

Severity Factors and Management of Severe Acute Asthma in Saint Louis, Senegal: About 20 Cases



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Abstract

Introduction: Severe acute asthma (SAA) is an unusual bronchial obstruction. It can be life-threatening. Its management first requires the early identification of serious forms. The aim of this work is to study the severity factors and the management of SAA in the intensive care unit of Saint Louis regional hospital.

Material and methods: We conducted a retrospective, descriptive and analytical study, which spans a year from January 1st to December 31st, 2018. We included all patients received for severe acute asthma. We have studied the severity criteria, clinical, anamnestic, therapeutic and prognosis data.

Results: The prevalence of SAA is 4.4% (20 cases out of 450 hospitalized patients). The average of age was 35.7 years (E: 14 - 83 years) and the sex ratio was 0.6. The severity factors found were respiratory distress (40%), peak expiratory flow <150l/min (35%), severe hypoxemia and consciousness disorders (15% each). The bronchodilator molecules used were Short Action Beta 2 Agonists by inhalation in 100% of cases (n = 20) or by injection in 55% of cases (n = 11), magnesium sulfate IV in 50% of cases (n = 10), adrenaline at beta dose and ketamine in 20% of cases (n = 4), halogenated in 10% of cases (n = 2). Intubation ventilation was required in 30% of cases and the use of Non-Invasive Ventilation (NIV) was notified in 25% of cases. The evolution was favorable in 95% of the cases and the mortality was 15% (3 cases).

Conclusion / Discussion: The initial therapeutic management of severe acute asthma is currently well codified. Its prognosis then depends on rapid assessment of severity and identification of risk factors that condition the therapeutic modalities and unit of management.

Keywords: Severe acute asthma; Severity factors; Treatment

Abbreviations: SAA: Severe Acute Asthma; PEF: Peak Expiratory Flow; SABA: Short Action Beta-2 Agoniste;

Introduction

Severe acute asthma (SAA), or severe asthma exacerbation, is defined as an unusual attack with severe bronchial obstruction that may be life-threatening in the short term [1]. Its management is well codified with clearly identified levels of management. More than diagnosis, early identification of severe forms of asthma is the real challenge in the management of this pathology. The objectives of this work was to study the severity factors,

management and prognosis of severe asthma exacerbations received in the resuscitation department of Saint Louis Regional's Hospital Center.

Material and Methods

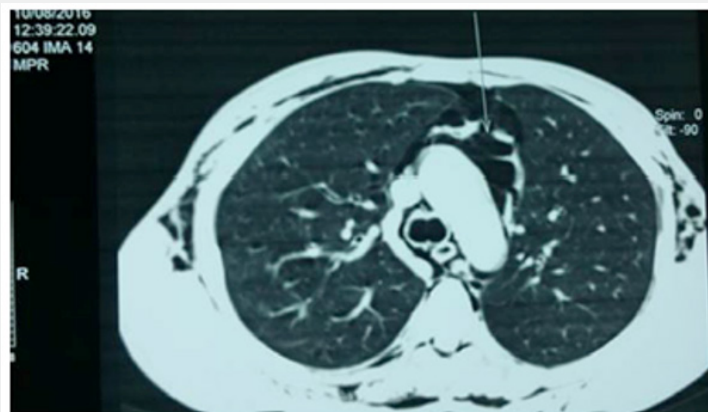
We conducted a retrospective, descriptive and analytical study at the resuscitation unit of the Saint Louis regional hospital

in Senegal, covering a year from January 1st 2018 to December 31st, 2018. We included all patients admitted to the department for the management of severe acute asthma. We studied all clinical, paraclinical, therapeutic, progression and severity data of patients admitted for severe acute asthma. The data were first collected on an Excel database and then analyzed on Epi Info 7.1; a uni-variate and then a bi-variate analysis was performed and a relationship was significant when the p value was < 0.05.

Results

We collected 20 cases of severe acute asthma (S.A.A.) out of a total of 450 patients admitted to the resuscitation department during the study period, representing a prevalence of S.A.A. of 4.4%. The mean age of our patients was 35.7 years with extremes ranging from 14 to 83 years. The sex ratio was 0.6. The interview and clinical anamnesis revealed that 80% of our patients (n=16) had a history of asthma, 15% of our patients (n=3) were already hospitalized for AAG during the same year and 10% of our patients (n=2) had a history of high blood pressure with poor adherence to treatment. For all our patients, the positive diagnosis of asthma was made according to clinical and anamnestic arguments (questioning, clinical examination, anamnesis, pulmonary auscultation...). The severity factors reported in all our patients ranged from respiratory distress in 40% of cases to severe hypoxemia and consciousness disorders in 15% of cases each. Peak expiratory flow (PEF) achieved in 55% of cases (n=11) led to the diagnosis of SAA in 7 patients, i.e. in 35% of cases. Table 1

shows the distribution of severity factors in our workforce. All of our patients benefited from a conditioning treatment (peripheral venous line, standard monitoring, oxygen therapy according to a mode adapted to the clinical condition), administration of injectable corticotherapy (hydrocortisone) and bronchodilators, and a standard chest X-ray. The bronchodilator molecules used were Short Action Beta 2 Agonists by inhalation in 100% of cases (n=20) or by injection in 55% of cases (n=11), magnesium sulfate by injection in 50% of cases (n=10), adrenaline in beta dose and ketamine by injection in 20% of cases (n=4), halogenated drugs by inhalation in 10% of cases (n=2). Table 2 shows the frequency of use of bronchodilator molecules in our population. All our patients benefited from oxygen therapy by mask, intubation ventilation was necessary in 30% of cases (n=6) and the use of Non Invasive Ventilation (NIV) was reported in 25% of cases (n=5). Anamnesis and etiological research identified two types of asthma triggers: community-acquired pneumonia in 45% of cases (n=9) and poor compliance with treatment in 20% of cases (n=4). The evolution of our patients was marked by the installation of complications like acquired pneumopathy under mechanical ventilation and spontaneous pneumomediastinum (Figure 1) which were noticed in 1 patient each, i.e. in 5% of cases. In 95% of the cases (n=17), the evolution was favorable with transfer of the patients to the pneumology department; however, 3 cases of death were reported, i.e. a mortality rate of 15%. The causes of death were septic shock in 67% of the cases (2 cases) and multiple organ failure in 33% of the cases (1 patient).



SABA: Short Action Beta-2 Agoniste

Figure 1: Thoracic axial CT showing a spontaneous pneumomediastinum (arrow) and axillary subcutaneous emphysema complicating severe acute asthma.

Discussion

A positive diagnosis of an asthma attack is usually not a problem in itself, whereas the severity of acute asthma is more complex to assess. This is the challenge in the medical management of acute asthma, since the assessment of severity will determine patient orientation and treatment modalities. Moreover, underestimation of the severity of an attack is a major contributor to under-

management and directly impacts the prognosis of severe acute asthma (SAA) [2]. The Global Initiative for Asthma (GINA) and the World Health Organization (WHO) estimate that asthma affects at least 200 million people worldwide and that the mortality rate is as high as 180,000 deaths per year [3]. However, the prevalence of asthma depends on the methods used to diagnose it and the healthcare provision, which at least partly explains its

variability between countries. In France, the prevalence of asthma symptoms varies from 10% to 18% in children aged 13-14 years and from 2.7% to 4% in adults aged 20-44 years [3]. The study "Asthma in emergency" (ASUR) conducted in France showed that SAA accounts for a quarter of the forms of acute asthma seen in emergency departments [3]. In total, between 50,000 and 100,000 SAA are treated in emergency departments each year in France; 10,000 to 15,000 are hospitalized in resuscitation and fewer than 1,000 are ventilated mechanically [4]. There is a seasonal distribution of SAA corresponding to periods of air pollination in the northern hemisphere and winter respiratory viral infections [1,5]. In our study, the prevalence of severe acute asthma of 4.4% is lower than in other studies, certainly due to the inadequacy of other diagnostic means such as the absence of blood gas and PEF, which is not performed systematically. This difference in prevalence is also related to the non-unambiguous nature of the definition of severe acute asthma. SAA can be considered as an unusual asthma attack due to a severe, life-threatening, short-term bronchial obstruction [1]. This definition does not clearly delimit the nosological framework of an entity whose clinical, functional and gas manifestations are not unambiguous. This confusion is aggravated by the Anglo-Saxon classification whose terminology is not completely appropriate to the French typology, hindering the understanding and analysis of the literature published in English. However, the criteria for determining the severity of an asthma attack seem to be fairly consistent between the different terminologies used in national or international recommendations, and there is a continuum at the clinical, functional and gas level in the expression of the intensity of an asthma attack [6]. Several studies have attempted to identify predictive factors of severe asthma exacerbation in patients with asthma. A meta-analysis published in 2005 found a significant association between the risk of mortality (fatal asthma) or of using mechanical ventilation (near-fatal asthma) and the following variables: hospitalization for asthma exacerbation, in particular in intensive care during the past year; previous exacerbation that prompted the use of mechanical ventilation; recent or current treatment with oral corticosteroids; high (more than 1 vial of inhaled salbutamol per month) or increasing consumption of beta-2 mimetics [7,8].

Lack of background treatment with inhaled steroids and psychosocial disorders appeared to be associated with a higher risk of severe exacerbation [9,10]. In patients admitted to resuscitation, advanced age, neurological disorder and tachycardia were clinical features associated with poor prognosis [11-13]. Data for patients admitted to resuscitation were published in Japan in 2017 [14]. Age >70 years, shock, altered consciousness, and infectious pneumonia were associated with an increased risk of death. Peak expiratory flow (PEF) at admission has been little assessed but would not be associated with a poor prognosis [11,12]. In our study, the most common severity factors were respiratory distress and decreased peak expiratory flow in 40% and 35% of cases, respectively. Severe hypoxemia as a sign of severity was

found in 15% of cases in our study. These results are close to those described in the literature, because due to severe bronchial obstruction, the decrease in peak expiratory flow is responsible for hypoxemia and more or less for hypercapnia. The management of severe acute asthma is well codified. The priority is first of all to ensure safety by putting the patient in the right condition (oxygen therapy, installation of a venous line, semi-seated position, etc.) and then the evaluation of the patient's severity will determine the need for admission to resuscitation. The evaluation of the severity of the bronchial obstruction is an essential first step before starting an adapted treatment. Although it can be done quickly, it should not be overlooked as it will serve as a reference to document the effectiveness of the treatment [15]. It is essentially based on clinical [15] and/or gas data. The general appearance of the patient is one of the most useful elements in assessing severity. The inability to lie down, the inability to speak, the use of accessory respiratory muscles, in particular sternocleidomastoid muscles, and excessive sweating are excellent simple markers of severity [16]. Respiratory rate above 30/min, tachycardia at more than 120/min are also evidence of the importance of bronchial obstruction [17]. The existence of a paradoxical pulse greater than 12mmhg frequently mentioned in the literature [17] can be difficult to determine in practice in polypneic patients. The presence and intensity of sibilance is poorly correlated with bronchial obstruction [18] which, when it is intense, may on the contrary be accompanied by true auscultatory silence. As for cyanosis, disturbances of consciousness, and respiratory pauses, these are signs of extreme seriousness, generally late signs that indicate that respiratory arrest is imminent [15]. The degree of bronchial obstruction can be quickly assessed in the patient's bed by measuring the peak expiratory flow (PEF). A PEF between 30 and 50% of the theoretical value of the patient's personal optimum figure (in practice less than 150l/min in adults) is usually considered as an index of severity and the vital prognosis is seriously threatened in the short term when the PEF is less than 30% of its theoretical value [19]. However, this simple test, which is useful in assessing severity and in therapeutic follow-up, may be difficult to perform in very dyspneic patients because the forced inspiration it imposes may aggravate bronchospasm. Other criteria such as $SpO_2 < 90\%$, $PaO_2 < 60\%$ and $PaCO_2 > 45\%$ are also important in determining asthma severity [20].

These same criteria of gravity, with a few differences, are also described by the French Society of Emergency Medicine in its work of formalized expert recommendation carried out in conjunction with the French Language Resuscitation Society [21]. Indeed, the two learned societies recommend to look for criteria of severity when faced with an asthma attack such as: a history of hospitalization and use of mechanical ventilation for asthma, recent intake of oral corticosteroids, significant or increasing consumption of beta 2 mimetics, age >70 years, difficulty in speaking, consciousness disorders, state of shock, respiratory rate > 30 cycles/min, existence of arguments in favor of an infectious

pneumopathy [22]. In our study the severity criteria ranged from respiratory distress in 40% of cases to severe hypoxemia ($SpO_2 < 90\%$) in 15% of cases. The same constraints described in the literature for the realization of the DEP were met and no blood gas severity criteria were reported due to the non-availability of arterial blood gas measurement in our center.

Humidified Oxygen Therapy is the treatment of any acute hypoxemic respiratory insufficiency without underlying chronic hypercapnic respiratory failure. Nebulization masks are conveniently used while at the same time allowing the administration of inhaled bronchodilators. High-concentration masks with mandatory minimum oxygen flow allow inhalation fractions close to 0.8 to be achieved while avoiding the re-inhalation of exhaled CO_2 . The objective of oxygen therapy is to maintain transcutaneous O_2 saturation $>92\%$ [22]. The use of inhaled short-acting beta-2 mimetics as a bronchodilator agent was widespread and in association with methylprednisolone

(1mg/kg IV) was the first-line treatment for decompensated asthma [15,22,23]. The addition of anticholinergic aerosol reduces the number of transfers to resuscitation. The subcutaneous form of short-acting beta-2 mimetics and epinephrine at beta 2 doses may be an alternative when aerosol therapy is poorly tolerated without a readily accessible venous route. Although there is no evidence for the superiority of intravenous administration of short-acting beta-2 mimetics (salbutamol 0.5 to 4 ug/kg/min), this route is recommended in the event of failure of continuous aerosol therapy in the same manner as the use of intravenous magnesium sulfate. Intravenous use requires hospitalization in intensive care for continuous monitoring, especially since short-acting beta-2 mimetics may cause vasodilation, tremor, hypokalemia, hyperglycemia, hypomagnesemia. Despite their specificity, short-acting beta-2 mimetics can also cause stimulation of B1 receptors and thus lead to tachycardia, which is often marked in children. Several authors recommend continued aerosol therapy during IV administration [22].

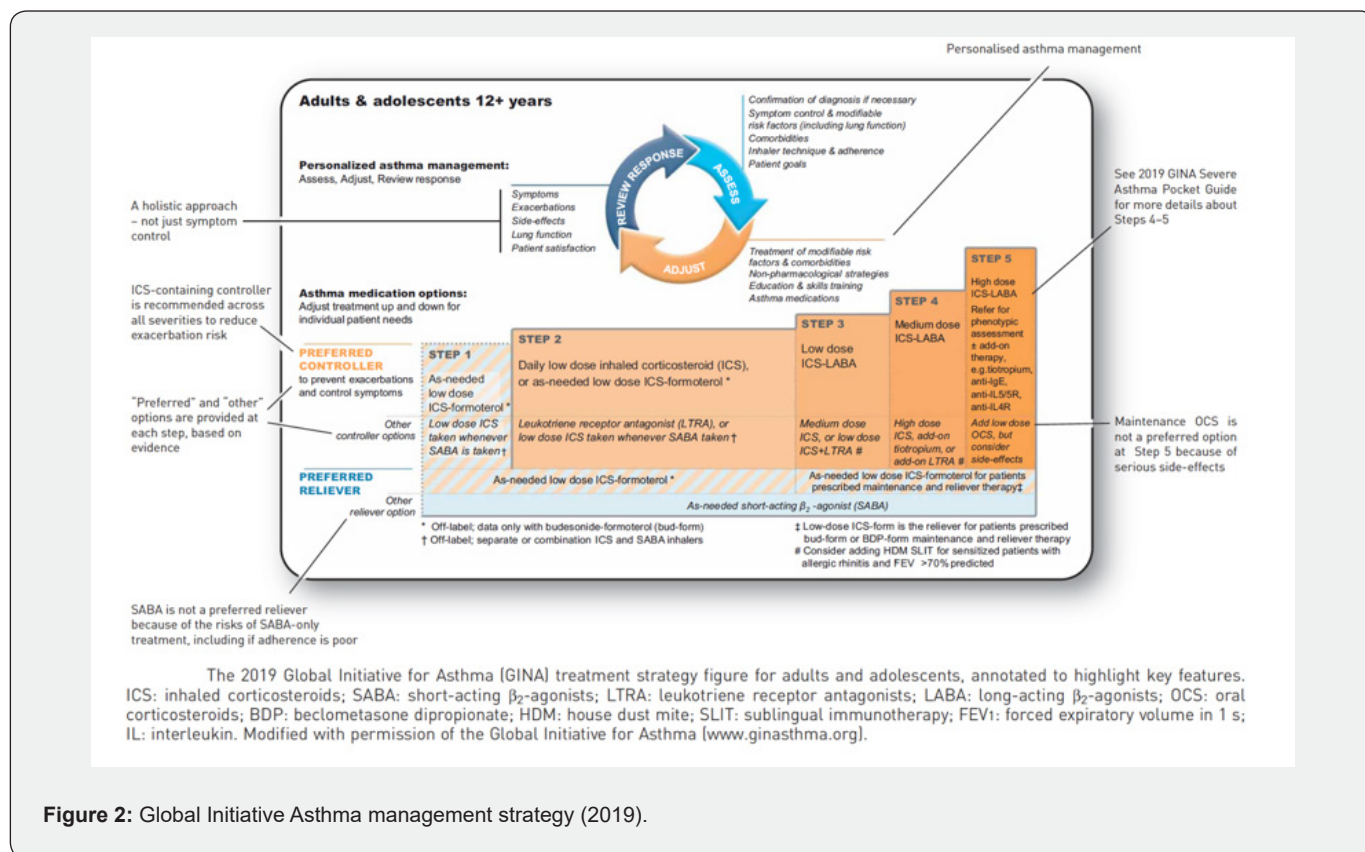


Figure 2: Global Initiative Asthma management strategy (2019).

However, since 2019 the Global Initiative for Asthma (GINA) has made the biggest change in asthma management in the last 30 years. For safety reasons, GINA no longer recommends treatment with short-acting beta-2 mimetics alone [22]. There is strong evidence that treatment with short-acting beta-2 mimetics alone provides short-term relief of asthma but does not protect the patient from severe exacerbations and that regular or frequent use of short-acting beta-2 mimetics increases the risk of exacerbation.

It is now recommended that all adults or adolescents with asthma should receive symptom-appropriate treatment (for mild asthma) or daily control therapy containing low-dose inhaled corticosteroids, which reduce the risk of severe exacerbations [23]. Figure 2 shows the asthma management strategy according to GINA 2019. In our study mechanical ventilation was required in 30% of the cases and non-invasive ventilation (NIV) was performed in 25% of the cases. The latter (NIV), although

controversial, could improve the clinical condition of patients and reduce the length of stay in intensive care as long as the right indication is given, while also respecting patient compliance and contraindications. However, it should be remembered that non-invasive ventilation would be more effective in patients with an exacerbation of chronic obstructive pulmonary disease [24]. The prognosis of patients with severe acute asthma depends on the signs of severity present and co-morbidities. Prognosis improvement requires control of comorbidities but also rapid and appropriate management [25]. Bacterial superinfection, including nosocomial pneumopathy acquired under mechanical ventilation, is a non-negligible mortality factor in severe acute asthma, as in the case of the patients who died in our study. The delay in management and the absence of a technical platform meeting the standards are limiting factors in the management of these serious cases.

Conclusion

The initial therapeutic management of severe acute asthma is currently well codified. Its prognosis then depends on rapid assessment of severity and identification of risk factors that condition the therapeutic modalities and unit of management. In our sub-Saharan African context, beyond the training of health actors on SAA, the permanent availability of all the molecules of the therapeutic arsenal is the essential element for improving the management and prognosis of this pathology in our government's health structures.

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