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Original article

Risk Factors and Characteristics of Early Childhood Wheezing Disorders: A Cross-Sectional Study

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Abstract
Wheezing in early childhood is a prevalent condition that represents a major health problem and frequently results in significant morbidity and healthcare resource utilisation. This study aimed to identify risk factors for wheezy chest in children aged ≤ 2 years and to compare the characteristics of first-time versus recurrent attacks. A cross-sectional descriptive observational study was conducted in the paediatric department at Al-Bayda Medical Centre (AMC) from March 2021 to March 2022. A total of 100 children aged ≤ 2 years who presented with wheeze were randomly selected using a structured clinical questionnaire. Data were analysed using SPSS software. Chi-square and t-tests were used to determine significant associations. Of the 100 enrolled children, 63% were male, and 37% were female; the mean age was 8.85 ± 6.26 months. Regular vaccination was observed in 73%, exclusive breastfeeding in 14%, a family history of asthma in 65%, and household smoking exposure in 58%. First-time attacks were reported in 48% of patients, while 52% had recurrent attacks. No statistically significant associations were found between attack type and age, gender, body weight, feeding type, prophylactic vitamin D3, family history of atopy, or smoking exposure ($p > 0.05$). Recurrent attacks showed statistically significant associations with paediatric intensive care unit (PICU) admission ($p = 0.003$) and ward admission ($p = 0.001$). Associated symptoms included fever (56%), cyanosis (26%), and diarrhoea (28%); only diarrhoea was significantly associated with attack type ($p = 0.039$). Chest radiography was performed in 61.5% of recurrent wheezers versus 66.7% of first-attack wheezers, with no statistically significant difference. A positive family history of asthma, passive smoking, and lack of breastfeeding are the primary risk factors for wheezy chest in children aged ≤ 2 years. Targeted health education programmes are essential to reduce trigger factors, particularly passive smoking, and to encourage exclusive breastfeeding to prevent complications.
Keywords. Children, First Attack, Risk Factors, Recurrent Attack, Wheezy Chest.

Introduction

Wheezing in early life is a common disorder, with approximately 50% of children experiencing at least one episode of wheezing during the first year of life [1]. Recurrent wheeze is estimated to affect one-third of preschool children and can cause significant morbidity, decrease quality of life, and increase both the use of healthcare services and economic costs [2]. The condition is influenced by atopic predisposition, genetic factors, and environmental exposures [3,4]. Wheezing is a symptom, not a diagnosis, and wheezing disorders should not be equated with childhood asthma [5]. Managing these patients, especially when symptoms are recurrent and severe, remains challenging because of numerous issues unique to this age group [6].

Current practice focuses on excluding diagnoses other than asthma and gathering information that supports an asthma diagnosis, which are among the most difficult issues to address in this age group [7]. The mainstay of treatment, alongside non-pharmacological measures such as avoidance of environmental tobacco smoke and parental education, includes inhaled corticosteroids as the first-choice maintenance therapy for multi-trigger wheeze [8]. Short-term systemic steroid therapy should be reserved for exacerbations of wheezy symptoms requiring hospitalisation [9]. Recurrent wheeze in preschool children is common and is frequently triggered by viral bronchiolitis, which is associated with the development of childhood wheezing. However, whether this association is causal or circumstantial remains unclear, and further studies are needed to establish the underlying mechanism [10]. Not all wheezing is due to asthma or viral infections; rare but important differential diagnoses must also be considered [11].

Human rhinovirus type C is the most common rhinovirus species in children with wheezing and, compared with other viruses, is more often associated with recurrent acute wheezing attacks severe enough to result in hospital presentation [12]. This study aimed to determine risk factors for wheezy chest in children aged ≤ 2 years and to compare attack type with associated risk variables.

Methods

Study Design and Setting

A cross-sectional descriptive observational study was conducted in the paediatric department at Al-Bayda Medical Centre (AMC) from March 2021 to March 2022.

Study Population

A total of 100 children aged ≤ 2 years who presented with wheezy chest were randomly selected. Data were collected using a specially designed questionnaire that included information on age, gender, mode of delivery, birth weight, current weight, feeding type, age at weaning, family history of allergic rhinitis, asthma, and atopy, history of passive smoking at home,

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associated symptoms of upper respiratory tract infection (URTI), diarrhoea, vaccination history, and age at the first attack (if recurrent).

Inclusion Criteria

Children aged ≤ 2 years who were admitted to or visited the outpatient department (OPD) at AMC with wheezy chest were included.

Exclusion Criteria

Children with pneumonia or chronic diseases were excluded.

Statistical Analysis

Data were analysed using SPSS software. Results were expressed as mean ± standard deviation (SD) or percentage. Chi-square and t-tests were used to determine significant associations. A p-value < 0.05 was considered statistically significant.

Results

A total of 100 cases fulfilling the inclusion and exclusion criteria were enrolled to identify and describe common risk factors for wheezy chest in children aged ≤ 2 years at AMC and to compare attack types with associated risk variables. Of the 100 children, 84% were aged ≤ 12 months, with a mean age of 8.85 ± 6.26 months. The sample included 63% males and 37% females. The mean recorded birth weight was 2.76 ± 0.69 kg. Birth-weight data were available for 85 children; the birth-weight percentages in Table 1 use the full cohort (N = 100) as the denominator, consistent with the other demographic variables. Regarding vaccination, 73% were vaccinated up to age, 23% had irregular vaccination, and 4% were unvaccinated. A positive history of household smoking exposure was found in 58% of cases (Table 1).

Table 1. Demographic data of the studied patients

Variable	N	%	Mean± SD	Range	Median
Age (months)					
≦12	84	84	8.85±6.26	2.00-24.00	7.00
≧13	16	16			
Gender					
Female	37	37			
Male	63	63			
Birth weight (kg)					
≤2.500	31	31	2.76±0.69	1.00-5.00	3.00
>2.500	54	54			
Not recorded	15	15			
Current weight (kg)					
≤5	15	15	7.89±2.41	2.00-15.00	8.00
>5	85	85			
Mode of delivery					
C/S	50	50			
Vaginal	50	50			
Vaccination					
Irregular	23	23			
Unvaccinated	4	4			
Up to age	73	73			
Positive H/O Smoking	58	58			
Negative H/O Smoking	42	42			

As shown in Figure 1, 52% of the total sample had recurrent attacks, while 48% presented with a first attack.

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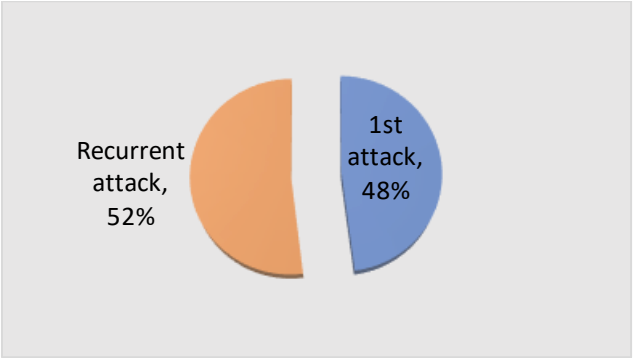

Figure 1. Distribution of cases according to attack episode

Recurrent attacks were more common in older children and females. No significant differences in age or gender were found between recurrent wheezing and first attacks ($p > 0.05$). No significant differences in recorded birth weight or current weight were observed between the two groups ($p > 0.05$). Birth weight was not recorded for six children in the first-attack group and nine children in the recurrent-attack group; all percentages in Table 2 use the stated group denominators (N = 48 and N = 52). Recurrent wheezing was more common in children born by vaginal delivery, but no significant difference was found by mode of delivery. Recurrent wheezing was also more common in children with irregular vaccination, while first attacks were more common in children vaccinated up to age; however, no significant difference was found in vaccination history (Table 2).

Table 2. Comparative analysis of wheezing episodes

Variable	Episodes of wheezing		X^2	p-value
	First attack N=48	Recurrent attack N=52		
Age				
≤12	43(89.6%)	41(78.8%)	2.14	0.178
≥13	5(10.4%)	11(21.2%)		
Gender				
Female	16(33.3%)	21(40.4%)	0.532	0.301
Male	32(66.7%)	31(59.6%)		
Birth weight (kg)				
≤2.500	12(25.0%)	19(36.5%)	2.236	0.177
>2.500	30(62.5%)	24(46.2%)		
Not recorded	6(12.5%)	9(17.3%)	—	—
Current weight (kg)				
≤5	5(10.4%)	10(19.2%)	1.521	0.171
>5	43(89.6%)	42(80.8%)		
Mode of delivery				
C/S	25(52.1%)	25(48.1%)	0.160	0.842
Vaginal	23(47.9%)	27(51.9%)		
Vaccination				
Irregular	9(18.8%)	14(26.9%)	5.058	0.080
Unvaccinated	4(8.3%)	0(0.0%)		
Up to age	35(72.9%)	38(73.1%)		
History of smoking				
Yes	30(62.5%)	28(53.8%)	0.767	0.251
No	18(37.5%)	24(46.2%)		

Regarding feeding history, 48% of cases received mixed bottle-feeding and breastfeeding, 14% were exclusively breastfed, and 38% were bottle-fed. Among patients with recurrent attacks, 50.0% received mixed feeding and 15.4% were exclusively breastfed. Among patients with a first attack, 45.8% received mixed feeding and 12.5% were exclusively breastfed. Weaning began early (by 6 months) in 91% of all patients (93.7% of first-attack patients and 88.4% of recurrent-attack patients), with no statistically significant difference ($p > 0.05$). Prophylactic vitamin D3 was received by 65% of patients, with no statistically significant association between receipt and attack type (Table 3).

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Table 3. Association between feeding history and wheezing phenotype

Variable	Total N= 100	Episodes of wheezing		X^2	p-value
		First Attack N=48	Recurrent Attack N=52		
Type of feeding					
Bottle	38	20(41.6%)	18(34.6%)	0.565	0.754
Breast	14	6(12.5%)	8(15.4%)		
Mixed bottle and breast	48	22(45.8%)	26(50%)		
Age of weaning					
≦6m	91	45(93.7%)	46(88.4%)	0.852	0.490
>7m	9	3(6.25%)	6(11.5%)		
Vitamin D3					
No	35	16(33.3%)	19(36.5%)	0.113	0.450
Yes	65	32(66.6%)	33(63.4%)		

In the current study, 15% of patients had a history of PICU admission, and all were recurrent wheezers; this association was statistically significant (p = 0.003). A history of paediatric ward admission was reported in 22% of cases, all of whom were recurrent wheezers, and the association was statistically significant (p = 0.001). Additionally, 36% had recurrent OPD visits, all among recurrent wheezers, and this association was statistically significant (p = 0.001) (Table 4).

Table 4. Distribution of the studied patients by hospitalisation history and wheezing episode

Variable	N=100	Episodes of wheezing		X^2	p-value
		First Attack N=48	Recurrent Attack N=52		
Previous PICU admission					
Yes	15	0	15	8.49	0.003
No	85	48	37		
Previous ward admission					
Yes	22	0	22	26.04	0.001
No	78	48	30		
Recurrent OPD visit					
Yes	36	0	36	51.92	0.001
No	64	48	16		

GERD and CHD were observed in 8% and 5% of patients, respectively, with p-values of 0.404 and 0.035. Each condition w as present in 9.6% of patients with recurrent attacks (Table 5).

Table 5. Distribution of chronic illness by wheezing episode

Variable	N=100	Episodes of wheezing		X^2	P-value
		First attack N=48	Recurrent attack N=52		
GERD					
Yes	8(8%)	3(6.2%)	5 (9.6%)	0.384	0.404
No	(%92)92	45(93.8%)	47(90.4%)		
CHD					
Yes	5(5%)	0(0.0%)	5(9.6%)	4.858	0.035
No	95(95%)	48(100%)	47(90.4%)		

Fifty-six per cent of patients had a history of fever with wheezing (44.6% first attack and 55.4% recurrent attack), 26% had a history of cyanosis (46.2% first attack and 53.8% recurrent attack), and 28% had a history of diarrhoea (32.1% first attack and 67.9% recurrent attack). Only diarrhoea was significantly associated with attack type (p = 0.039) (Table 6).

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Table 6. Association between symptoms and wheezing episodes in children

Variable	N=100	Episodes of wheezing		X^2	p-value
		First Attack N=48	Recurrent Attack N=52		
Fever					
Yes	56	25(52.0%)	31(59.6%)	0.575	0.289
No	44	23(47.9%)	21(40.3%)		
Cyanosis					
Yes	26	12(25%)	14(29.1%)	0.048	0.504
No	74	36(75%)	38(73.0%)		
Diarrhoea					
Yes	28	9(18.7%)	19(36.5%)	3.918	0.039
No	72	39(81.2%)	33(63.4%)		
URTI symptoms					
Yes	89	44(91.6%)	45(86.5%)	0.670	0.311
No	11	4(8.3%)	7(13.4%)		

Chest radiography and other investigations were undertaken in 64% of patients; among these, 61.5% were recurrent wheezers and 66.7% were first-attack wheezers, with no statistically significant difference ($p > 0.05$) (Table 7).

Table 7. Association between investigations or chest radiography and wheezing episodes

Variable	N=100	Episodes of wheezing		X^2	P-value
		First Attack N=48	Recurrent Attack N=52		
Chest radiography and investigations	64%	32(66.6%)	32(61.5%)	0.285	0.678
No	36%	16(33.3%)	20(38.4%)		

Of the 100 patients, 65%, 35%, 55%, and 58% had positive family histories of asthma, atopy, allergic rhinitis, and passive smoking, respectively, with no statistically significant associations with attack type ($p > 0.05$). These findings are summarised in Figure 2 and Table 8.

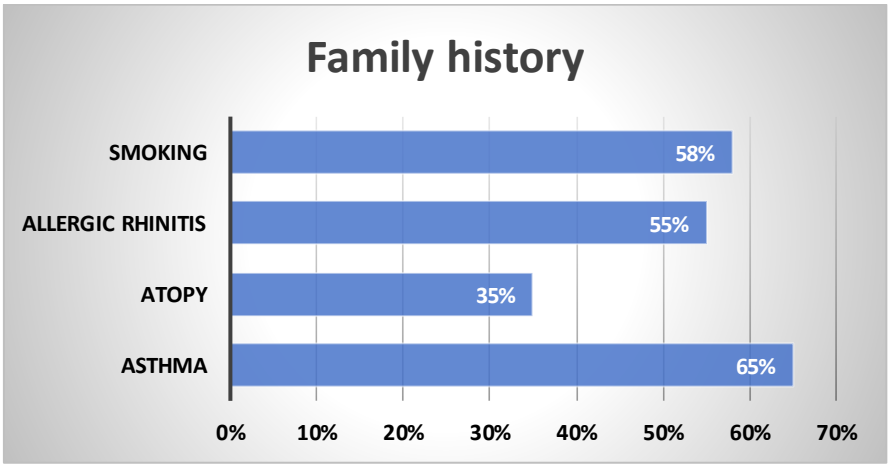

Figure 2. Distribution of the studied cases according to family history

Table 8. Comparative analysis of recurrent and first attacks by family history and smoking exposure

Variable			X2	P-value
	First Attack N=48	Recurrent Attack N=52		
Family history of asthma				
Yes (N=65)	31(64.5%)	34(65.3%)	0.07	0.550
No (N=35)	17(35.4%)	18(34.6%)		
Family history of atopy				
Yes (N=35)	13(27.0%)	22(42.3%)	2.543	0.083
No (N=65)	35(72.9%)	30(57.6%)		
Family history AR				
Yes (N=55)	25(52.0%)	30(57.6%)	0.317	0.359

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No (N=45)	23(47.9%)	22(42.3%)		
History of smoking				
Yes (N =58)	30(62.5%)	28(53.8%)	0.767	0.251
No (N =42)	18(37.5%)	24(46.1%)		

Discussion

The clinical management of early childhood wheezing remains challenging due to the complex interplay between genetic predisposition and environmental exposures [3,4]. In our study, male children predominated (63%), a pattern aligning with previous epidemiological findings by Kawshty et al. [12] in Egypt and Guilbert et al. [13] in the USA. URTIs were identified as the primary trigger in 89% of cases, reinforcing global observations by Garcia-Marcos et al. [14] and Aranda et al. [15] that viral colds are the single most significant factor in initiating acute wheezing episodes. Passive exposure to tobacco smoke was identified in over half of our sample (58%), consistent with reported environmental risks by Halken et al. [16] in Denmark. Furthermore, exclusive breastfeeding was strikingly low (14%), while early weaning before 6 months was documented in 91% of infants. These figures underscore critical targets for public health intervention, as prolonged breastfeeding has been demonstrated by Wright et al. [17] to confer protection against recurrent wheezing, whereas premature weaning significantly elevates disease odds [18].

Although daily prophylactic vitamin D3 administration showed no statistically significant protection in our study, contrasting with findings from Kelly et al. [19], this discrepancy may reflect variable treatment adherence or the lack of baseline serum 25(OH)D measurements. Family history of atopy, allergic rhinitis, and asthma was reported in 35%, 55%, and 65% of patients, respectively. This strong hereditary background mirrors reports from Saudi Arabia by Hijazi et al. [20], reinforcing the pivotal role of genetic susceptibility. Interestingly, mode of delivery showed no significant association with wheezing phenotypes in our study, consistent with Maitra et al. [21], despite other literature suggesting an increased atopic risk following cesarean sections [22].

Additionally, gastroesophageal reflux disease (GERD) was identified in 8% of children. While higher prevalence rates have been reported elsewhere [23,24], such differences likely stem from varying diagnostic modalities. Notably, 64% of enrolled infants underwent chest radiography, with a higher proportion among first-episode wheezers. This high rate of radiation exposure reflects potential overutilization of imaging, a trend also highlighted by Patel et al. [25] and Chao et al. [26]. Current national and international guidelines (GINA) [8] discourage routine chest X-rays in uncomplicated viral bronchiolitis/wheezing to avoid unnecessary radiation and healthcare costs. Finally, recurrent wheezing was strongly associated with emergency visits, ward hospitalisations, and intensive care admissions ($p < 0.05$). These findings align with data from Mallol et al. [2] in South America, emphasising that recurrent wheezers place a heavy burden on healthcare resources and require structured management plans to reduce exacerbations.

Conclusion

Wheezy chest is a common medical problem that significantly affects the quality of life of patients and their families and increases healthcare use and economic costs. It is more common in young infants and males. In this study, viral-induced wheeze was prevalent, and URTI was the most common trigger. Recurrent attacks were more common among cases with a positive family history of allergy or asthma. Passive smoking was also common, including among cases with a positive family history of asthma. Few children were exclusively breastfed, and early weaning was common.

Recommendations

Because wheezy chest is a common health problem and many trigger factors can be identified and avoided, families should be educated about avoiding common triggers and the risks of passive smoking. Mothers should be encouraged to breastfeed exclusively, and caregivers should seek medical advice early to reduce hospital admissions and prevent complications.

Conflict of interest. Nil

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