



# NEAR-FATAL ASTHMA: REPORT OF AN EMERGENCY CASE AT SANTA ROSA HOSPITAL

ASMA CASI FATAL: REPORTE DE UN CASO EN EMERGENCIA DEL HOSPITAL SANTA ROSA

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## ABSTRACT

**Introduction:** Asthma, classically, is defined as a chronic inflammatory disease of the airways; characterized by a history of respiratory symptoms, such as wheezing, shortness of breath, chest tightness, and cough, that vary over time and in intensity. Near-fatal asthma are situations in which asthma exacerbations can lead to cardiorespiratory arrest, orotracheal intubation and mechanical ventilation, admission to an intensive care unit (ICU); Knowing the characteristics and risk factors that predict this situation in a patient who arrives at the emergency room is very important for early action. Clinical case: We present a 23-year-old patient with a history of asthma since he was 5 years old and irregular treatment; with a stay in the ICU and on mechanical ventilation for almost fatal asthma 8 months before; the clinical signs and the arterial blood gas analysis predicted an almost fatal asthma condition, which is why it was decided to intubate and mechanically ventilate the patient, and then transfer to the ICU with a favorable evolution and discharge 9 days after admission. Conclusion: Patient who already had a previous admission for almost fatal asthma and admission to the ICU, persistence of desaturation in the face of rescue treatment for said pathology; determining factors for deciding rapid sequence orotracheal intubation and transfer to the intensive care unit; with remission of the admission clinical picture and prompt discharge of the patient.

**Keywords:** Asthma; Near-fatal asthma; Mechanical ventilation. (Source: MESH-NLM)

## RESUMEN

**Introducción:** El asma, clásicamente, se define como una enfermedad inflamatoria crónica de las vías respiratorias; caracterizado por la historia de síntomas respiratorios, como sibilancias, dificultad para respirar, opresión en el pecho y tos, que varían con el tiempo y en intensidad. El asma casi fatal son situaciones en que las exacerbaciones asmáticas pueden conducir al paro cardiorrespiratorio, intubación orotraqueal y ventilación mecánica, ingreso en una unidad de cuidados intensivos (UCI); conocer las características y los factores de riesgo que predicen dicha situación en un paciente que llega a emergencia es muy importante para la actuación temprana del mismo. **Caso clínico:** Presentamos un paciente de 23 años con antecedente de asma desde los 5 años y tratamiento irregular del mismo; con estancia en UCI y en ventilación mecánica por asma casi fatal 8 meses antes; la clínica y el examen de análisis de gases arteriales predijeron un cuadro de asma casi fatal por lo cual se decidió la intubación y ventilación mecánica del paciente, para luego pasar a UCI con evolución favorable de mismo y alta a los 9 días del ingreso. Conclusión: Paciente que ya tenía ingreso anterior por asma casi fatal y su ingreso a UCI, persistencia de desaturación ante el tratamiento de rescate para dicha patología; factores determinantes para decidir intubación orotraqueal de secuencia rápida y su pase a la unidad de cuidados intensivos; con remisión del cuadro clínico de ingreso y el alta pronta del paciente.

**Palabras clave:** Asma; Asma casi fatal; Ventilación mecánica. (Fuente: DeCS- BIREME)

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## INTRODUCTION

Asthma is a syndrome that includes several clinical phenotypes that share similar clinical manifestations, but probably different etiologies. Classically, it is defined as a chronic inflammatory disease of the airways, involving different cells and mediators of inflammation, conditioned in part by genetic factors, with bronchial hyperresponsiveness and variable airflow obstruction, totally or partially reversible, either by drug action or spontaneously<sup>(1)</sup>.

Asthma is a heterogeneous disease, generally characterized by chronic inflammation of the airways. It is defined by a history of respiratory symptoms, such as wheezing, shortness of breath, chest tightness, and cough, which vary over time and in intensity, along with variable expiratory airflow limitation. Airflow limitation may later become persistent<sup>(2)</sup>. Several asthma-related risk factors for death have been identified, such as history of previous intubation, ICU stay, multiple emergency room visits in the previous year, beta-agonist drug abuse, respiratory tract infections, aeroallergen sensitivity, old age, respiratory tract infections, systemic glucocorticoid dependence<sup>(3)</sup>.

In Peru, up to epidemiological week 08 - 2023, 7530 episodes of bronchial obstructive syndrome/asthma have been reported in the country. In 2022, during the same period, 5808 episodes were reported in Peru, and the cumulative incidence rate (CIR) was 21.95 cases per 10,000 inhabitants<sup>(4)</sup>. Asthmatic exacerbation accounts for approximately 10% of emergency department visits. Life-threatening asthma, near-fatal asthma, asthmaticus or status asthmaticus are known as asthmatic exacerbations leading to cardiorespiratory arrest, orotracheal intubation and mechanical ventilation, admission to an intensive care unit (ICU), hypercapnia or acidosis.

Of the exacerbated asthmatics who will be hospitalized, 2.4% presented the first situation and 6.3% the second in the EAGLE study. Patients requiring life support had an in-hospital mortality of 2.5%. The following are predictors of life-threatening asthma: history of sudden exacerbations; previous intubation and ventilation for asthma; previous admission to the ICU for asthma; two

or more hospitalizations in the last year for asthma; three or more visits to the emergency room for asthma in the last year; use of more than 2 salbutamol canisters in one month; recent abandonment of systemic corticosteroid treatment; poor perception of dyspnea; low socioeconomic status; use of illicit substances: cocaine, heroin<sup>(5)</sup>.

Classically, two types of exacerbations have been identified: type 1, with inflammatory predominance, slow onset and slow response to treatment, which represents 90% of crises, and type 2, with bronchial spasm predominance and rapid response to treatment, which represents 10% of cases<sup>(5)</sup>. In addition, seizures can be mild, moderate, severe or near-fatal. Objectively, we identify patients as life-threatening because they present with agonal respiration or apnea, absence of speech, bradypnea or apnea, bradycardia or cardiac arrest, hypotension, paradoxical pulse, paradoxical thoracoabdominal movement, auscultatory silence, impaired level of consciousness or coma, pulse oximetry less than 90%, hypoxemia and hypercapnia<sup>(5)</sup>.

The initial evaluation of the patient will respect the ABC of any emergency, identifying and assisting in order of priority the difficulty to defend the airway, the assistance of ventilation and oxygenation and circulatory support<sup>(5)</sup>.

Regarding airway instrumentation in apneic patients, with impaired level of consciousness or hypercapnic acidosis, if rapid sequence intubation is required, the use of propofol or ketamine is preferred, while atracurium and morphine are discouraged due to histamine release, which could enhance bronchospasm<sup>(5)</sup>.

Patients requiring mechanical ventilatory support are those who present to the emergency department in apnea, with impaired level of consciousness, hypoxemia and hypercapnia or who do not respond to initial treatment. The goal of ventilation is to reverse hypoxemia, stabilize hemodynamics, prevent and reverse air trapping and mechanical ventilation-induced damage<sup>(5)</sup>.



**Table 1.** Classification of asthmatic crisis according to the parameters described; into mild, moderate, severe or severe and near-fatal or life-threatening.

CLINICAL CASE

Taken from the Spanish Guide for the Management of Asthma (GEMA 5.3). 2023. Pag. 97  
(<https://www.semg.es/index.php/consensos-guias-y-protocolos/399-gema-5-3-guia-espanola-para-el-manejo-del-asma>)

**Table 2.** Predisposing factors in near-fatal asthma related to history, comorbidity, form of presentation, and adherence to treatment.

Taken from the Manual of Diagnostics and Therapeutics in Pneumology. 3rd ed. Chapter 35. Page 391  
([https://www.neumosur.net/files/publicaciones/ebook/35-ASMATICA-Neumologia-3\\_ed.pdf](https://www.neumosur.net/files/publicaciones/ebook/35-ASMATICA-Neumologia-3_ed.pdf)).





CLINICAL CASE

Male patient, 23 years old, with incomplete high school, born and coming from Lima-Peru, currently a student; he presents asthma since he was 5 years old with irregular salbutamol inhaler treatment; allergic rhinitis since he was 5 years old with symptomatic treatment; Asperger syndrome; as an important antecedent, he presented severe asthmatic crisis in December 2022, hospitalized for 28 days at the Santa Rosa Hospital in the Intensive Care Unit in mechanical ventilation and tracheostomy for prolonged intubation (more than 21 days). In addition, he presented psychiatric post-traumatic syndrome in treatment for 5 months. Patient 5 days before admission presented "flu-like process" characterized by rhinorrhea, cough and general malaise, with symptomatic treatment; 1 day before admission he presented shortness of breath despite the use of salbutamol inhaler with no apparent improvement; the day of admission patient with increased respiratory distress and decreased oxygen saturation going directly to the trauma shock unit.

BP: 155/100 mmHg HR: 130 min FR: 30 x min T°: 37.2 °C Sat O2: 87%.

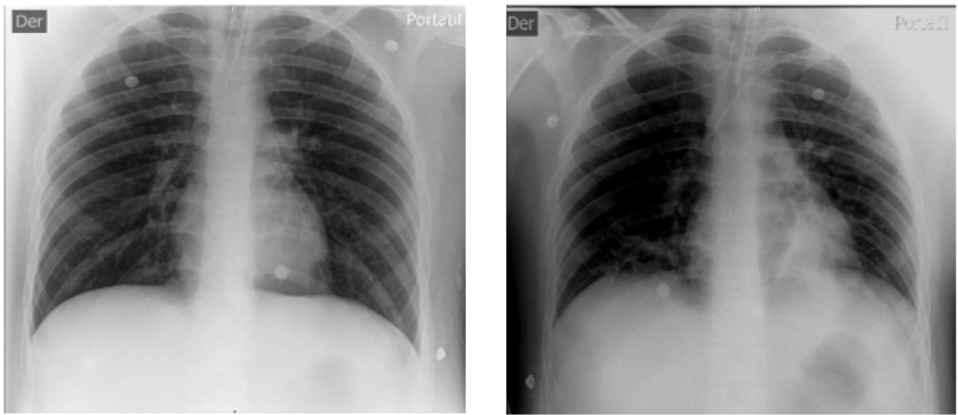
On examination, decreased vesicular murmur in both lung fields with diffuse wheezing; rhythmic, tachycardic heart sounds of regular intensity, no murmurs; Glasgow Coma Scale: 15, no meningeal signs or focalization.

**DIAGNOSIS AND INITIAL MANAGEMENT:** severe asthmatic crisis. Oxygen therapy; Nebulization with SABA/SAMA, intravenous and inhalation corticotherapy, intravenous magnesium sulfate.

**EVOLUTION AND TREATMENT:** 40 minutes after admission to the trauma shock unit, the patient was evaluated with arterial blood gas examination interpreted as respiratory acidosis and hypoxemia; also vital functions: BP: 160/100 mmHg HR: 155 x min FR: 32 x1min Sat O2: 81% (FiO2 0.40) with final diagnosis of ALMOST FATAL ASTHMA and orotracheal intubation is decided under rapid sequence using ketamine at a dose of 2 mg/kg and mechanical ventilation (continuous pressure controlled mechanical ventilation: PC-CMV). Poor respiratory mechanics, respiratory acidosis (pCO2: 64), previous history of severe asthmatic crisis with orotracheal intubation and long-stay ICU (Figure 1 and Table 3).

Tabla 3. Arterial gases on admission.

PARAMETER	RESULT FiO2: 0.40	NORMAL VALUES
pH	7.21	7.35-7.45
pCO2 (mmHg)	64	35-45
PO2 (mmHg)	58	80-100
Sat O2 (%)	85	95-100
PaO2/FiO2	148	> 300
HCO3 (mEq)	25	22-26



**Figure 1.** Chest X-ray, taken in emergency. 3a. Preserved radiotranslucent lung fields. Orotracheal tube in D3. 3b. Lung fields show left basal alveolar radio opacity. Central venous catheter projected in left subclavian vein.

Patient is transferred to the intensive care unit to continue management of critically ill patient on mechanical ventilation with diagnostics:

- Acute respiratory failure on mechanical ventilation
- Near-fatal asthma

- Respiratory sepsis: rule out aspiration pneumonia
- Asperger Syndrome

Daily evolution of the arterial blood gas test showing pCO2 correction on the second day and correction of the acid-base disorder on admission (Table 4).

Table 4.

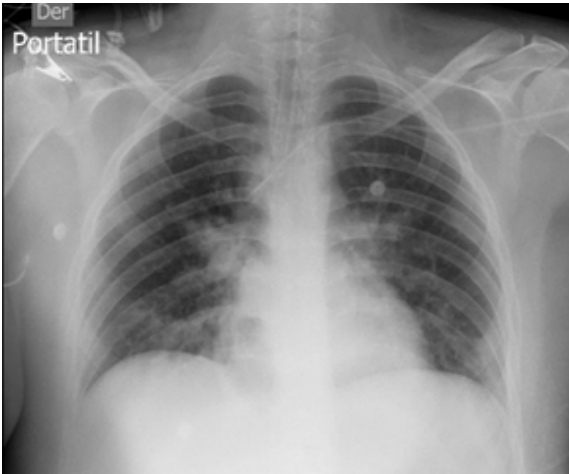
PARAMETER	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	NORMAL VALUES
pH	7.20	7.19	7.27	7.40	7.52	7.52	7.35-7.45
pCO2 (mmHg)	65	37	48	40	38	35	35-45
PO2 (mmHg)	153	102	72	107	93	69	80-100
Sat O2 (%)	99	98	95	98	98	96	95-100
PaO2/FiO2	191	340	300	382	332	180	> 300
HCO3 (mEq)	25	14	22	24	31	28	22-26

Hemogram showing leukocytosis with left deviation on the second day (abstinence 9%) related to the

respiratory infectious picture associated with probable aspiration pneumonia (Table 3 and Figure 2).

Table 5.

HEMOGRAM	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6
LEUCOCYTES	17250	50260	41510	34790	26070	17510
HEMOGLOBIN	11.5	11	10.1	10.3	10.9	12.6
PLATELETS	354000	397000	361000	373000	380000	384000
BANDED	1	9	5	2	3	2
SEGMENTED	92	80	89	85	83	75
LYMPHOCYTES	2	3	4	6	6	14



**Figure 2.** Chest X-ray in ICU. There is evidence of accentuation of the pulmonary interstitium, with confluent posterobasal alveolar opacities predominantly on the right and bilateral hilar reinforcement.



The mainstays of treatment were antibiotic therapy (Ceftriaxone/Clindamycin), intravenous and inhalation corticotherapy, short-acting beta agonists (SABA), short-acting antimuscarinics (SAMA), magnesium sulfate, aminophylline, sedoanalgesia and neuromuscular blocking agents (vecuronium). Patient with favorable evolution, on the fourth day is extubated and on the sixth day goes to the medical hospital for 3 days, discharged on the ninth day of emergency admission.

## DISCUSSION

Near-fatal asthma defines a subset of patients with asthma who are at increased risk of death from their disease. Studies show that deaths from asthma attacks typically occur in patients who present with poorly controlled asthma and whose condition gradually deteriorates over days or weeks before presenting with a fatal or near-fatal asthma episode. Despite advances in treatment, asthma continues to be a disease of high prevalence and incidence worldwide. Approximately 2 to 4% of hospitalized patients with critical asthma syndrome develop acute ventilatory failure requiring mechanical ventilation, among which mortality ranges from 6.5% to 10.5%<sup>(6)</sup>.

Infections, especially viral infections, are also a risk factor as an important trigger for near-fatal asthma. Viral nucleic acids have been detected in up to 55% of patients, and patients with asthma and lower respiratory infection tend to have more severe and prolonged symptoms. There is progressive airway obstruction, with mucus plugs, loss of respiratory epithelium, mucous gland hyperplasia and submucosal eosinophilia (late phase). These patients have frequent use of bronchodilators and little use of inhaled steroids with a higher risk of reaching an asthmatic state<sup>(6)</sup>. The signs and symptoms evidenced in the patient were progressive respiratory distress with decreased oxygen saturation (87%), rescue treatment for severe asthmatic crisis was started on admission with oxygen therapy, corticotherapy, SABA (nebulization) and SAMA (inhalation), magnesium sulfate 2g EV. After 20 minutes the patient was clinically reevaluated, tachypnea and

low oxygen saturation persisted (81%), silent thorax and arterial gas analysis (pH: 7.21, pCO<sub>2</sub>: 64, pO<sub>2</sub>: 58, PaO<sub>2</sub>/FiO<sub>2</sub>: 148) with a diagnosis of ALMOST FATAL ASTHMA and orotracheal intubation is decided by rapid intubation sequence with the use of ketamine at a dose of 2 mg/kg, for its bronchodilator effect as it relaxes the bronchial smooth muscle and mechanical ventilation with PC-CMV mode (continuous pressure controlled mandatory ventilation). Among the poor prognostic factors that make us suspect and predict the possible use of mechanical ventilation is the patient's history of mechanical ventilation for a similar asthmatic crisis, associated with the lack of adherence to treatment (he only used the medication during exacerbations) and the post traumatic psychiatric syndrome disorder associated with a history of Asperger's syndrome; Apart from insufficient oxygenation and ventilation, the expected clinical evolution of the patient was clinical deterioration and the need for intubation and mechanical ventilation (PC-CMV).

The decisions made upon admission to the emergency room regarding intubation and early mechanical ventilation may have influenced the patient's prompt recovery and discharge at 9 days, in contrast to the previous similar situation.

It is important to know the history of emergency admission, adherence or not to the treatment received, precipitating risk factors and clinical factors to decide on orotracheal intubation in this type of patient, since early intervention improves morbidity and mortality (superinfections, prolonged stay).

## CONCLUSIONS

Despite advances in treatment, asthma continues to be a disease of high prevalence and incidence globally; asthmatic crises are an important percentage of emergency care; knowing, diagnosing and treating this pathology in a timely and appropriate manner is very important for the patient's prognosis. Patients with near-fatal asthma have an increased risk of death from their disease, related to the complication of the disease. The signs and symptoms evidenced in the patient were progressive respiratory distress with decreased oxygen saturation (87%), which did not respond to initial



rescue treatment; persisting low oxygen saturation (81%), at physical examination silent chest and arterial gas analysis examination pH: 7.21, pCO<sub>2</sub>: 64, pO<sub>2</sub>: 58, PaO<sub>2</sub>/FiO<sub>2</sub>: 148; with diagnosis of ALMOST FATAL ASTHMA and orotracheal intubation is

decided by rapid intubation sequence. The favorable response of the patient from his emergency admission, transfer to the intensive care unit and discharge was determined by a rapid response to the emergency admission and the treatment followed in the ICU.

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