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ORIGINAL ARTICLE

EPIDEMIOLOGY, TREATMENT, AND COMPLICATIONS OF CROUP SYNDROME IN CHILDREN

Gjinovska-Tasevska Elena, Doksimovski Filip, Boshkovska Katerina, Tasevska Rajkovikj Ana, Petlichkovska Sandra, Jakjovska Tatjana, Arnaudova-Daneva Ivana
Institute for Respiratory Diseases in Children, Skopje, Republic of North Macedonia

ABSTRACT

Introduction: Croup syndrome is an urgent pediatric condition. It is characterized by the abrupt onset, most commonly at night, of a barking cough, that is usually accompanied by inspiratory stridor, hoarseness and respiratory distress resulting from upper-airway obstruction. This is the most common reason why parents are upset and immediately seek medical help.

Objective: This study aimed to evaluate the frequency, treatment, and possible complications of croup syndrome in children hospitalized at our institute.

Materials and methods: In our retrospective study we examined 56 pediatric cases with croup syndrome that were hospitalized in our Institute and we analyzed gender and age, the season in which we had the most frequent hospitalizations of children with croup syndrome, as well as treatment and possible complications after completion of croup symptoms. Period of examination was one year.

Results: Mean age at diagnosis of children with croup was 26,5 ±2.6 months (range from 45 days to 8 years). As well the world statistics we got a larger number of hospitalized boys with croup syndrome, rather than girls (ratio 2,3:1). Regarding the period of the year, the autumn period was dominant. As far as the treatment, we noticed significant number of children with moderate to severe croup syndrome that required in-patient care. All of them received nebulized adrenalin as well as parenteral corticosteroid. The average duration of the hospitalizations that occurred in our unit for close monitoring and semi-intensive care was 5 days (1-14d). Antibiotics were used in 71% (n=40). Most common comorbidity was pneumonia and bronchopneumonia (14,2%, n=8). None of the children was of need of intubation and referral to intensive care unit.

Conclusion: Our one-year research has documented considerable number of children with the necessary hospitalization, as many as 10% of hospitalized children in our Institute were due to moderate to severe croup syndrome. The sex, the age of the children as well as the season are most often in line with world statistics. We are noticing high percent of hospitalized patients with moderate croup. There is evident discrepancy between the use of antibiotics and its duration in our practice in comparison with other reports. These observations lead to reassessment of the hospitalization criteria as well as more rational use of antibiotics.

Keywords: Croup syndrome, intensive care, pediatric, treatment.

INTRODUCTION

Infections of the upper respiratory tract are the most common acute infectious pathology in childhood. Croup syndrome is an urgent pediatric condition and is characterized by the abrupt onset, most commonly at night, of a barking cough, hat is usually accompanied inspiratory stridor, hoarseness, and respiratory distress resulting from upper-airway obstruction.

The disease has an autumn-winter season predominance [1] and affects children from 6 months to 3 years of age, peaking at 2 years of age, which is determined by the anatomical features of the upper respiratory tract (URT) in infants and young children. The male to female ratio is 3: 2 [2].

Croup is usually caused by viruses, which are detected in up to 80 percent of patients. Various presentations of croup are based on the causative virus. Parainfluenza virus (types 1 to 3) is the most common etiology (50 to 75 percent of patients with croup). Of the three types, parainfluenza type 1 is the most common. Although parainfluenza type 3 virus infections often occur in young children, croup develops in only a small percentage of those exposed. Other viruses that cause croup are enterovirus, human bocavirus, influenza A and B viruses, respiratory syncytial virus, rhinovirus, and adenovirus. Measles has been reported rarely in patients with croup where the population is inadequately vaccinated. Bacterial causes are also rare and include diphtheria and Mycoplasma pneumonia [3, 4].

Pathogenesis is associated with generalized inflammation of the dilated pits with swelling of the mucosa and hypersecretion of the mucous glands. The subglottic area narrows, leading to obstruction of the respiratory tract.

Westley Croup Score, is the most widely used clinical score, and its validity and reliability have been well demonstrated. However, RCTs included in the review use a variety of croup scores. **Mild croup:** occasional barking cough; no stridor at rest; and no-to-mild suprasternal, intercostal indrawing (retractions of the skin of the chest wall), or both corresponding to a Westley Croup Score of 0–2. **Moderate croup:** frequent barking cough, easily audible stridor at rest, and suprasternal and sternal wall retraction at rest, but no or little distress or agitation, corresponding to a Westley Croup Score of 3–5. **Severe croup:** frequent barking cough, prominent inspiratory and, occasionally, expiratory stridor, marked sternal wall retractions, decreased air entry on auscultation, and significant distress and agitation, corresponding to a Westley Croup Score of 6–11 (Table1) [5]. For severe croup immediate treatment is with nebulized adrenaline (1:1000 dilution) at a dose of 0.5 mL/kg of body weight to a maximum dose of 5 mL, delivered neat to the nebulizer bow. Dexamethasone and budesonide are effective in relieving the symptoms of croup as early as 30 minutes after treatment [6]. Corticosteroids play a major role in the treatment of pseudocroup due to their vasoconstrictor and anti-inflammatory properties. They reduce vascular permeability and mucosal edema. The main requirements for the "ideal" inhaled corticosteroid are potent and persistent anti-inflammatory effect, rapid penetration into the target tissue, minimal systemic exposure, including low systemic bioavailability, rapid systemic clearance, and minimal cumulative potential. Antibiotics as a prophylaxis against these cases are not recommended. Antitussives and decongestants should not be administered, also there is no clear theoretical reason to use short-acting b2-agonists for treatment of croup [7, 8]. Oxygen must be given via a face mask in moderate to severe croup. The aim of this study was to evaluate the frequency, treatment, and possible complications of croup syndrome in children hospitalized at our institute.

Table 1. Clinical scores for assessing severity of croup

Croup scoring systems
Downes and Raphaely Croup Score Total score ranging from 0-10 points. Five component items make up the score: - inspiratory breath sounds (0=normal, 1-hard with rhonchi, 2-delyed) - stridor (0-normal, 1=inspiratory, 2=inspiratory and expiratory) - cough (0-none, 1=hoarse cry, 2=bark) - retraction/nasal flaring (0=normal, 1=suprasternal/present, 2=suprasternal and intercostal present) - cyanosis (0=none, 1=in room air, 2= in FIO2 0.4) Taussing Croup Score Total score ranging from 0-14 points. Five component items make up the score: - colour (0=normal, 1=dusky, 2=cyanotic in air, 3=cyanotic in 30-40% oxygen) - air entry (0=normal, 1=mildly diminished, 2= moderately diminished) - retractions (0=none, 1=mild, 2=moderate, 3=severe) - level of consciousness (0=normal, 1=restlessness, 2=lethargy [depression]) - stridor (0=none, 1=mild, 2=moderate, 3=severe [or no stridor in the presence of other signs of severe obstruction) Westley Croup Score Total score ranging from 0-17points. Five component items make up the score: - stridor (0=none, 1=with agitation only, 2=at rest) - retractions (0=none, 1=mild, 2=moderate, 3=severe) - cyanosis (0=none, 4=cyanosis with agitation, 5= cyanosis at rest) - level of consciousness (0=normal [including asleep], 5=disorientated) - air entry (0=normal, 1= decreased, 2=markedly decreased)

MATERIALS AND METHODS

Our Institute is the largest of its kind in our country and specializes in pediatric pulmonology. During the last year, 33.763 children were examined at the Institute, out of which 3344 were hospitalized, of which about 500 children were initially placed in the unit for close monitoring and semi-intensive care.

Of all 500 children, 10% were with croup. In our retrospective study we examined 56 pediatric cases with croup syndrome that were hospitalized in our Institute and we analyzed gender and age, the season in which we had the most frequent hospitalizations of children with croup syndrome, as well as treatment and possible complications after completion of croup symptoms. Period of examination was one year.

RESULTS

We analyzed our data with Statistical Package for the Social Sciences (SPSS) 17.0. Mean age at diagnosis of children with croup was 26,5 ±2.6 months - range from 45 days to 8 years (Figure 1). As well as the world statistics we got a larger number of hospitalized boys with croup syndrome, rather than girls. The male: female (M: F) ratio was 2.3:1. The peak season incidence of croup was autumn. As far as the days spent in hospital, they ranged from 1 to 14, with 5 days medium duration of stay.

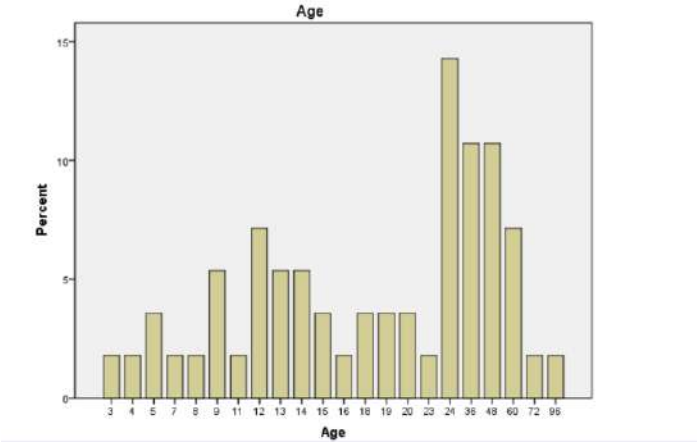

Fig. 1. Age of children hospitalized on ICU.

About the initial treatment all of patients were treated with nebulized adrenaline. Regarding parenteral and inhaled corticosteroids, we received data that 85.7% received parenteral (methylprednisolone), while 87.5% (n= 49) received inhaled corticosteroid, budesonide (Table 2).

Table 2. Percentage of administered intravenous and inhaled corticosteroids

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
I.V.Corticosteroids	48	85,7%	8	14,3%	56	100,0%
InhaledCorticosteroids	49	87,5%	7	12,5%	56	100,0%

But what deviates from world statistics is the high number of antibiotics used during and after hospitalization. As many as 35.7% of the children received i.v. antibiotic and oral antibiotic 48.2%.-total percentage of antibiotics use 83,9% (Figure 2). After the hospital treatment, 50 % of the patients were discharged with oral antibiotics, and 94.6% with inhaled corticosteroids.

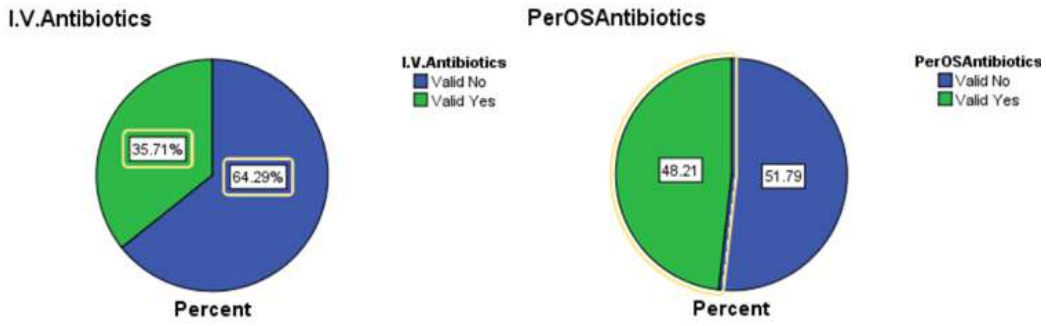

Fig. 1. Percentage of administered I.V. antibiotics and per oral antibiotics.

The most common croup complications were pneumonia and bronchopneumonia (7.1%), bronchitis (3.6%), enterocolitis (1.8%), and tracheobronchitis (3.6%) (Table 3).

Table 3. The five most common comorbidities of croup

Complications

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	/	42	75,0	75,0	75,0
	bronchitis	2	3,6	3,6	78,6
	bronchopneumonia	4	7,1	7,1	85,7
	enterocolitis	1	1,8	1,8	87,5
	pneumonia	4	7,1	7,1	94,6
	tracheobronchitis	2	3,6	3,6	98,2
	tracheomalacia	1	1,8	1,8	100,0
	Total	56	100,0	100,0	

DISCUSSION

Croup syndrome is one of the most common research conditions in the pediatric population, although guidelines for admitting children with this condition and treatment are well known. However, more major studies have been epidemiologically generic except for the period of the croup syndrome due to the geographical location of the countries.

The difference is generally in the treatment of these patients. In this retrospective study of 56 hospitalizations of children with croup in 2019, we analyzed the distributions of age, sex, treatment, and management of patients with croup.

Our results showed that the mean age of patient was 26.5 months, and male dominancy with M: F ratio 2.3:1 that is in accordance with almost all previous reports. One of them was research of Rosychuk et al., (2010) in big Canadian study [9] and Orntoft et al (2013) [10]. According to the months from October to early December in which we had the most of our patients with croup, the pick season is mid to late autumn. The results did differ from children and adolescents with croup and epiglottitis who visited 146 emergency departments in Korea (July with 11.6% of all ED visits, August, March, and April had the next highest incidences with 10.8%, 10.4%, and 10.1%, respectively), Lee et al.,(2015) [11] but are in correlation with the statistics form Croup Hospitalizations in Ontario, Segal et al., (2005) [12]. About the treatment, if we take into consideration that all of the admitted patients were with moderate to severe croup presentation, the initial treatment was with nebulized adrenalin in all of the 56 patients [13]. According to randomized controlled trials (RCTs) or quasi-RCTs involving children with croup evaluated in an emergency department (ED) or admitted to hospital, nebulized adrenalin was associated with improvement of the croup score in 30 min and significantly shorter hospital stay (Kawaguchi et al., 2015) [13]. In 87.5% (n=49) of the patients nebulized corticosteroid was given and in 85.7% parenteral methylprednisolone, which is in correlation with Universal guidelines for the diagnosis and management of croup [14, 15], including those released by the Alberta Medical Association that dictate the use of nebulizing or oral glucocorticoids in all children who receive a diagnosis of croup [12].In spite of the fact that neither of the guidelines recommend giving antibiotic therapy in croup, during and after the hospitalization significant number of our patients have received antibiotics.

Intravenous antibiotics were given in 35.7% of the children oral antibiotic in 48.2%, total percentage of antibiotics use 83,9%. After the hospitalization of the ICU, 50% of the patients were discharged with oral antibiotic. Although the croup is mostly viral infection, most of the patients initially had high inflammatory markers that lead the pediatrician to start with antibiotic course. In a Polish study from 482 patients in 58.1% were given antibiotics (Pejcz et al.2004) [16]. There are a lot of articles and scientific papers that show that giving antibiotics doesn't shorten the days of hospitalization. But if we look back at the comorbidities that are 25%, and if we take into consideration the social and economic status of the country, secondary bacterial infections in children are very common.

Most studies show that the most common form of croup is moderate, 1-8% need hospitalization and only 3% need intubation [7]. In our study, on the contrary, as many as 50% of children needed hospitalization, leading to a conclusion that the admission criteria should be a subject of further reassessment. Administering nebulized adrenalin in the emergency room with subsequent several hour observations may avoid unnecessary hospitalizations. Use of antibiotics for predominantly viral infection remains to be questioned and rationalized.

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