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ARTICLE ORIGINAL

Asthma exacerbations in pediatric emergency department : Single_centre cross-sectional study

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MOTS CLÉS

Crise d'asthme
Suivi d'asthme
sous-traitement
plan d'action
éducation
thérapeutique

Résumé

Introduction : Les exacerbations d'asthme chez l'enfant constituent l'un des motifs de consultation les plus fréquents aux urgences pédiatriques. Nos objectifs : Identifier les caractéristiques des enfants consultant pour une exacerbation d'asthme. Évaluer le contrôle de leur asthme et la prise en charge des exacerbations, à domicile et aux urgences pédiatriques.

Méthodes : Étude prospective, descriptive et mono centrique menée auprès d'enfants asthmatiques vus aux urgences pédiatriques de l'EHS Mère et Enfant de Tipaza sur une période hivernale de trois mois.

Résultats : Cinquante-quatre patients asthmatiques ont présenté une exacerbation d'asthme. La moyenne d'âge est 49.83 ± 39.26 . Des antécédents de sibilances chez 63 % d'entre eux survenus avant l'âge de 12 mois. Le nombre moyen d'épisodes de sibilances antérieures était de 5.56 ± 3.70 . Seulement 18 % des patients prenaient les corticostéroïdes inhalés (CSI) alors que presque la moitié déclarer avoir un suivi. On note que 41.7 % des patients ayant présenté une crise d'asthme modérée avaient un asthme bien contrôlé, contre seulement 8 % de ceux ayant présenté des crises légères. la prise en charge intra hospitalière se basant sur SABA par nébulisation avec O_2 (96.3%) et corticoïde par voie injectable IM/IV (93.3%) pour ceux ayant nécessité les corticoïdes aux urgences et avec un taux total d'hospitalisation estimé à 5.6%.

Conclusion : Le suivi régulier et le traitement d'entretien se sont avérés insuffisants ; la prise en charge des exacerbations à domicile était souvent non conforme aux recommandations ; et le traitement d'urgence reposait principalement sur l'administration de bronchodilatateurs à courte durée d'action (SABA) par nébulisation, associée à l'oxygénothérapie et la corticothérapie était essentiellement utilisée par voie parentérale. Il est nécessaire de renforcer l'éducation thérapeutique des patients.

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KEYWORDS

Abstract

Introduction: Asthma exacerbations are one of the most frequent reasons for visits to the pediatric emergency department. Our objectives: To identify the characteristics of children presenting with an asthma

Asthma exacerbations	exacerbation. To evaluate their asthma control and the management of exacerbations, both at home and in the pediatric emergency department.
Follow-up	Methods: A prospective, descriptive, single-center study of asthmatic children seen in the pediatric emergency department of the Mother and Child Hospital of Tipaza over a three-month winter period.
Undertreatment	Results: Fifty-four asthmatic patients experienced an asthma exacerbation. The mean of age 49.83 ± 39.26 . Sixty-three percent of these patients had a history of wheezing, which had occurred before the age of 12 months. Only 18% of patients were taking inhaled corticosteroids (ICS), while almost half reported receiving medical follow-up. It is noteworthy that 41.7% of patients who experienced a moderate asthma exacerbations had well-controlled asthma, compared to only 8% of those who experienced mild attacks. In-hospital management relied on nebulized SABA (96.3%) and intramuscular/intravenous corticosteroids (93.3%) form those how needed corticosteroid in emergency room, with a total hospitalization rate of 5.6%.
written action plan	Conclusion: In this series, regular follow-up and maintenance therapy proved inadequate; home management of exacerbations often failed to adhere to guidelines; and emergency treatment relied primarily on nebulized SABAs by oxygen and the corticosteroids used essentially by parenteral route. There is a need to strengthen patient education.
therapeutic education	© 2026 Algerian Journal of Allergy and Clinical Immunology.. All rights reserved.

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Introduction:

Asthma is a chronic inflammatory disease of the airways, most often beginning in childhood, it is a heterogeneous disease with recurrent paroxysmal exacerbations which represent the most alarming clinical manifestation and can be life-threatening[1]. The burden of asthma is high worldwide[2]. In the Global Asthma Network Phase I survey, which included about 120,000 children and adolescents from 27 centers in 14 countries, around one in ten reported wheezing in the previous year, and roughly half of them had severe symptoms[3].

In Algeria, ISAAC surveys of 13–14-year-olds reported current wheeze of 5.9% to 7.8% in Algiers durant Phase I and 8.7% to 14% Durant Phase III[4], In Sétif the prevalence was 6.3% in 2007 and 5.6% in 2016 [5]. In the same Sétif survey, only about a quarter of adolescents with current asthma used inhaled corticosteroids and 62 % had no follow-up outside exacerbations[5].

Asthma therefore represents a major pediatric public health issue, due to its prevalence, the frequency of emergency care visits and hospitalizations, the high costs incurred, and the significant rates of school absenteeism it causes.

This paper aims to identify the characteristics of children consulting for asthma exacerbations. We focused on evaluating how well their asthma was controlled and how the asthma exacerbations were managed, both at home and during their time in the pediatric emergency department(ED)

Materials and methods

We conducted a single-center, prospective, and descriptive study involving children admitted for asthma exacerbations to the Pediatric Emergency Department (ED) of the Mother and Child Hospital of Tipaza. The study spanned three winter months, from December 1, 2024, to March 1, 2025.

Our center is an urban, academic specialized hospital , consisting of a Pediatric (ED) with 30000 visits/ year , children aged 0–15, a day stay observation with 5 beds, and a ward with 12 beds. Tipaza city is a coastal city, and also a satellite city of the capital, Algiers; it is a urban and tourist center with approximately 35,000 inhabitants, including a pediatric population (0-14 years) of nearly 10,000 children.

Inclusion & Assessment:

We included all children aged one to 15 years presenting to the Pediatric ED during the study period with asthma exacerbation with prior asthma history:

- For children aged ≥ 36 months:
a documented physician diagnosis of asthma or ≥ 2 previous episodes of reversible wheezing.
- For children aged 12 to 35 months: ≥ 3 wheezing episodes with first-degree family history of atopy in accordance with the recommendations of the Algerian Society of Pediatric[6]

An asthma exacerbation was clinically defined by acute or sub-acute wheezing, coughing, and increased respiratory effort.

Exclusion Criteria:

To maintain a clear focus on asthma, we exclude children ≥ 36 months of age experiencing their first episode of wheezing, and those < 36 months of age with two or fewer episodes of wheezing, or without a personal or family history of atopy. We also exclude patients with other chronic respiratory diseases, extreme prematurity, congenital heart disease, or other significant co morbidities. Children who visited the emergency department more than once for an asthma exacerbation during the study period were counted only once.

Data Collection & Analysis:

The data collected by residents in the emergency department under the supervision of an attending physician using a questionnaire designed specifically for this study, with 49 Items: documenting socio-demographic factors (7 items), medical history (13 items), maintenance therapy, and the asthma exacerbations management at home before arriving at hospital (6 Items), Admission examination and PRAM score (12 Items) and Treatment modalities (11 Items).

To ensure accuracy, we assessed severity at the bedside using the Pediatric Respiratory Assessment Measure (PRAM) (Table I)[7], and we used GINA classification for the asthma control for the period of the last four weeks (Table II)[1].

Statistical analysis was performed using EpiData and Microsoft Excel, utilizing open-access licenses. The associations between qualitative variables were evaluated with Chi-square test. Results were deemed as significant for $p < .05$. Percentages are based on the total study population (N) for variables with $\leq 5\%$ missing data, and on available cases (n) when it exceeds 5%. the denominator is given for each variable.

Table I. Pediatric Respiratory Assessment Measure (PRAM) Score

Criterion	0 point	1 point	2 points	3 points
Oxygen saturation (SpO ₂)	$\geq 95\%$	92 – 94 %	$< 92\%$	
Suprasternal retractions	Absent		Present	
Scalene muscle contraction	Absent		Present	
Air entry	Normal	Decreased at the bases	Decreased at apices and bases	Minimal / absent
Wheezing	Absent	Expiratory only	Inspiratory and expiratory	Audible without a stethoscope, or absent with minimal air entry
Total score (/12)	Severity of exacerbation			
0 – 3	Mild exacerbation			
4 – 7	Moderate exacerbation			
8 – 12	Severe exacerbation			

Table II. GINA classification of asthma control

Score= 0 well controlled	
Score=1-2 partial controlled	
Score=3-4 uncontrolled	
• Daytime symptoms >2 /week	Yes=1 No=0
• Waking up at night due to asthma	Yes=1 No=0
• Need for SABA treatment >2 /week	Yes=1 No=0
• Limitation of activity due to asthma	Yes=1 No=0

Results (table IV)

We validated the questionnaires of fifty-four asthmatic patients experiencing an exacerbation out of a total of fifty-seven questionnaires, three missed data excluded.

3.1. Socio-demographic Profile and Patient History

The study included 54 children with the mean age 49.83 ± 39.26 months (4.15 years). Children under 3 years old represented 22/54 (40.7%), and from 3 to 5 years 13/54 (24%), those aged 6 to 12 years

(33.3%), and just one adolescent more than 12 years (1.8%). A male predominance was observed (61.1%, sex ratio 1.6). Regarding parental socio-professional status, 25/54 (46.3%) of fathers were civil servants, while 38/49 (77.5%) of mothers were unemployed.

Regarding medical history, 34/54 (62.9 %) of patients experienced their first episode of wheezing before the age of 12 months. The Average number of anterior wheezing episodes was 5.56 ± 3.70 and 15/54 (27.8%) with previous hospitalizations without any prior admission in a pediatric intensive care unit (PICU). Thirty patients (55.6%) said having a regular follow-up, 9/50 (18%) responders said receiving Maintenance therapy and 4 don't know if their child have or not a maintenance therapy so ICS represent 9/30 (30%) of patients with follow-up.

For the Asthma control prior to the emergency visit, 21/54 of asthma (38.9%) were uncontrolled, 18/54 (33.3%) partially controlled and just 13/54 (24%) well controlled asthma.

3.2. Pre-hospital Management

In the management of asthma exacerbations at home, we have three missing data we noted 24/51 families (47%) had a written action plan, which was reported to be used in 22/24 cases (91.7%). SABA was used at home by 36/54 patients (66.7%); however, the dosage was incorrect for 11/36 patients (30.6%), and it was administered without a spacer in 8/36 cases (22.2%). Meanwhile, 16/54 cases (29.6%) did not use SABA prior to their pediatric ED consultation with tow missing data. Parents of 33/54 patients (61.1%) were able to identify the onset of symptoms. Among them, 7/33 (21.2%) presented to the ED within 6 hours, 8/33 (24.2%) between 6 and 12 hours, and 18/33 (54.6%) more than 12 hours after symptom onset. We noted that 21/54 respondents (38.9%) did not know when the exacerbation began.

3.3. Emergency Department Management and Outcomes

The clinical severity was mild in 25/54 patients (46.3%), moderate in 24/54 patients (44.4%), and severe in 3 cases (5.6%) the same cases how have a $SpO_2 < 92\%$ (5.4%) and 51/54 (94.4%) of the patients with $SpO_2 \geq 92\%$. We noted that 41.7% of patients with moderate asthma exacerbations have well controlled asthma against only 8% those with mild asthma exacerbations. Emergency department treatment primarily consisted of nebulized (SABAs) via aerosolized oxygen (96.3%). Ipratropium bromide (Atrovent®) for three patients and Corticosteroids were administered to 30/54 patients (55.6%). The route of administration was in 80% of patients

intramuscular (IM) injections and 13.3% intravenous (IV) injections, while the oral route was used in only 6.6 % of cases. The hospitalization rate was 3/54 (5.6%) and we don't have any transfers for the PICU.

Table IV. Collected data		
VARIABLE		
AGE	N= 54	100%
< 3	22	40.7
3-5	13	24
6-12	18	33.3
> 12	1	1.9
Gender	N= 54	100%
Female	21	38.9
Male	33	61.1
Father's occupation	N= 54	100%
Unemployed	5	9
Civil servant	25	46.3
Self-employed	16	29.3
Retired	5	9
N/A	3	3.7
Occupation/mother	n=49	100%
Unemployed	38	77
Civil Servant	11	23
N/A	5	9
Place of residence	N=54	100%
Within the Wilaya	52	97
Outside the Wilaya	2	3
Age (year) at the first wheezing episode	N=54	100%
≤ 1	34	62.9
1 – 3	8	14.8
3 – 5	5	9.2
> 5	7	12.9
previous hospitalizations	N=54	100%
YES	15	27.8
NO	37	68.5
N/A	2	3.7
In Intensive Care	-	-
Regular follow-up	N=54	100%
YES	30	55.6
NO	24	44.4
Asthma maintenance therapy	N=54	100%
Don't know	4	7.4
I know	50	92.6
ICS	n=50	100%
YES ICS	9	18
NO ICS	41	82
Asthma control	N=54	100%
Well controlled	13	24.2
Partially controlled	18	33.3
Uncontrolled	21	38.9
N/A	2	3.7
Written asthma plan	n=51	100%
Existence		
Yes	24	47
NO	27	53
N/A	3	5.5

Used (n=24)	n=24	100%
Yes	22	91
NO	2	9
Onset of symptoms / consultation at ED	n=33	100%
<6 h	7	21.2
6- 12 h	8	24.2
12 – 24 h	16	48.8
> 24 h	2	6
Onset of symptoms	N=54	100%
I Don't know	21	38.9
I know	33	61.1
Management at home	N=54	100%
SABA		
Yes	36	66.7
No	16	29.6
N/A	2	3.7
What the dose	n=36	100%
Correct Dose	22	61.1
Incorrect Dose	11	30.6
I Don't know the dose	3	8.3
Device	n=36	100%
without Spacer	8	22.2
with Spacer	16	44.4
Nebulizer	12	33.3
SpO₂	N=54	100%
≥ 92%	51	94.4
<92%	3	5.6
Asthma attack Severity (PRAM)	N=54	100%
Mild (PRAM ≤ 3)	25	46.3
Moderate (PRAM 4 – 7)	24	44.4
Sever (PRAM ≥ 8)	3	5.6
N/A	2	3.7
Therapy in ED	N=54	100%
SABA nebulization with O₂		
Yes	52	96.3
No	-	-
N/A	2	3.7
Atrovant ®	N=54	100%
Yes	3	5.5
No	49	94.5
Corticosteroid	N=54	100%
Yes	30	54%
No	24	46%
Route of administration corticoid	n=30	100%
IV	4	13.3%
IM	24	80%
PO	2	6.6%
Hold for observation	N=54	100%
1H	10	18
1H - 4H	27	50
>4H	11	20.3
Hospitalization	3	5.5
N/A	2	3.7

Discussion

In this single-centre study of 54 children with asthma exacerbations managed in pediatric ED during three winter months, the mean age was 4.15 years, and 40.7 % were under 3 years old, the sex ratio 1.6 (61.1 % were boys). A male predominance is described in children before puberty and is attributed to relatively narrower airways in boys (dysanapsis) and to sex-related differences in airway reactivity[8]. The age profile and sex ratio are close to those of the French prospective ED series of Julian et al. [9] (143 children aged 1 to 16 years; mean age 3.9 ± 3.3 years; 49.6% under 3 years; 60.1% boys, sex ratio 1.5). However, the analysis of association factors in our Data (**Table III**) did not find a correlation between severity of asthma exacerbations and the sex ($P=0.43$) nor the age ($P=0.58$), regarding the "Control of asthma" variable deserves further study on a larger cohort ($p=0.08$).

Table III. Association of asthma exacerbations Severity and age, sex and control of asthma

N= 52	Mild Attack (n=25)	Moderate Attacks (n=24)	Sever Attacks (n=3)	P
Sex				
Male	18	13(54%)	2(67%)	p=.43
Femal	(72%) 7(28%)	11(46%)	1(33%)	
Age (year)				
< 3	9(36%)	12(50%)	1(33%)	p=.58
≥ 3	16(64 %)	12(50%)	2(67%)	
Asthma control				
Well	2(8%)	10(41.7%	1(33%)	p=.08
Partial	12(48 %	5(21%)	1(33%)	
uncontro lled	11(44 %	9(37%)	1(33%)	

Regular follow-up was reported for 30/54 children (55.6 %), whereas only 9/50 (18 %) reported maintenance therapy, in spite of a mean of 5.6 previous wheezing episodes and a previous hospitalization in 27.8 %. In the Rabat series, 27 % of children received maintenance corticosteroid therapy [10]. Low use of controller treatment and poor asthma control have also been reported in multi-country surveys [3] and in sub-Saharan Africa [11]. Algerian series reported the regular follow-up in 50% Aissat et al [12] and 33% Radoui et al [13]. The barriers described in the literature, such as cost and inhaler technique stigma and

parental beliefs about inhaled corticosteroids[14–16] were not assessed in our study.

Our findings highlight some gaps in therapeutic patient education (TPE) and self-management during pediatric asthma exacerbations. First, action plan coverage and implementation remain suboptimal, 24 /54 families (47 %) reported a written action plan. Second, Insufficiency in home-treatment techniques and dose, SABA given at home to 36/54 children, with an incorrect dose in 11/36 and without a spacer in 8/36. Third, poor symptom perception and delayed healthcare seeking were prominent: over a third of caregivers were unable to identify symptom onset, and among those who could, the vast majority experienced substantial delay before presenting to the emergency department. Finally, a paradoxical result emerged: well-controlled asthma was more frequently reported among moderate than mild exacerbations (10/24 vs 2/25). This finding may be explained by the important underlying, persistent chronic obstruction, a pattern more consistent with poorly controlled disease than with a truly mild, transient attack. Regular follow-up and effective TPE with optimize maintenance therapy are key to detect and control asthma symptoms[17].

To place our findings in context, (**Table IV**) compares some characteristics of our series with those of six published studies on pediatric asthma exacerbations managed in emergency settings, in Algeria and abroad [9,10,12,13,18,19]. Although these studies differ in design, age range, severity classification and recruitment period, they allow us to situate our results regarding severity, follow-up, inhaled corticosteroid (ICS) use and written action plans (WAP).

Studies	Age (year)	Duration (mth)	Severity of the attack	Follow up/ICS	WAP	Type	Centre
Aissat et al [12] 2017 N= 111	0-15	3	Mod+Sev = 78% Mild=22%	50%/-	39,6%	Mono. Prosp.	Algiers Algeria
Radoui et al [13] 2011 N= 676	Ped	6	-	33%/-	-	Mono. Retro.	Oran Algeria
Julian V, et al, [9] 2014 N= 143	1-16	3	Mod+Sev= 69% Mild= 31%	60%/-	16,5%	Mono. Prosp.	France
Boubkraoui ME [10] 2015 N=1461	2-15	12	Mod= 71% Sev= 29 % Mild= Excl	- /27%	-	Mono. Retro.	Rabat Morocco
Yousef, A. et al [18] 2025 N=1750	2- 14	12	Mod= 42% Sev=3 % Mild= 57%	- / 29%	10,5%	Mono. Retro	Eastern Province of Saudi Arabia
Dondi A et al [19] 2017 N=603	0-16	12	Mod.+Sev.=44 % Mild = 56%	51%/10%		Mono. Prosp.	Bologna Italy
<i>Our data</i>	1-15	3	Mod.+Sev.= 50.% Mild = 46.3%	55.6%/18%	47.1%	Mono. Prosp.	Tipaza Algeria

Table IV. Comparison of our results with published studies on pediatric asthma exacerbations managed in emergency settings

Mod, moderate; Sev, severe; ICS, inhaled corticosteroids; WAP, written action plan; Mono., single-center; Multi., multicenter; Prosp., prospective; Retro., retrospective; Excl., exclude

In the emergency department, 96.3% of children received nebulized SABA with supplemental oxygen while the majority (94.4%) had a correct SpO₂; this practice contrasts with GINA guidelines, which recommend using a pressurized metered-dose inhaler with a spacer for mild-to-moderate exacerbations, reserving oxygen solely for hypoxemic patients [1]. In the recommendations of the Algerian Society of Pediatrics, we have the choice between nebulization using wall-mounted oxygen and the use of a spacer device [6]. Similarly, systemic corticosteroids were administered to 55.6% of patients—primarily via the intramuscular route (80%)—even though the oral route remains the standard of care. These departures from international guidelines probably reflect local structural and logistical constraints, although we did not assess them directly. First, spacers are not routinely available in the ED when patients do not bring their own, which leads clinicians to rely on nebulizers connected to wall-mounted oxygen outlets. Second, no community pharmacy is open nearby during on-call hours, and oral formulations may be out of stock in the hospital. Clinicians may therefore prefer intramuscular injection to ensure treatment delivery. In our setting, for instance, the nearest pharmacy is more than 500 meters from the hospital and is open only during the day. These observations suggest that implementing guidelines depends closely on the availability of equipment and medicines, and on the location of the health facility.

Strengths and Limitations of the Study

Prospective design providing real-time evaluation of pre-hospital and in-hospital management
Scarcity of prospective ED data in our region makes these findings highly relevant for local clinical practice.

Strict exclusion criteria (excluding first-time wheezers and severe comorbidities) reduced diagnostic confusion.

On the other hand, it is single-centre study limited to the winter period, which prevents conclusions on seasonality. Viral testing was not done. Challenging diagnostic in young children.

Conclusion

In this series, regular follow-up and maintenance therapy proved inadequate; home management of exacerbations often failed to adhere to guidelines; and emergency treatment relied primarily on nebulized SABAs by oxygen and parenteral corticosteroids. There is a need to strengthen patient education.

Declaration of interests

The authors declare that they have no conflicts of interest.

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