



# Anaphylactic Shock Due to Atracurium in a Patient Underwent General Anesthesia

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## Abstract

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**BACKGROUND:** Anaphylaxis is a systemic hypersensitivity reaction marked by life-threatening, rapid onset of the airway, breathing, and circulation problems. Despite its rare incidence, without proper treatment, it may cause fatality.

**CASE REPORT:** In this report, we present a 19-year-old female with an infected ovarian cyst, who was scheduled for gynecologic laparotomy. In pre-operative assessment, she was classified as an American Society of Anesthesiologist (ASA) one patient without any history of drug or food allergy. Hemodynamic changes occurred on anesthesia induction after the administration of atracurium, a muscle relaxant agent. Marked clinical signs were wheezed-bronchospasm, dyspnea, hypersalivation, desaturation, tachycardia, hypotension, and systemic erythema. She was diagnosed with anaphylactic shock. We provided 100% oxygenation, fluid resuscitation, epinephrine, and supportive therapy by anaphylaxis guidelines. Respiratory and cardiovascular functions stabilized 2 h post-resuscitation. The surgery was canceled, and she was observed in ICU for 24 h.

**CONCLUSION:** Timely diagnosis and early resuscitation are key factors determining the outcome of an anaphylactic reaction.

## Introduction

Anaphylaxis is a severe, life-threatening systemic hypersensitivity reaction that is characterized by the emergence of life-threatening airway, respiratory, and circulatory problems with rapid onset and is usually associated with changes in the skin and mucosa [1]. Its prevalence ranges from 1:3,500 to 1:13,000 [2]. Overall, anaphylaxis has a good prognosis, with a case fatality ratio of <1%. The risk of death is increased in patients with asthma, especially in uncontrolled asthma [3].

Anaphylactic reactions are generally unpredictable allergic reactions, which occur very quickly, which can arise especially during surgery due to varying drug administration. The diagnosis of anaphylaxis in the perioperative period is still a challenge for the anesthesiologist. A study reported that of the 42 anesthesia teams tested by simulators, none was able to identify anaphylaxis in the first 10 min. [2], [4].

## Case Illustration

A 19-year-old woman, 55 kg, was planned for laparotomy surgery due to an infected left ovarian

cyst. A day before the surgery, detailed history, physical examinations, and investigations were carried out. There was no history of allergy to drugs or food, no history of asthma, and no history of the previous surgery. There were no marked abnormalities in physical or supporting examinations.

She was planned for general anesthesia with the insertion of the orotracheal tube. She received cefotaxime 1 g and metronidazole 500 mg as prophylactic antibiotics an hour before surgery and was premedicated with dexamethasone 5 mg and midazolam 2 mg. After induction with 75 mcg fentanyl and 100 mg propofol intravenously, she still showed stable hemodynamic conditions. To facilitate intubation, we administered intravenous atracurium 25 mg. One minute after the administration of atracurium, we noticed hypersecretion in her airway. She then developed wheezing sounds and difficulty to ventilate the airway. Saturation was decreased to 80% despite 100% O<sub>2</sub> being given, followed by marked erythema developed in most parts of the skin, hypotension (BP 67/33 mmHg), and tachycardia (HR 134–138 bpm).

Anaphylaxis shock was diagnosed. We immediately performed intubation to maintain the airway – positive pressure ventilation with 100% FiO<sub>2</sub> oxygen. Epinephrine 0.5 mg was given intramuscularly, and dexamethasone 5 mg was administered intravenously.

An hour later, all parameters were improved. We decided to cancel the surgery. We obtained blood sample for the IgE test on intensive care unit (ICU) admission, which returned increased. As she regains consciousness, she was extubated and sent to ICU for 24 h of observation before finally being transferred to the inpatient ward. She was discharged on the 4<sup>th</sup> day after the event.

The patient was rescheduled for surgery 4 weeks after the event. We used vecuronium as an alternative muscle relaxant for this case. The surgery went uneventful, and the patient was then relieved from her previous condition.

## Discussion

The term anaphylaxis comes from the word “*ana*” which means opposite and “*phylaxis*” which means protection. This term was coined by Portier and Richet in 1902 to describe the adverse reactions that occur after repeated exposure to foreign proteins, rather than immunization or prophylaxis as expected. Anaphylaxis generally occurs after repeated exposure to a specific antigen, and the release of inflammatory mediators occurs. However, anaphylactic reactions can occur in the first exposure to a product or drug due to a cross-reaction. [2], [5].

Anaphylactoid reactions (also called non-immune anaphylaxis) are different from anaphylaxis because they occur through the process of releasing inflammatory mediators directly without mediating immunoglobulins or through complement activation. However, both have the same clinical manifestations [2].

The clinical manifestations of anaphylaxis occur due to the release of chemical mediators from mast cells and basophils. In susceptible individuals, the first exposure to an antigen will trigger IgE production which will bind to mast cells and basophils. On repeated exposure, the antigen will cross with two IgE receptors which will then induce tyrosine phosphorylation by Lyn and Syk tyrosine kinases. This process initiates a series of signal transduction which leads to an increase in intracellular calcium levels and the release of mediators such as histamine, protease, proteoglycans, and platelet-activating factors. Phospholipid metabolism in the next process will produce leukotrienes and prostaglandins. Histamine, leukotrienes, and prostaglandins are vasoactive mediators that play a role in changes in vascular permeability, flushing, urticaria, angioedema, hypotension, and bronchoconstriction.

The diagnosis of anaphylaxis in the perioperative period presents its challenges. In this period, the patient is generally covered by sterile cloth and is typically unconscious or sedated so that signs of anaphylaxis can only be identified by bronchospasm and cardiovascular

dysfunction. Unfortunately, these manifestations can also occur due to anesthesia. The severity of anaphylactic reactions can vary from mucocutaneous abnormalities that occur thoroughly to cardiac arrest [2], [6].

The diagnosis of anaphylaxis is based on the clinical manifestations. The supportive examination is not beneficial in acute conditions because it takes time and may give false negative results [5]. In our case, the patient experienced a disorder that occurs rapidly after the intravenous administration of atracurium. The first manifestation is respiratory abnormalities in the form of wheezing and increased airway pressure followed by skin redness and cardiovascular system disorders such as tachycardia and hypotension.

The goal of anaphylactic management is to stop exposure to precipitating agents, reduce the effects of detached mediators, and prevent the production and release of further mediators. Epinephrine is the drug of choice for anaphylaxis. Epinephrine has an  $\alpha$ -1 adrenergic vasoconstrictor effect in almost all organ systems and can relieve airway obstruction due to mucosal edema and prevent and overcome shock.

Furthermore, epinephrine is an agonist for  $\beta$ -1 and  $\beta$ -2 adrenergic receptors [6]. Effects on  $\beta$ -adrenergic receptors provide positive bronchodilator, inotropic, and chronotropic effects [7]. The recommended method of administration is intramuscular injection. This injection technique allows faster onset than the subcutaneous. Intravenous administration of epinephrine can be applied to exceptional conditions such as severe hypotension, cardiac arrest, or respiratory arrest, or if multiple doses of intramuscular epinephrine do not produce satisfactory results [8].

The patients who experience anaphylaxis should be positioned supine by lifting the inferior limb to maintain adequate fluid in the intravascular space. In anaphylaxis, the patients are susceptible to large numbers of intravascular fluid losses that move to the interstitial space so that in addition to the position, it is necessary to administer saline fluid quickly with a good monitoring to avoid excess fluid.

The administration of antihistamines and glucocorticoids should not replace the position of epinephrine as the drug of choice [9]. The time of antihistamine onset and the time needed to reach the peak of concentration is longer.

Selective  $\beta$ -2 adrenergic agonists are sometimes given anaphylaxis as an adjunct therapy to treat wheezing, coughing, or shortness of breath that does not improve with epinephrine. Although beneficial for the lower respiratory tract, this drug should not replace epinephrine as a first-line drug.

Endotracheal intubation, if needed, should be carried out by the most experienced personnel available. In anaphylaxis, it can be difficult to recognize the anatomical structure of the upper airway due to swelling of the oropharynx's tongue and mucosa, excessive

mucous secretion, or due to angioedema. This condition will complicate the insertion of endotracheal tubes [10]. It should be noted that oxygenation is more critical than intubation. It is best to choose the most accessible and most available oxygenation technique.

## Conclusion

Anaphylaxis in the perioperative period is a challenge for anesthesiologists due to the use of several types of drugs at almost the same time. Therefore, an anesthesiologist must be equipped with proper knowledge and skills and has a high awareness of anaphylaxis because early diagnosis and appropriate therapy determine patient safety.

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