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Audit of acute asthma management at the Paediatric Emergency Department at Wad Madani Children's Hospital, Sudan

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ABSTRACT

This audit of hospital care of acute wheeze and asthma aimed to assess the degree of adherence of the acute care of the asthma patients to the published international guidelines. Information was collected in six key areas: patient demographics; initial asthma severity assessment; in-hospital treatment; asthma prophylaxis; asthma education and emergency planning; and follow-up arrangements.

The area of initial asthma severity assessment showed deficiencies in the clinical measures currently used to verify case severity. In- hospital treatment on the other hand was consistent with recommendations in the use of the inhaled β-2 agonist salbutamol as bronchodilator, the discrete use of aminophylline and the small number of patients ordered chest X-ray. However, the treatment was incoherent with recommendations in the delivery method used for inhaled bronchodilator in relation to the age group of treated patients, absence of ipratropium bromide as a bronchodilator in the management and the large use of antibiotics.

Assessment of the areas of asthma prophylaxis, asthma education and emergency- planning and follow-up arrangements illustrated that little efforts were made to assure safe discharge, although these measures have been shown to reduce morbidity after the exacerbation and reduce relapse rates and significantly reduce hospitalizations, unscheduled acute visits, missed work days, as well as improving quality of life.

This audit emphasizes the need for the adoption of a management protocol for acute asthma care in the emergency department based on published international guidelines and the assurance of its implementation, monitoring and evaluation using the right tools to improve patient care.

Key words: Acute asthma, asthma guidelines, prophylaxis, asthma severity.

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INTRODUCTION

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. Involved cells include mast cells, eosinophils, T lymphocytes, macrophages, neutrophils, and epithelial cells. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment. The inflammation also causes an associated increase in the existing bronchial hyper responsiveness to a variety of stimuli. Reversibility of airflow limitation may be incomplete in some patients with asthma [1].

Globally, it is now estimated that as many as 300 million people of all ages, and all ethnic backgrounds, suffer from asthma. The burden of this disease to governments, health care systems, families, and patients is increasing worldwide.

It is estimated that asthma accounts for about 1 in every 250 deaths worldwide. Many of the deaths are preventable, being due to suboptimal long-term medical care and delay in obtaining help during the fatal attack. The number of disability-adjusted life years (DALYs) lost due to asthma worldwide has been estimated to be currently about 15 million per year [2].

Asthma is the most common chronic disease affecting all age groups in Britain, with a prevalence of up to 13% in children [3], and up to 8% in young adults [4]. In Switzerland the prevalence of asthma is 7% [5]. Most of the morbidity and mortality associated with asthma result from acute exacerbations [6].

In the United States, asthma affects more than 22 million persons. It is one of the most common chronic diseases of childhood, affecting more than 6 million children according to the National Health Interview Survey (NHIS) in the United States [1].

Mean prevalence of clinical asthma in the Middle East is 5.8% with available evidence indicating that the prevalence of asthma has increased over recent decades throughout the Middle East. The burden of severe asthma is considerable within the Middle East, with hospital admission rates in excess of 150-200 per 100,000 per year in some high prevalence countries [2]

In Africa, inter-country prevalence data are limited to the International Study of Asthma and Allergies in Childhood (ISAAC) in which seven African countries participated (English-speaking regions: Ethiopia 9.1%, Kenya 15.8%, Nigeria 13.0%, and South Africa 20.3%; and French-speaking regions: Algeria 8.7%, Morocco 10.4%, and Tunisia 11.9% [7].

In Sudan variations in Asthma prevalence in children was observed between rural and urban areas, with a prevalence of 5% in Gedaref (rural) and 12.3% in Khartoum (urban) [8,9]. In Gezira state the prevalence of childhood bronchial asthma was found to be 13.6% in Wad Madani (urban) and 12.7% in Wad El Hadad (rural) [10].

Advances in science have led to an increased understanding of asthma and its mechanisms as well as improved treatment approaches. In order to help health care professionals bridge the gap between current knowledge and practice, clinical practice guidelines must be adopted. Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances. They define the role of specific diagnostic and treatment modalities in the diagnosis and management of patients [1], this is done through describing a range of generally accepted approaches for the diagnosis, management, or prevention of specific diseases or conditions and defining practices that meet the needs of most patients in most circumstances. For asthma management, a number of guidelines exist; The Global Initiative for Asthma (GINA) guidelines; British

Guideline on the Management of Asthma and The American National Asthma Education and Prevention Program (NAEPP) Clinical Practice Guidelines.

The Global Initiative for Asthma was created to increase awareness of asthma among health professionals, public health authorities, and the general public, and to improve prevention and management through a concerted worldwide effort. The Initiative prepares scientific reports on asthma, encourages dissemination and implementation of the recommendations, and promotes international collaboration on asthma research. GINA is one of the founding participants in the World Health Organization's Global Alliance Against Chronic Respiratory Diseases (GARD).The goal of this effort is to improve collaboration between already existing governmental and non-governmental programs against chronic respiratory diseases.

The British Guidelines on the Management of Asthma was developed through an agreement in 1999 between British Thoracic Society (BTS) and the Scottish Intercollegiate Guidelines Network (SIGN) to jointly produce a comprehensive new asthma guideline, both having previously published guidance on asthma. The original BTS guideline dated back to 1990 and the SIGN guidelines to 1996. Both organizations recognized the need to develop the new guideline using explicitly evidence based methodology. The joint process was further strengthened by collaboration with Asthma UK, the Royal College of Physicians of London, the Royal College of Paediatrics and Child Health, the General Practice Airways Group, and the British Association of Accident and Emergency Medicine (now the College of Emergency Medicine). The outcome of these efforts was the British Guideline on the Management of Asthma published in 2003, UK BTS/SIGN asthma guidelines (2003).

On the other hand and regarding (NAEPP) Clinical Practice Guidelines, The NAEPP of the American National Heart, Lung, and Blood Institute (NHLBI) had convened Expert Panels to prepare guidelines for the diagnosis and management of asthma. Published in 1991, the "Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma" (EPR 1991) organized the recommendations for the treatment of asthma around four components of effective asthma management: use of objective measures of lung function to assess the severity of asthma and to monitor the course of therapy, environmental control measures to avoid or eliminate factors that precipitate asthma symptoms or exacerbations, patient education that fosters a partnership among the patient, his or her family, and clinicians, comprehensive pharmacologic therapy for long-term management designed to reverse and prevent the airway inflammation characteristic of asthma as well as pharmacologic therapy to manage exacerbations.

The aim of this retrospective study was to audit the acute wheeze/ asthma management in children admitted to the Emergency Department in relation to the published international guidelines recommended for acute asthma care. It also aimed to provide base-line data on acute asthma management to be used in studying future interventions to improve asthma care.

MATERIAL AND METHODS

The study was conducted at Wad Madani Paediatrics' Teaching Hospital, Wad Madani, Gezira State, Sudan, over an eight months period (February to September 2008) using audit form of the British Paediatrics Respiratory Society (BPRS) / British Thoracic Society (BTS) for any child over 1 year admitted with acute wheeze/ asthma to the emergency department (ED)

The hospital was assigned a centre number to enable data entry. The audit form (www.brit-thoracic.org.uk, 2008) was completed on-line from the patients' admission sheet for any child over 1 year of age admitted with acute wheeze/asthma to the ED in Wad Madani Paediatrics' Teaching Hospital, for more than 4 hours. A total of 369 admissions met those criteria during the study period.

Information was collected in six key areas: patient demographics; initial asthma severity assessment; in-hospital treatment; asthma prophylaxis (if any); asthma education and emergency planning; and follow-up arrangements.

The computer based version posted online for the year 2007 was updated for the year 2008 to question extra 4 parameters regarding in-hospital treatment. These are: use of ipratropium bromide as a bronchodilator, admission of children to the Paediatric Intensive Care Unit (PICU)/ High Dependency Unit (HDU) if needed, use of intravenous magnesium sulphate and use of intravenous β agonist. Entering the required information takes around 5 minutes per child. Where there was no information in the clinical notes e.g. checking inhaler device technique, answers were coded as not done.

An admission was defined as more than 4 hours in hospital from triage to discharge. Children under 1 were excluded because bronchiolitis due to respiratory syncitial virus infection, a common cause of wheezing in young children, can not be easily differenciated from asthma. There was no specific upper age limit cut off.

Statistical Analysis

The data was analyzed using SPSS Statistical Package program

Ethics

Ethical consent was not sought because this study is retrospective and involved data collection of routinely available information extracted from patient notes.

RESULTS

The median age of children admitted was 2 years (range 1-16 years) as shown in Table 1.

Table 1- Age of children with acute asthma.

	Age	Frequency	(%)
Valid	1 year	21	(5.7)
	2-5 years	181	(49.1)
	≥ 6 years	165	(44.7)
	Total	367	(99.5)
Missing	System	2	(0.5)
Total		369	(100)

Sex distribution of the study group shows that 61.5% of them were boys, while 38.5% were girls (Figure 1).

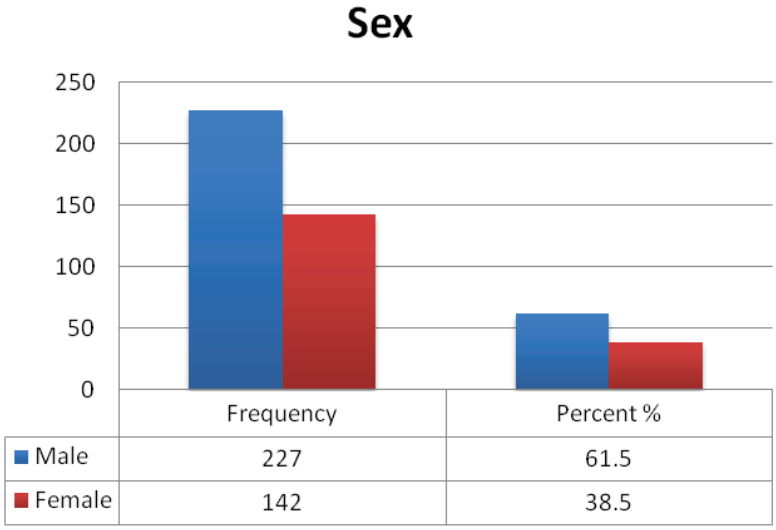

Figure 1- Sex of children with acute asthma

The median length of stay was 1 day (range 0-4 days) (Figure 2)

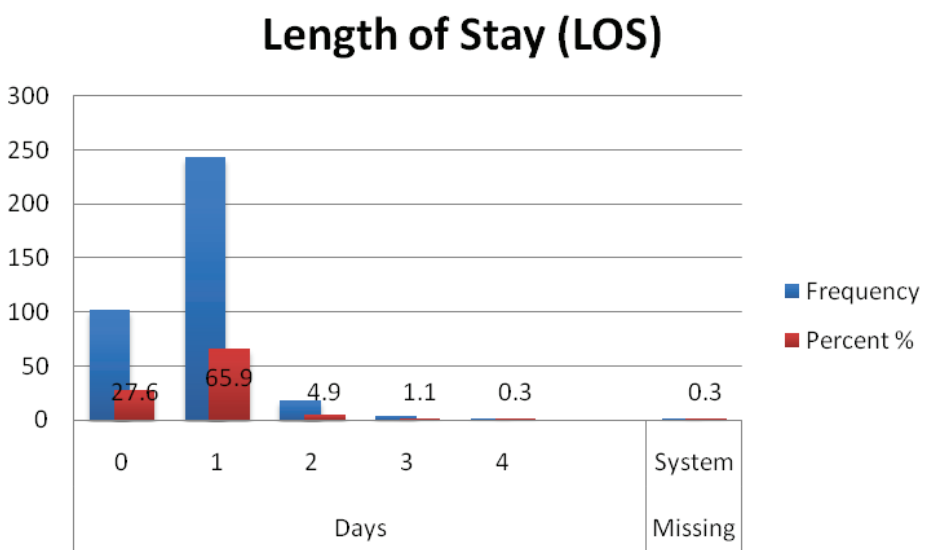

Figure 2 - Length of Stay of children with acute asthma

The initial respiratory rate was measured for 352 children representing 95.4% of all cases, while the initial pulse rate was measured in 331 representing, 89.7% of the cases (Table 2).

Regarding initial pulse rate, collected data showed that 35 subjects of the age group (2-5) years - representing 19% of this group - had initial pulse rate > 130/min, and 17 of the age group ≥ 6 years of age - representing 10% of this group - had initial pulse rate >120/min. Both rates categorize these children as having acute severe asthma according to the UK BTS/SIGN asthma guidelines severity criteria.

Table 2- Initial clinical assessment (respiratory and heart rate).

	Initial respirstory rate	Initial pulse rate
Valid No.	352	332
Missing No.	17	37
Median	40	113
Minimum	16	40
Maximum	82	200

Table 3- Steroids prescription for children with acute asthma.

		Frequency	(%)
Valid	Oral	236	(64.0)
	Intravenously	27	(7.3)
	Both	12	(3.3)
	None	92	(24.9)
	Total	367	(99.5)
Missing	System	2	(0.5)
Total		369	(100.0)

74.6% of patients received systemic steroids; either intravenous (7.3%), oral (64%) or both (3.3%), and 10.8% of admitted children received oxygen although oxygen saturation was not measured for any child during initial assessment.

Only 0.3% received intravenous aminophylline while 99.7% did not. Chest X-ray was done for 0.3% of patients. Only 24.4% of children admitted during the audit period received antibiotics.

No records regarding prophylaxis at discharge was available in the admission sheet.

During the audit period, there was no records in patients' notes concerning discharge planning. In almost all patients, the discharge date and time wasn't clearly stated. However, the discharge date was estimated from the last medication received by the patient in the hospital. No records confirmed that patients were given asthma information/leaflets, taught device techniques assessments, or given written asthma emergency management plan.

No records indicating that further respiratory follow up by hospital or primary care arranged by hospital staff during the audit period.

DISCUSSION

In early life, the prevalence of asthma is higher in boys. At puberty, however, the sex ratio shifts, and asthma appears predominantly in females [11]. In consistence with this verdict, 61.5% of children admitted to ED were boys while 38.5% were girls. Number of acute asthma admissions in previous 12 months prior to the current admission was not reported for any child in the audit period. The British guidelines on the management of asthma consider previous admission for asthma; especially if in the last year; among other factors, indicate severe asthma, making the patient at risk of developing near fatal or fatal asthma [12].

Only the initial respiratory and heart rate measurements were reported in the admission sheet while Peak Expiratory Flow rate (PEF) and pulse oximetry were not done as shown in table 3. UK BTS/SIGN asthma guidelines (2008) recommend that before children receive appropriate treatment for acute asthma in any setting, it is essential to assess accurately the severity of their symptoms. The following clinical signs should be recorded: pulse rate (increasing tachycardia generally denotes worsening asthma; a fall in heart rate in life threatening asthma is a pre-terminal event), respiratory rate and degree of breathlessness (i.e. too breathless to complete sentences in one breath or to feed), use of accessory muscles of respiration (best noted by palpation of neck muscles), amount of wheezing (which might become biphasic or less apparent with increasing airways obstruction), and degree of agitation and conscious level.

Clinical signs correlate poorly with the severity of airways obstruction [13-15]. Some children with acute severe asthma do not appear distressed. Measurements of lung function provide an assessment of the severity, reversibility, and variability of airflow limitation, and help confirm the diagnosis of asthma in patients older than 5 years.

Objective measurements of PEF and oxygen saturation are essential. Suitable equipment should be available for use by all health professionals assessing acute asthma in both primary and secondary care settings [12].

The PEF measurement is not used in Children younger than 5 to assess asthma severity, because at this age children can not perform the required method of use.

Regarding initial pulse rate, collected data showed that 35 subjects of the age group (2-5) years - representing 19% of this group - had initial pulse rate > 130/min, and 17 of the age group ≥ 6 years of age - representing 10% of this group - had initial pulse rate >120/min. Both rates categorize these children as having acute severe asthma according to the UK BTS/SIGN asthma guidelines severity criteria and should have been managed as such.

Regarding in-hospital treatment, analysed data showed

that 99.2 % of the patients received bronchodilator treatment with nebulizers only, the bronchodilator given was the β-2 agonist salbutamol in all cases and no child was given ipratropium bromide as a bronchodilator.

Inhaled β-2 agonists are the first line treatment for acute asthma [15-17]. Pressurized Metered-Dose Inhalers (pMDI) plus spacer is an effective alternative to nebulisers for bronchodilator inhalation to treat mild to moderate asthma. Children receiving β-2 agonists via pMDI and spacer are less likely to have tachycardia and hypoxia than when the same drug is given via a nebulizer [18,19], Children aged <3 years are likely to require a face mask connected to the mouthpiece of a spacer for successful drug delivery. Inhalers should be actuated into the spacer in individual puffs and inhaled immediately by tidal breathing.

There is good evidence for the safety and efficacy of frequent doses of ipratropium bromide used in addition to β-2 agonists for the first two hours of a severe asthma attack. Benefits are more apparent in the most severe patients [20].

Intravenous magnesium sulphate is a safe treatment for acute asthma although its place in management is not yet established [21,22]. During the audit period no child was given ipratropium bromide or intravenous magnesium sulphate.

Most of the patients in this study (74.6%) received systemic steroids; either intravenous (7.3%), oral (64%) or both (3.3%). The early use of steroids for acute asthma can reduce the need for hospital admission and prevent a relapse in symptoms after initial presentation [23,24]. Benefits of steroid can be apparent within three to four hours. Although their onset of action is slow (>4 hours), systemic corticosteroids are important in the treatment of moderate or severe exacerbations because these medications prevent progression of the exacerbation, speed recovery, and prevent relapses [1]. Oral and intravenous steroids are of similar efficacy [25]. Intravenous hydrocortisone (4 mg/kg repeated four hourly) should be reserved for severely affected children who are unable to retain oral medication. There is no need to taper the dose of steroid tablets at the end of treatment. Treatment for up to three days is usually sufficient, but the length of course should be tailored to the number of days necessary to bring about recovery.

There is insufficient evidence to support the use of inhaled steroids as alternative or additional treatment to steroid tablets for acute asthma [26-28].

Children with chronic asthma not receiving regular preventative treatment will benefit from initiating inhaled steroids as part of their long term management. There is no evidence that increasing the dose of inhaled steroids is effective in treating acute symptoms, but it is good practice for children already receiving inhaled steroids to continue with their usual maintenance doses. Only 10.8% of patients in this study received oxygen treatment while 88.9% did not receive oxygen. Oxygen saturation was not measured for any child during initial assessment. Children with life threatening asthma or oxygen saturation <92% should receive high flow oxygen via a tight fitting face mask or nasal cannula at sufficient flow rates to achieve normal saturations.

Only 0.3% received IV aminophylline. There is no evidence that aminophylline is of benefit for mild to moderate asthma and side effects are common and troublesome [29]. However, one well conducted study has shown evidence for benefit in severe acute asthma unresponsive to multiple doses of β-2 agonists and steroids [30].

Chest X-ray was done for only 0.3% of studied patients which is consistent with evidence based practice. Chest x-rays in children with acute asthma rarely produce additional useful information and are not routinely indicated [31].

About a quarter (24.4%) of children admitted

during the audit period received antibiotics.. There is insufficient evidence to support or refute the role of antibiotics in acute asthma [32], however, the majority of acute asthma attacks are triggered by viral infection. Antibiotics shouldn't be given routinely in the management of acute childhood asthma. The proportion of children prescribed antibiotics is likely to have been inappropriately high.

No single physiological parameter defines absolutely the timing of discharge from an admission with acute asthma. Patients should have clinical signs compatible with home management, be on reducing amounts of β-2 agonist (preferably no more than four hourly) and be on medical therapy they can continue safely at home.

Although diurnal variability of PEF is not always present during an exacerbation, evidence suggests that patients discharged with PEF <75% best or predicted and with diurnal variability >25% are at greater risk of early relapse and readmission [33].

No records concerning prophylaxis at discharge are mentioned in the admission sheet of studied patients.

During the audit period, there was no records in patients' case notes concerning discharge planning, in almost all of the cases the discharge date and time wasn't clearly stated and was estimated from the last medication prescribed in hospital. Furthermore, no records of patients given asthma information/ leaflets, had their device techniques assessed, given written asthma plan, peak flow meter, and steroids for emergency use or advised to visit General Practitioner (GP) within 1 week.

Patient self-monitoring is an important tool for patients to assess the level of their asthma control and to adjust treatment according to their action plan [1].

The British guideline on asthma management recommend that prior to discharge, trained staff should give asthma education. This should include education on inhaler technique and PEF record keeping, with a written PEF and symptom-based action plan being provided allowing the patient to adjust their therapy within recommendations. These measures have been shown to reduce morbidity after the exacerbation and reduce relapse rates [34].

No records concerning further respiratory follow up by hospital or primary care arranged by hospital staff during the audit period. It is recommended that after the exacerbation is resolved, the factors that precipitated in the exacerbation should be identified and strategies for their future avoidance implemented, and the patient's medication plan reviewed [35].

This study aimed to audit the acute asthma care in the ED at Wad Madani Paediatrics' Hospital in regard to the published BTS guidelines for management of asthma. During the audit period acute asthma care followed published asthma guidelines in some areas, but deviated from them in many others: Assessment of asthma severity of admitted children appears to contain some deficiencies; The lack of objective measurements of PEF and oxygen saturation using suitable equipment, the number of acute asthma admissions in previous 12 months prior to the current admission which was not reported for any patient. During audit period, the care of acute asthma cases followed the recommendations of in-hospital treatment in the use of inhaled β-2 agonist as a bronchodilator for almost all cases, but the delivery method wasn't complying with these guidelines which recommend the use of different devices according to the age group to assure good delivery of medication and minimize side effects. On the other hand ipratropium bromide as a bronchodilator was not used for any case, whether that was due to not being needed was not clear, though ipratropium bromide is reserved for difficult cases refractory to initial β-2 agonist treatment. The large use of systemic steroids is another achievement of the delivered care being given to almost 3 in every 4 admitted children. The little use of aminophylline, which was used in 0.3% of all patients, appears complying with guidelines which recommend that

aminophylline should be reserved for severe acute asthma unresponsive to multiple doses of β-2 agonists and steroids. The little use of chest x-ray which was done for 0.3% only appears complying with guidelines too, chest x-rays in children with acute asthma rarely produce additional useful information and are not routinely indicated. One in every 4 children received antibiotics, a proportion that appears inappropriately high since antibiotics shouldn't be given routinely in the acute management.

For safe discharge of patients, they should have clinical signs compatible with home management, be on reducing amounts of β-2 agonist and be on medical therapy they can continue safely at home. Unfortunately, discharge planning and documentation was inadequate during the audit period that need more revision to comply with evidence based guideline to assure better patient care.

The findings of this study raise a need for adoption and implementation of a management protocol for acute asthma care in the emergency department based on published international guidelines, the protocol should consist of assessment sheet and written guidelines for the initial management of acute asthma in the emergency department detailing; clinical assessment, medications to be used and specific criteria for safe discharge. Carrying educational programmes for physicians and nurses in the management of acute asthma according to the adopted guidelines is also crucial.

The area of patient information also showed deficiency raising a need for assuring the quality and completeness of information documented in case notes through direct monitoring and follow-up, as well as improvement of the quality of data management by using computer program.

There is an enormous need for adoption of an audit system to evaluate and monitor the effect of management protocols, education and any other interventions or efforts implemented to improve asthma care. Audit can highlight opportunities for research and improve care locally and nationally. Establishment of a dedicated asthma care unit or asthma centre to which ED patients' are directed, a practice that result in significant improvement in the quality of asthma care and resource utilization, is definitely a step forward.

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