

A Clinical Audit of the Management of Acute Asthmatic Attacks in Adults and Children Presenting to an Emergency Department

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ABSTRACT

Objective: To compare the guidelines in the University Hospital of the West Indies (UHWI) acute asthma management protocol with actual practice in the Accident and Emergency Department.

Methods: A prospective docket audit was done of all consecutive medical records of patients, presenting with a diagnosed acute asthmatic attack between June 1 and September 30, 2010, to the emergency department of the UHWI. A convenient sample was used. The audit tool used was created from the UHWI protocol for the emergency management of asthma in adults and children, as well as the British Adult Asthma Audit Tool. The audit tool assessed three main sections: initial assessment, initial management, and discharge considerations. Data were coded and entered in Microsoft Excel 2007 and statistical analyses conducted using Stata version 10. Management patterns were compared to the actual protocol and then discussed.

Results: A total of 15 864 patients were seen during the study period. Of these, a total of 293 patients were seen for a presentation of acute asthma. More females (57.3%) than males were seen, with the mean age of 33.53 years. Only 31% of patients were given a severity assessment of mild, moderate, or severe. Peak expiratory flow rate (PEFR) was attempted and recorded in 62%, but only 18.1% of patients had both pre and post PEFR done. Only 4.4% of patients were administered nebulizations within the suggested time frame. Positively, 94.2% of patients were given a prescription for inhaled corticosteroids and bronchodilators to continue post-discharge.

Conclusions: Acute asthma management still remains an area of medical practice that continues to have long-standing difficulties. Failure to assess and document the severity of asthma attacks along with the under-utilization of PEFR was noted.

Keywords: Acute asthma, emergency department, Jamaica

Auditoría Clínica del Tratamiento de Ataques de Asma Agudos en Adultos y Niños que Acudieron a un Departamento de Emergencias

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RESUMEN

Objetivo: Comparar las pautas del protocolo para el tratamiento del asma aguda en el Hospital Universitario de West Indies (HUWI) con la práctica real en el Departamento de accidentes y emergencias.

Métodos: dientes de todos los registros médicos consecutivos de pacientes a quienes se les diagnosticó ataque de asma agudo entre junio 1 y septiembre 30 de 2010, Se utilizó una muestra conveniente. El instrumento para la auditoría fue creado a partir del protocolo para el tratamiento de urgencias de asma en adultos y niños, así como la Guía Británica de la Auditoría del Asma en Adultos. El instrumento de la auditoría evaluó tres secciones principales: la evaluación inicial, el tratamiento inicial, y las consideraciones para el alta. Los datos fueron codificados e introducidos en Microsoft Excel 2007, y los análisis estadísticos se realizaron utilizando el programa Stata versión 10. Los patrones de tratamiento fueron comparados con el protocolo real y luego discutidos.

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Resultados: Un total de 15864 pacientes fueron vistos durante el periodo de estudio. De éstos, un total de 293 pacientes presentaban asma aguda. Se vieron más hembras (57.3%) que varones, siendo la edad promedio 33.53 años. Sólo el 31% de los pacientes recibieron una evaluación de la severidad en término de leve, moderada o severa. La tasa de flujo espiratorio máximo (TFEM) se intentó y se registró en el 62% de los pacientes, pero sólo al 18.1% se les realizó mediciones anteriores y posteriores de TFEM. Sólo al 4.4% de los pacientes se le aplicaron nebulizaciones dentro del marco de tiempo sugerido. En un sentido positivo, 94.2% de los pacientes recibieron prescripciones para continuar con la inhalación de corticosteroides y broncodilatadores después del alta.

Conclusiones: El tratamiento del asma aguda sigue siendo un área de práctica médica con una larga historia de dificultades. Se observó falta de evaluación y documentación de la severidad de los ataques de asma, acompañada de una subutilización de TFEM.

Palabras claves: Asma aguda, departamento de emergencia, Jamaica

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INTRODUCTION

Asthma is a chronic disease characterized by recurrent attacks of breathlessness and wheezing and is the most common chronic disease among children in the world (1). In the United States of America (USA), 17.5 million adults and 7.1 million children currently suffer from asthma (2). This disorder is still under-diagnosed and under-treated in most countries in the world including Jamaica (1, 3–5). In 2007, an island wide, cross-sectional, community based survey was done to estimate the prevalence of asthma and allergies in the Jamaican population (3–5). This survey examined the paediatric, adult and elderly populations separately. From preliminary results reported, the investigators found the current prevalence of asthma in children aged 2–17 years was 26.5%, in adults 13.5% and in the elderly, 65 years and older, it was 12.5% (3–5). The Pan American Health Organization (PAHO) reported that in 1999, respiratory tract infections accounted for a total of 12% of all visits to the emergency department (ED) of hospitals, and 49% of these visits were related to asthma (6).

There have been no published emergency room based asthma studies done in Jamaica. The Accident and Emergency Department of the University Hospital of the West Indies (UHWI) has a protocol for acute management of asthma in adults and children which has not yet been modified to match the Global Initiative for Asthma (GINA) Guidelines for 2009 (7). The current protocol has never been audited. It is based on the National Asthma Education and Prevention Programme Guidelines (NAEPP) Expert Panel III, published in 2007 (8). This clinical audit of the current management will identify both the positive and negative aspects and pave the way for appropriate protocol adjustment that will not only fulfil the 2009 GINA guidelines but will be geared toward the needs of our population.

The aim of the study was to compare the written UHWI acute asthma management protocol with actual management. The specific objectives were to compare what was set out in the UHWI acute asthma management protocol with actual practice in the Accident and Emergency Department for:

- Initial assessment:
 - a. Use of peak expiratory flow rate
 - b. Use of oxygen saturation
- Initial management:
 - a. Use of intravenous corticosteroids
 - b. Use of nebulizations
- Discharge instructions

SUBJECT AND METHODS

A prospective docket audit was carried out, looking at all consecutive medical records of patients, aged two years and older, presenting with a diagnosed acute asthmatic attack between June 1 and September 30, 2010, to the Accident and Emergency Department of the UHWI. Ideally, the sample size should have been calculated using prevalence data, however, this was not available until after the study was started. Therefore, a convenience sample was used. The asthma audit tool (Appendix 1) used in the study was adapted and created from the UHWI protocol for the emergency management of asthma in adults and children, as well as the British Adult Asthma Audit Tool (9–10). The audit tool assessed three main sections: initial assessment, initial management and discharge considerations. In the initial assessment section, performance of the peak expiratory flow rate (PEFR) was used. The definition used for PEFR, also known as peak flow, is “the maximal rate that a person can exhale during a short maximal expiratory effort after a full inspiration” (11).

Once all the data were collected, they were analysed and a comparison was made between the standard UHWI management protocol and what was actually performed.

All patients aged two years and older that presented to the Accident and Emergency Department of the UHWI complaining of an acute asthmatic attack between June 1 and September 30, 2010, were included in the study.

All patients discovered after initial assessment to have a different primary cause to their “asthmatic type” symptoms (wheezing, coughing, and/or shortness of breath), such as cardiac asthma, chronic obstructive pulmonary disease

(COPD) or foreign body ingestion, were excluded from the study.

Data were coded and entered in Microsoft Excel 2007 and statistical analyses conducted using Stata version 10. Frequency tables and histograms were generated to display univariate distributions. Chi-squared (or Fisher's exact where appropriate) tests of associations were used to examine bivariate analyses for categorical variables and Student's *t*-tests used for analyses involving age and PEFR.

Ethics approval for this study was obtained from the University Hospital of the West Indies/University of the West Indies/Faculty of Medical Sciences Ethics Committee.

RESULTS

A total of 15 864 patients were seen in the Accident and Emergency Department at UHWI during the study period June 1 to September 30, 2010. Of these, a total of 293 patients were seen for a presentation of acute asthma. As some patients had multiple visits, the 293 records represented 260 unique patients. For assessing age and gender distribution of the patients, only data from the first visit were used. Otherwise, each record was treated independently for the purpose of analyses.

There were 42.7% (111/260) male and 57.3% (149/260) female patients. Among the 260 unique patients, ages ranged from two to 93 years with mean (SD) of 33.53 (21.34) years. As shown in Fig. 1, the age distribution was

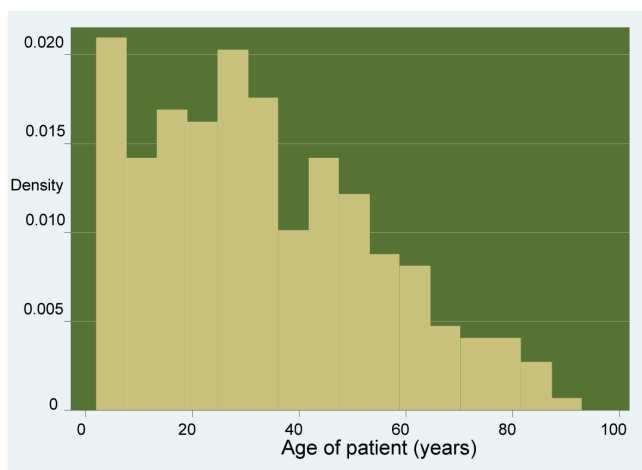


Fig. 1: Graph showing positively skewed age distribution.

positively skewed. Furthermore, the coefficient of skewness was 0.515 and coefficient of kurtosis as 2.510 with respective *p*-values being 0.001 and 0.049 for the Skewness-Kurtosis tests for normality, suggesting that the distribution of age deviated from normality.

Areas of assessment

Section 1: Initial assessment

There were no data available for the majority of patients, 162/293 (55.29%), regarding the previous hospital visit for

acute asthma attack. Sixty-five (22.18%) of 293 patients reported never coming to hospital for their asthma attacks or it had been longer than one year (Table 1).

Table 1: Frequency distribution of patient visits to the University Hospital of the West Indies Accident and Emergency Department for an acute asthma attack

Last visit (months)	Frequency (n)	Percentage
Less than 1 month	41	14.0
1–3 months	10	3.4
3–12 months	15	5.1
> 12 months/never	65	22.2
No data available	162	55.3

First recorded PEFR values were available for 184 (62.8%) of the 293 patient records, and ranged from 100 to 720, with a mean (SD) of 285.43 (117.11). Distribution of PEFR was positively skewed. Coefficient of skewness was 0.886 and coefficient of kurtosis was 4.234 with respective *p*-values being < 0.001 and 0.009 for the Skewness-Kurtosis tests, indicating departure from normality. Graphical display of the distribution of the first recorded PEFR is shown in Fig. 2.

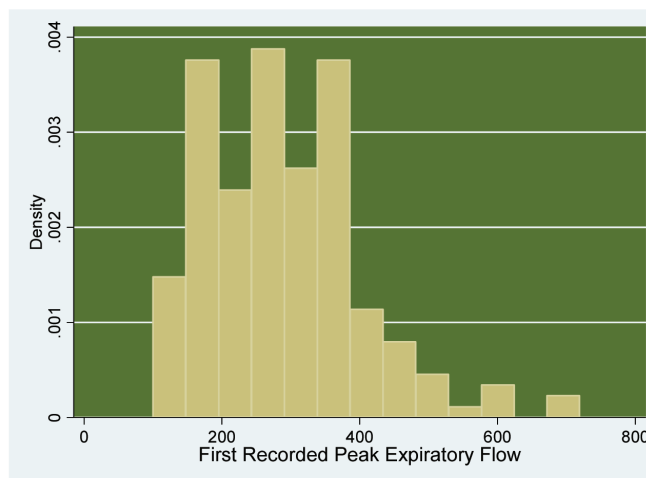


Fig. 2: Graph showing distribution of first recorded peak expiratory flow rate.

Of the 184 (62.8%) patients that received PEFR, only 64 (34.8%) were measured prior to bronchodilation, and of these, only 34 (18.5%) had the expected PEFR recorded. Two hundred and seventy-three (93.2%) of the patients had a recorded oxygen saturation of greater than 90%, however, 263/293 (89.8%) patients had their oxygen saturation (SaO₂) done on room air; the other ten patients had oxygen saturation done while on oxygen. Of the 263 who had SaO₂ done on room air, 251 (95.4%) had an SaO₂ exceeding 90%. In total, an arterial blood gas was performed on 12/293 (4.1%) patients.

Section 2: Initial treatment

On arrival, 93/293 (31.7%) of the patients had their acute asthma attack assessment recorded as either mild, moderate or severe. Of the 293 patients, 16 (5.5%) were given intravenous corticosteroids on arrival at the emergency department. Three nebulizations to be given every twenty minutes for the first hour were ordered for all the patients, however, only 13 (4.4%) patients were administered the nebulizations within this time frame. Ipratropium bromide had been ordered by the physician to be given with the nebulizations in 272/293 (92.8%) of the cases, however, it was only ordered appropriately (one dose per set of three salbutamol nebulizations) in one case. The majority of patients were reassessed almost two hours post-completion of nebulizations and many patients had no recorded reassessment times (Fig. 3).

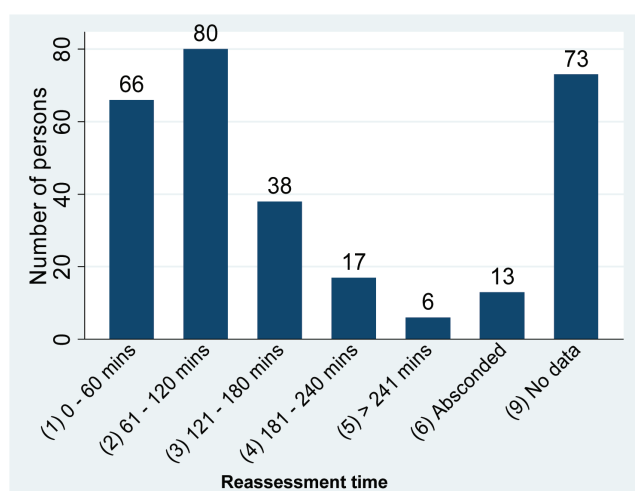


Fig. 3: Distribution of reassessment times post nebulizations.

Of the 293 patients, 148 (50.5%) had a PEFR recorded after a set of nebulizations. A total of 53/293 (18.1%) patients had both pre and post PEFR done. Out of the 293 patients, 13 (4.4%) and four (1.4%) patients received magnesium sulphate ($MgSO_4$) and intravenous aminophylline, respectively during the four-month study period. The majority of the patients treated for acute asthmatic attacks, 86.7% (254/293), were discharged home after initial treatment in the emergency department. Thirteen (4.4%) of the patients were admitted to the general medical wards (Fig. 4). No patients died and none was admitted to the intensive care unit (ICU) during the study period.

Section 3: Discharge considerations for patients discharged home

Among the 293 patients, 137 (53.9%) patients had a past history of inhaled corticosteroids use prior to their emergency room visit. Ninety-four per cent (94.2%; 129/137) of them were given a prescription for inhaled corticosteroids to continue post-discharge. In addition, 77/293 (30.3%) patients were started on oral corticosteroids post-discharge as well.

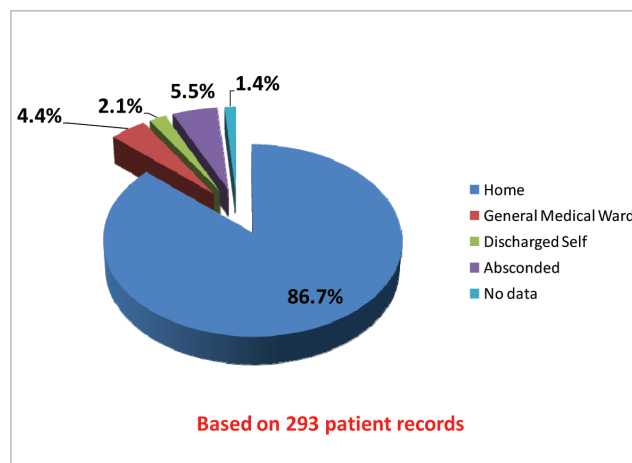


Fig. 4: Pie chart describing discharge distribution.

Inhaler technique was checked in only 1.6% (4/293) of patients, while 0.8% (2/293) received an action plan. Thirteen per cent (33/293) of the patients seen were referred for follow-up 24 hours post-discharge.

DISCUSSION

The demographic data from the UHWI clinical audit revealed that asthma is predominantly a disease of young adults, with a mean age of 33.53 years (1, 12). Gender demographics were almost equal, with the number of females seen (57.3%) being slightly higher than the total number of males seen (42.7%). Information on the patient's previous admission for asthma is important to gauge the patient's control; however, no data were available for the majority of presentations during the four-month study period (55.29%). Fourteen per cent of the patients had been seen within the last month. This might have been due to poor compliance on discharge medications from previous visits either due to inability to buy medications, inability to use the inhalers properly, an asthma plan that was improperly understood by the patient, or poor in-hospital management on previous admission resulting in increased post-discharge morbidity and re-admission (13).

At the UHWI emergency department, the acute asthma management protocol aims to categorize the patient into one of four categories before treatment is started. The four categories are mild, moderate, severe and life-threatening exacerbations. There are two components to this evaluation: clinical examination and PEFR measurements (10). It was demonstrated that some of the emergency physicians assessing the patients were effectively recording many of the indicators that are needed to objectively categorize the patients, such as record of last attack (44.71%), history of steroid use while having the acute attack (73.2%), oxygen saturation on room air (89.8%) and pre-bronchodilation PEFR (34.8%). However, only 31.7% of the patients had translation of their clinical parameters to an assessment of their asthma attack severity. This was worrisome because

patients not being assessed into a 'management group' could not be guaranteed consistent treatment according to the protocol, which is based on accurate categorization of the patient. It may result in under-treatment during the ED admission, which has been associated with higher rates of morbidity post-discharge and increased rates of ED re-admission (13–14). Similar outcomes were seen in a study done in West Glasgow at a large urban teaching hospital, where severity assessment was only done in approximately half the patients, resulting in inappropriate treatment in many cases (15).

With regards to the initial assessment, only 62.8% of patients seen in the four-month period had a PEFR done. Of this total, approximately one-third (34.8%; 64 patients) had a pre-bronchodilation PEFR collected, while even less patients (53/293) had both pre and post bronchodilation PEFR done. Also, only 18.5% of the patients who had a PEFR done, concurrently had their expected PEFR recorded. This would mean there was no comprehensive interpretation of the PEFR for most patients (81.5%). It is well recognized that it is the percentage value of the expected PEFR that is used in conjunction with other indicators to determine severity of the attack (10). For example, patients who have a PEFR that is between 50 and 80% of their predicted value will be classified as having a moderate exacerbation (10). The results from the audit in regards to the complete documentation of PEFR collection needs improvement, as PEFR is a major component of the evaluation of the acute asthmatic patient as recognized in the institutional protocol used (10).

The audit showed that most (89.8%) patients had their oxygen saturation done on room air and of these, 95.4% had SaO₂ greater than 90%. This was better than some studies that showed that SaO₂ was performed as infrequently as PEFR (16–17). According to the guidelines, an arterial blood gas was only necessary in patients whose oxygen saturation was less than 90%. Only 4.1% of the patients who had SaO₂ done needed an arterial blood gas (SaO₂ < 90%). The literature showed that the routine use of arterial blood gas in an emergency room to determine severity of asthma attack varied between zero and 75%, and that the more objective measures were respiratory rate, pulse oximetry, heart rate and PEFR (13–15). In fact, this re-emphasizes the importance of the pulse oximetry, as this tool guides the physician to patients that need an arterial blood gas (ABG), which will in turn identify patients with a partial pressure of CO₂ (PCO₂) greater than 42 mmHg, indicating a possible impending ICU admission [as per UHWI protocol] (10).

All the acute management protocols for asthma that are available indicate inhaled beta-agonists as the mainstay of bronchodilator treatment (7–8, 18). The dosage and frequency of the drug is dependent on the severity of the asthmatic attack (10). The recommended drug is salbutamol, and the initial therapy is 2.5–5 mg in 3 cc of normal saline administered *via* nebulization every 20 minutes over one hour (10, 19). If there is inadequate response to this dosage

and frequency, then continuous nebulizations should be considered (19). Studies have also shown that metered dose inhalers of salbutamol when used with a holding chamber (spacer) have similar efficacy to nebulization therapy in severe asthmatic attacks (20). Of note, 400 mcg of inhaled salbutamol is equivalent to 2.5 mg of nebulized salbutamol, and the frequency of delivery may be adjusted according to the patient's response (20).

The addition of ipratropium bromide, an anticholinergic agent to the beta-agonist, either by metered dose inhaler or by nebulization has been shown to increase the bronchodilation effect (21). The recommended dose is 0.5 to 1.0 cc (500 mcg) in 3 cc of normal saline, administered with the first dose of salbutamol in each set of three (first hour). This dose can be repeated every sixty minutes if adequate response is not achieved. It is reported that the addition of ipratropium bromide is most beneficial in the patient with severe airflow obstruction (21). This drug has not been associated with any side effects and is recommended for use in both children and adults; however, there have been no studies to see the effects of giving the medication with every dose of salbutamol (22). This was noted in the UHWI audit. Ipratropium bromide was ordered in 92.8% of the patients, but was ordered appropriately in only one case.

Nebulizations were ordered for all asthmatics seen in the emergency department during the audit period, but only 4.4% (13/293) of the patients received nebulizations as ordered, one every 20 minutes over one hour. This may have been due to poor staffing of the asthma treatment section. It would be interesting to discern if the addition of bronchodilator inhalers as an alternative in the UHWI protocol would correct this problem, since this delivery system is much less time consuming.

Associated with this was the second problem of reassessment post-nebulizations. Ideally, patients should be reassessed shortly after they have completed their first set of nebulizations or metered dose inhalations, approximately 60 minutes from the start of their treatment. In a busy emergency department this may not be practical for every asthmatic patient that presents. In the UHWI audit, the majority of patients (27.30%) were reassessed between 61 and 120 minutes post nebulizations. Longer reassessment times may cause patients to take longer to recover from their attack, as well as cause more patient congestion in the ED.

The audit scrutinized the use of intravenous corticosteroids, and this was recorded in 5.5% (16/293) of patients. The low number of usage may be misleading as patients may have been receiving oral steroids instead, which was not recorded. In retrospect, it would have been prudent to collect data for both oral and intravenous steroid use.

The current UHWI protocol recommends administering MgSO₄ over 10 minutes for severe asthmatics (10). Thirteen patients received MgSO₄ in the emergency department. Intravenous aminophylline use is restricted only to patients that present with 'refractory life-threatening

asthma', for use as an adjunct to conventional treatment options (23). Aminophylline has been associated with an increase of side effects and so should be used with caution at a loading dose of 6 mg/kg over 30 minutes, then as a maintenance infusion of 0.5 to 0.9 mg/kg/hour (23). The current UHWI protocol does not state dosages to be used for aminophylline, and recommends it be reserved primarily for the patients with chronic obstructive pulmonary disease COPD (10). Only four patients required the use of aminophylline as indicated by the results of the audit.

The majority of patients seen during the study period were discharged home (254/293 = 86.7%). After an acute exacerbation of asthma, lung function takes approximately seven to 10 days to completely stabilize and for asthmatic symptoms to disappear (24). It is for this reason that a short seven to 14 day course of oral corticosteroids is recommended on discharge from the ED, to decrease early relapse after acute exacerbation of asthma (25–26). However, only 30.3% of the discharged patients received a prescription for oral corticosteroids. The current UHWI protocol is not specific on duration and dosage of oral corticosteroids at discharge (10). Patients should also either be started on or continued on an inhaled corticosteroid to be used as their 'control/maintenance' medication to keep away the asthma symptoms (7–8, 18). It must be emphasized that the main objectives of asthma therapy are to expeditiously establish and maintain control with comprehensive strategies that may be individualized. Most patients (94.2%) in the audit were given an inhaled corticosteroid in their discharge prescription. It is clear that this criterion is being met which may explain the overall relatively low admission rate.

Only four patients had their inhaler use technique checked, two patients received an asthma action plan, and only 33 had follow-up arranged for them within 24 to 48 hours post discharge. The current UHWI protocol does not include checking inhaler usage (10). These deficiencies were also seen in other asthma audits performed around the world, such as data collected from emergency departments in Chicago showed that less than 50% of their patients received any training on the use of an inhaler, received a written asthma action plan, or received a follow-up appointment at discharge (27). Similar complaints were made from studies done in Spain as well (16–17).

LIMITATIONS

Limitations of this study include the time period chosen for the study. Asthma has seasonal variations and the winter months may have afforded a larger sample size than what was found in the summer months of the year – June to September. This study was a single centre study, an important limitation. A more detailed audit that included data collection on the use of oral steroids as well as post-nebulization PEFR would be useful. An education campaign on acute asthma management, and familiarizing the staff with the

protocol before starting data collection might have yielded better audit results.

RECOMMENDATIONS

The UHWI acute asthma management protocol should be updated to the most current guidelines; inhaled beta-agonists and inhaled corticosteroids should be added as alternatives in the management protocol. There should always be a good supply of peak flow monitors in the ED. Educational campaigns, including both didactic teaching and visual aids that impress the management of acute exacerbation of asthma in the ED, and bi-annual audits on the management of acute asthma in the ED, should be initiated. This is to ensure a regular auditing process.

It might be prudent to consider creating a standard form that gathers history and examination findings on all asthmatics presenting, and that also outlines management according to the severity assessment. This would eliminate documentation time that is needed to take all the recommended information, and ensure that there is uniformity in ordering of medications and other management orders. This is especially important in the ED where there is a high turnover of new doctors working at any given time of the year. The formation of an ED task force that enforces timely management and follow-up would help improve overall management. Patient education by the customer service staff as well as the patient advocates will create the right environment for improvement of patient care. Finally, sharing this study information with other hospitals, clinics and the Ministry of Health can spur further research in this area, which ultimately will improve acute asthma management.

CONCLUSION

Acute asthma management still remains an area of medical practice that continues to have long-standing difficulties. Our clinical audit demonstrated that despite availability of evidence-based guidelines in management, the receiving emergency room teams continue to fail to assess the severity of the attack and manage the patient appropriately. Educational campaigns and regular re-auditing may help to improve this situation.

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APPENDIX**ASTHMA AUDIT TOOL****Section 1: Initial Assessment**

- 1.1 Study Identification Number _____ 1.2 Male
Female
- 1.3 Age _____
- 1.4 Admission Date _____
- 1.5 Has patient recently been in hospital for asthma?
Within 1 month of admission date
Within 1 and 3 months
3 months, but within past year
Never admitted/more than 12 months ago
No data/not recorded
- 1.6A Was there a First recorded Peak Expiratory Flow Yes No
No data
If yes to 1.6A then answer 1.6B–1.8
- 1.6B First recorded Peak Expiratory Flow _____
- Was this PEFR measured pre bronchodilation? Yes No No data
- 1.8 Was the expected PEFR recorded? Yes No No data
- 1.9A Was the SaO₂ done on room air? Yes No No data
- 1.9B Was the SaO₂ >90%? Yes No No data
- 1.10 Was ABG performed? Yes No No data

Section 2: Initial Treatment

- 2.1 Were intravenous corticosteroids given? Yes No No data
- 2.2 Were 3 nebulizations given every 20 mins for 1st hour? Yes No
No time recorded absconded
- 2.3 Was patient's acute attack assessment recorded as a mild, moderate or severe asthmatic episode? Yes No No data
- 2.4 Was ipratropium bromide ordered by doctor for nebulizations? Yes
No No data
- 2.5 Was ipratropium bromide ordered appropriately? (One dose with the 1st dose of salbutamol in each set of three) Yes No
No time/data recorded
- 2.6 How long after 1st set of nebulizations, was patient reassessed?
0–60 mins 60–120 mins 121–180 mins 181–240 mins
>241 mins Absconded No data
- 2.7 Was a post nebulization PEFR done after last set of nebulisations?
Yes No No data
- 2.8 Did the patient receive magnesium sulphate in the ED? Yes No
No data
- 2.9 Did the patient receive intravenous aminophylline in the ED? Yes
No No data
- 2.10 Where was the patient discharged to? Home
General medical ward ICU Morgue Discharged self
Absconded No data

Section 3: Discharge Considerations – ONLY for patients discharged home

- 3.1 Was the patient taking inhaled corticosteroids (ICS) before presentation?
Yes No No data recorded
- 3.2 If answer to 3.1 was yes, were ICS continued on discharge prescription?
Yes No No data/NA
- 3.3 Was inhaler technique checked? Yes No No data
- 3.4 Was a course of oral steroids prescribed from ED? Yes No
No data
- 3.5 Was a written action plan given to the patient? Yes No
No data
- 3.6 Was a follow-up arranged within 24–48 hours? (Primary care, pulmonology clinic) Yes No No data