolitis was done as per institutional protocol. After 24 hours, clinical severity scores were again recorded. Children with persistent oxygen saturation levels < 92%, increased respiratory rate or inappropriate oral intake were forwarded for hospitalization.[14] Outcome was labeled as children requiring hospital admissions after 24 hours following enrollment. All study data was taken on predesigned format.

For data analysis, SPSS version 26.0 was employed. Numerical data was represented as mean and standard deviation while categorical variables were shown as frequency/percentage. Post-stratification, chi-square test was applied considering $p<0.05$ as significant.

RESULTS

In a total of 220 children, 126 (57.3%) were males and 94 (42.7%) females. Overall, mean age was 7.9±5.3 months while 170 (77.3%) children were aged between 2 to 12 months. Residential status of 132 (60.0%) children was rural. Monthly family income of 165 (75.0%) children was below 25,000 Pakistani Rupees (PKR). Maternal educational status of 91 (41.4%) children was illiterate. Mean baseline clinical severity score was calculated to 7.28 ± 1.47 while clinical severity score was above 8 in 68 (30.9%) children. Baseline characteristics of children in both study groups are shown in table-1.

Table-1: Comparison of Baseline Characteristics (N=220)

Characteristics		HS Group (n=110)	NS Group (n=110)	P-Value
Gender	Male	65 (59.1%)	61 (55.5%)	0.5856
	Female	45 (40.9%)	49 (44.5%)	
Age in months	2-12	83 (75.5%)	87 (79.1%)	0.5199
	13-24	27 (24.5%)	23 (20.9%)	
Residential Status	Rural	68 (61.8%)	64 (58.2%)	0.5820
	Urban	42 (38.2%)	46 (41.8%)	
Monthly Family Income in PKR	<25,000	84 (76.4%)	81 (73.6%)	0.6404
	≥25,000	26 (23.6%)	29 (26.4%)	
Maternal Education	Illiterate	48 (43.6%)	43 (39.1%)	0.4937
	Literate	62 (56.4%)	67 (60.9%)	
Clinical Severity Score	≤8	74 (67.3%)	78 (70.9%)	0.5595
	>8	36 (32.7%)	32 (29.1%)	

Overall, need for hospital admission was required in 84 (38.2%) children. In HS group, post-treatment mean clinical severity score was 4.29 ± 2.83 in comparison to 5.99 ± 2.64 in NS groups. There were 28 (25.5%) children in HS group who required hospitalization in comparison to 56 (50.9%) in NS group (p=0.0001) as shown in table-2.

Table-2: Distribution of Cases with respect to Need for hospitalization in Both Study Groups (n=220)

Need For Hospitalization	HS Group (n=110)	NS Group (n=110)	P-Value
Yes	28 (25.5%)	56 (50.9%)	0.0001
No	82 (74.5%)	54 (49.1%))	

DISCUSSION

In this study, we noted that 57.3% children with acute bronchiolitis were male. Arif et al in a local study revealed that 68% of cases with acute bronchiolitis were male.[16] Another local study by Amhed et al showed male to female ratio of 1.4 to 1 which is close to what we noted.[17] International data also reported 69% of acute bronchiolitis cases to be male.[18] Contrary to our findings, a local study has reported that 60% of acute bronchiolitis cases were female.[7]

In this study, mean age of children with acute bronchiolitis was 7.9±5.3 months while 77.3% children were aged between 2 to 12 months. Arif et al in a local study revealed mean age of children with acute bronchiolitis to be 5.4 ±9.4 months which is slightly lower than what we noted.[16] Another local study revealed mean age of acute bronchiolitis children to be 7.6±4.7 months which is very consistent with our findings.[17] Jacobs and colleagues showed mean age of children with acute bronchiolitis to be 6.0±3.9 months.[18] Mean clinical severity score at baseline in the present study was 7.28 ± 1.47 while clinical severity score was up to 8 in 69.1% children. Past local data has shown mean clinical severity score of children with acute bronchiolitis to be 5.7±0.73 which is relatively lower than what we found.[19]

In the present research, need for hospital admission was required in 84 (38.2%) children while 25.5% children in HS group and 50.9% in NS group needed hospitalization and the difference was found to be statistically significant (p=0.0001). Obviously, HS proved significantly more effective in preventing need for the hospitalization when compared to NS. Wu S et al noted 28.9% children with acute bronchiolitis treated with HS to have need for hospital admission in comparison to 42.6% with normal saline while the difference was found to be statistically significant ($p<0.05$).[20] These findings are pretty similar to the present findings. Local data from Siddiqa S et al concluded that HS was significantly more effective and resulted in improved outcomes in children with acute bronchiolitis when compared to NS which is very similar to what we found in this research.[21]

CONCLUSION

In comparison to nebulization with normal saline, nebulization with hypertonic saline solution was found to be significantly more effective in reducing clinical severity score and need for hospitalization among children aged up to 2 years with acute bronchiolitis. Hypertonic saline nebulization needs to be used in routine among children visiting emergency department accompanying acute bronchiolitis.

REFERENCES

1. Cunningham S. Bronchiolitis. Kendig's disorders of the respiratory tract in children. 2019;420-426.e3.
2. Uyar M, Kuyucu N, Tezcan S, Aslan G, Tasdelen B. Determination of the frequency of human bocavirus and other respiratory viruses among 0-2 years age group children diagnosed as acute bronchiolitis. Mikrobiyol Bul. 2014;48(2):242-258.
3. Murray J, Bottle A, Sharland M, Modi N, Aylin P, Majeed A, et al. Risk factors for hospital admission with RSV bronchiolitis in England: A population-based birth cohort study. PLoS One. 2014;9:e89186. doi: 10.1371/journal.pone.0089186.
4. Turnham H1, Agbeko RS2,3, Furness J4, Pappachan J5, Sutcliffe AG6, Ramnarayan P7.Non-invasive respiratory support for infants with bronchiolitis: a national survey of practice. BMC Pediatr. 2017;17(1):20. doi: 10.1186/s12887-017-0785-0.
5. Florin TA1, Shaw KN2, Kittick M3, Yakscoe S3, Zorc JJ2. Nebulized hypertonic saline for bronchiolitis in the emergency department: a randomized clinical trial. JAMA Pediatr. 2014 Jul;168(7):664-70.
6. Silver AH1, Esteban-Cruciani N2, Azzarone G2, Douglas LC2, Lee DS2, Liewehr S3, et al. 3% Hypertonic Saline Versus Normal Saline in Inpatient Bronchiolitis: A Randomized Controlled Trial. Pediatrics. 2015;136(6):1036-1043.
7. Naz F, Raza AB, Ijaz I, Kazi MY. Effectiveness of nebulized N-acetylcysteine solution in children with acute bronchiolitis. J Coll Physicians Surg Pak. 2014;24(6):408-411.
8. Ansari K, Sakran M, Davidson BL, Sayyed RE, Mahjoub H, Ibrahim K. Nebulized 5 % or 3% hypertonic or 0.9% saline for treating acute bronchiolitis in infants. J Pediatr. 2010;157:630-634.
9. Burgel R, Bergeron A, Blic JD, Bonniaud P, Bourdin A, Chanez P, et al. Small airways diseases, excluding asthma and COPD: an overview. Eur Respir Rev 2013;22:131-147.
10. Bigatello LM, Allain RM. Acute Respiratory Failure. Surgical Intensive Care Medicine. 2015;319-334.
11. Matthay MA, Zemans RL, Zimmerman GA, et al. Acute respiratory distress syndrome. Nat Rev Dis Primers. 2019;5(1):18.
12. Awad S, Hatim R, Khader Y, et al. Bronchiolitis clinical practice guidelines implementation: surveillance study of hospitalized children in Jordan. Multidiscip Respir Med. 2020;15(1):673.
13. Mansbach JM, Piedra PA, Stevenson MD, Sullivan AF, Forgey TF, Clark S, et al. Prospective multicenter study of children with bronchiolitis requiring mechanical ventilation. Pediatrics. 2012;130(3):e492-500.
14. Sarrell EM, Tal G, Witzling M, Someck E, Houri S, Cohen HA, et al. Nebulized 3% hypertonic saline solution treatment in ambulatory children with viral bronchiolitis decreases symptoms. Chest. 2002;122(6):2015–2020.
15. Pinto FR, Correia-Costa L, Azevedo I. Comparison of Kristjansson Respiratory Score and Wang Respiratory Score in infants with bronchiolitis in a hospital emergency department. Hong Kong Physiother J. 2020;40(2):145-153.
16. Arif A, Tajammul A. Acute Bronchiolitis - a clinical study Pak Paed J. 1998;22(4):175-7.
17. Ahmad S, Aamir S, Ahmad S. Acute bronchiolitis in children; epidemiologic and clinical features. Professional Med J. 2013;20(5):707-12.
18. Jacobs JD1, Foster M, Wan J, Pershad J. 7% Hypertonic saline in acute bronchiolitis: a randomized controlled trial. Pediatrics. 2014;133(1):e8-13.
19. Ejaz I, Siddique A, Rathore AW, Khan HI. Hypertonic saline (3%) vs normal saline (0.9%) nebulizition for acute viral bronchiolitis: A randomized control trial. Pak Paed J. 2015;39(4):248-51.
20. Wu S, Baker C, Lang ME, Schrager SM, Liley FF, Papa C, et al. Nebulized hypertonic saline for bronchiolitis: a randomized clinical trial. JAMA Pediatr. 2014;168(7):657-663.
21. Siddiqa S, Ashraf S, Noor S, Khan S, Mushtaq S, Saleem M. Comparison of nebulized 3% hypertonic saline with 0.9% normal saline for treatment of acute bronchiolitis in children up to 2 years of age. JRMC [Internet]. 18Sep.2019 [cited 27Apr.2022];23(3):123-127.