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Recognition and management of patients with anaphylaxis

NS393 Finney A, Rushton C (2007) Recognition and management of patients with anaphylaxis. *Nursing Standard*. 21, 37, 50-57. Date of acceptance: March 22 2007.

Summary

Anaphylaxis is a severe and potentially fatal systemic allergic reaction. It requires rapid recognition, treatment and management by health professionals. With their rapid onset and multiple organ involvement, anaphylactic reactions are a medical emergency. Therefore, health professionals must have a good understanding of the condition and be able to identify symptoms promptly to follow the treatment guidelines provided by the Resuscitation Council (UK).

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Keywords

Allergy; Anaphylaxis; Emergencies

These keywords are based on the subject headings from the British Nursing Index. This article has been subject to double-blind review. For author and research article guidelines visit the *Nursing Standard* home page at **www.nursing-standard.co.uk**. For related articles visit our online archive and search using the keywords.

Aims and intended learning outcomes

This article aims to provide nurses with the relevant knowledge to quickly and correctly identify anaphylaxis and respond effectively. After reading this article you should be able to:

- Discuss the immune system in relation to anaphylaxis.
- Describe the pathophysiological processes involved in an anaphylactic reaction.
- Identify potential causes of anaphylaxis.
- Recognise clinical signs and symptoms of anaphylaxis.
- Make a differential diagnosis of anaphylaxis.
- Discuss the nurse's role in the treatment of patients with anaphylaxis.

Introduction

Anaphylaxis is a severe allergic reaction that is potentially fatal. Anaphylaxis remains ill defined because of the variety of ways that patients can present following a reaction (Rusznak and Peebles 2002, Moneret-Vautrin *et al* 2005). The difficulty in defining anaphylaxis has contributed to the poor reporting of incidents, making the prevalence of the disorder unclear (Crusher 2004). However, anaphylaxis is becoming increasingly common because of the rise in the number of people with allergic diseases over recent years (Sheikh and Alves 2000, Reading 2004). Patients with anaphylaxis are poorly managed (Jowett 2000, Project Team of the Resuscitation Council (UK) 2005).

While some patients will present to health services with suspected anaphylaxis, others may be susceptible to allergic reactions to treatments administered while in hospital. Sheikh and Alves (2000) found when examining national discharge statistics that therapeutic drugs accounted for 62% of cases of anaphylaxis. Nurses have a responsibility to recognise anaphylaxis promptly and take immediate action because of the potential seriousness yet sudden onset of a reaction. Following correct treatment patients often make a rapid recovery. However, without appropriate treatment death can be imminent. This provides a serious challenge for nurses at the forefront of care.

The shock reaction

The human body is under constant threat of attack from a diverse range of invading agents, including bacteria, viruses, fungi and toxins. While some organisms can live in the body and cause no harm, others produce toxic chemicals or destroy cells. The immune system provides a mechanism by which the body can guard against attack to preserve life.

Time out 1

Using an anatomy and physiology textbook revise immunity, paying particular attention to specific immunity and the function of B-lymphocytes. Define the following terms: antigen, antibody, B-lymphocyte, T-lymphocyte and atopy.

Anaphylaxis occurs when the body fails to regulate its immune system leading to an excessive and inappropriate immune response. While some authors prefer to only consider those reactions that include life-threatening symptoms as 'true anaphylaxis', such as cardiovascular and respiratory collapse, others include milder allergic symptoms such as pruritus and angio-oedema (Crusher 2004). Whatever the preferred definition, it is important for nurses to be able to recognise all signs along the allergy continuum to prevent progression of the reaction and respond appropriately.

Anaphylaxis will be considered here as the result of an allergic reaction. It can be triggered by a variety of environmental antigens that the body wrongly perceives as a threat (Box 1). Antigens capable of provoking an allergic response are known as allergens (Montague *et al* 2005). Before anaphylaxis can occur allergens must first gain entry to the body. There are a number of routes for entry, including inhalation, ingestion and injection.

The body is able to launch an attack against invading antigens using the immune system. The immune system is divided into general protective devices known as 'innate' or 'non-specific' immunity that include the skin barrier, hostile secretions, antimicrobial proteins, white blood cells known as phagocytes and the inflammatory response and specific immunity that includes B-lymphocytes and T-lymphocytes. B-lymphocytes are most important in understanding an anaphylactic reaction.

On entry to the body, the antigen comes into contact with B-lymphocytes which then proliferate into memory cells and antibody-producing plasma cells. The antibodies (or immunoglobulins) that are produced by the plasma cells may travel round as soluble proteins in the blood or attach themselves via receptors on their surface (Fc receptors) to certain cells in the immune system that then act as receptors for future antigens (Pack 2001). The immune system is now 'sensitised' to the particular antigen and can launch an immediate attack on next contact. The antigen, on next entry, will become 'locked' onto its specific antibody ready for destruction by phagocytes.

Antibodies are grouped into five classes, all beginning with the initials Ig (for immunoglobulin). Anaphylaxis is classified as a hypersensitivity reaction that involves the antibody or immunoglobulin E (IgE). Anyone can become affected but it is more common in individuals who have a history of one or more atopic diseases such as asthma or eczema or previous anaphylactic reactions (Jurewicz 2000).

IgE is usually only found in small amounts and is bound to certain white blood cells called basophils and mast cells. Basophils found circulating in the blood become mast cells when they enter tissues. Mast cells can be found in connective tissue, particularly in the gastrointestinal tract, respiratory tract and skin. They contain preformed mediators including histamine, serotonin and eosinophil chemotactic factor of anaphylaxis (ECF-A).

On entry to the body the antigen locks onto the IgE receptors and they cross link with each other causing them to activate. The activation of antigen-specific IgE molecules causes degranulation of the mast cells and basophils and release of these powerful vasoactive compounds (Figure 1). So sensitive is this response that

BOX 1

Common causes of anaphylaxis

Drugs:

- Penicillin and cephalosporin antibiotics are the medical agents most commonly reported as causing anaphylaxis.
- Aspirin and non-steroidal anti-inflammatory drugs.
- Anaesthetic agents.
- Opiates.
- Muscle relaxants.

Intravenous radiocontrast media can cause an anaphylactoid reaction that is clinically identical to true anaphylaxis.

Plasma expanders.

Blood products.

Latex.

Food allergies, for example, nuts, fish, eggs and dairy products.

Insect stings.

(Ferns and Chojnacka 2003)

minute amounts of the allergen can be enough to trigger a reaction. The signs and symptoms of anaphylaxis are caused by the activity of these mediators on receptors throughout the body, including those contained in the cutaneous, respiratory and cardiovascular systems.

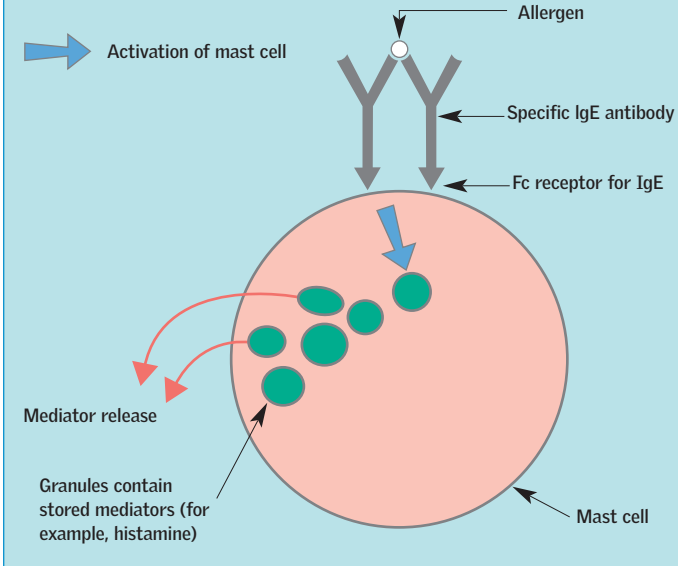
Collectively the mediators cause:

- Increased vascular permeability. This results in the loss of fluid from the blood supply into intravascular spaces and can cause hypotension, oedema (including face, tongue and larynx), hypovolaemia and tachycardia.
- Vasodilation. This causes increased blood flow which exacerbates fluid loss and hypotension.
- Smooth muscle contraction. This includes the bronchial smooth muscle and can lead to respiratory distress. Bronchoconstriction together with oedema of the larynx can lead to asthma, asphyxia and respiratory arrest.
- Chemotaxis. This causes movement of phagocytes into the area of inflammation to dispose of the immune complexes.

Other vasoactive compounds are released (slow reacting substances of anaphylaxis), for example, prostaglandins, leukotrienes, thromboxanes and platelet-activating factors to provoke a similar but more prolonged response.

FIGURE 1

Activation of mast cells by allergen crosslinking of adjacent immunoglobulin E (IgE) on cell surface in a hypersensitivity reaction



(Ewan 1998, reproduced with permission of Blackwell Publishing)

Some allergic reactions mimic anaphylaxis but are not IgE mediated. The systemic reaction to the antigen is the same but the release of mediators from the mast cells and basophils occurs without the need for recognition from IgE antibodies. The antigens involved are called anaphylactoid agents and include anaesthetics, aspirin and morphine (Rusznak and Peebles 2002). While the mechanism of release differs, response and management are essentially the same.

Time out 2

Consider the skin, respiratory, cardiovascular and gastrointestinal systems. Write down the clinical features that the patient may display in these systems during an anaphylactic reaction.

Early diagnosis of anaphylaxis

The speed at which anaphylaxis is first recognised is vital to achieve successful treatment and safe recovery. It is therefore vital that nurses understand and recognise the clinical features and symptoms of the condition (Box 2).

Jevon (2004) warns that because the clinical features of anaphylaxis are not always consistent, accurate diagnosis can be difficult. Misdiagnosis of anaphylaxis can be life threatening because true anaphylactic reactions are a medical emergency. Potential misdiagnosis can be a result of panic, asthma or vasovagal attacks (Jurewicz 2000, Project Team of the Resuscitation Council (UK) 2005) because symptoms of these conditions can include both anxiety and hyperventilation.

To be certain of avoiding misdiagnosis it is important to understand clinical features that share similarities with anaphylaxis and how to confirm the crucial diagnosis (Table 1). Ruling out other conditions is vital. Cardiac arrhythmia, myocardial infarction, insulin reactions and pulmonary embolism (Jurewicz 2000) all mimic elements of an anaphylactic reaction. Ellis and Day (2003) also warn of hereditary angio-oedema, which presents with similar physical features as angioedema during an allergic response.

Time out 3

Consider ways in which treatment of a patient experiencing a vasovagal or anxiety attack would differ to treatment of a patient experiencing anaphylaxis.

The symptoms of an anaphylactic reaction usually occur immediately or in the first 15 to 20 minutes following exposure to the antigen, but as

there are many different clinical features, the allergic response can manifest itself in many different ways. Severity and location of symptoms can depend on the method and degree of exposure, along with the patient's sensitivity to the allergen (Crusher 2004). If exposure to the antigen was oral then symptoms may be delayed for a number of hours. In this case symptoms may be less severe following their slower onset. Close monitoring of the patient is always recommended because there can be a recurrence of symptoms hours later. Whether onset is rapid or slow nurses should be aware that patients will not necessarily experience all symptoms (Jevon 2006). Equally important is the knowledge that patients may collapse from anaphylaxis without displaying any early symptoms (Hourihane and Warner 1995).

Montague *et al* (2005) suggest three phases of anaphylaxis that should be considered:

- Early phases – patients may present with skin flushing, throat irritation, coughing, a potential tight chest and nausea.
- Progression phases – patients can present with pruritus, hypotension, stridor or wheeze with possible abdominal pain and vomiting.
- Late phases – patients may present with more severe symptoms such as angio-oedema (Figure 2), laryngeal obstruction and respiratory or cardiac arrest.

A structured system of assessment is required to make a rapid yet safe diagnosis of an allergic reaction. Ahern and Philpot (2002) recommend the use of an A to E assessment, which uses the first five letters of the alphabet to prioritise and check the stability of physical functions, because this will have implications for treatment. A to E is broken down into five stages: A = airway, B = breathing, C = circulation, D = disability and E = exposure.

Airway First you need to determine the patient's conscious level and ability to speak. Asking a simple question such as 'are you ok?' will determine whether patients can respond and in doing so inform you of their ability to breathe. On checking the upper airway you aim to determine its patency by observing for any obstruction such as the tongue, dentures or a foreign body. You can also listen for any breath sounds such as 'stridor', which would indicate respiratory distress involving the larynx or 'wheeze', which may identify lower airway collapse (Ahern and Philpot 2002), as well as observing for angio-oedema.

Breathing Determining adequate ventilation can be done quickly by assessing respiratory rate. Quickly assess depth and ease of respiration. Can you hear breathing, or visualise the movements of breathing such as rise and fall of the chest? A range of different sounds can be heard from a partially occluded airway whereas complete obstruction of the airway will mean that breath sounds are absent.

Circulation Assessment of circulation will determine whether vital organs are being adequately perfused. A capillary refill test will monitor tissue perfusion – the amount of blood flow to the tissues. Capillary refill time (CRT) will identify poor peripheral perfusion (Resuscitation Council (UK) 2006). Normal

BOX 2

Potential clinical features and symptoms of anaphylaxis

- Angio-oedema
- Anxiety
- Hypotension
- Pallor
- Pulmonary oedema
- Respiratory distress
- Stridor
- Tachycardia
- Tightness of the chest
- Urticaria
- Wheeze

FIGURE 2

Angio-oedema

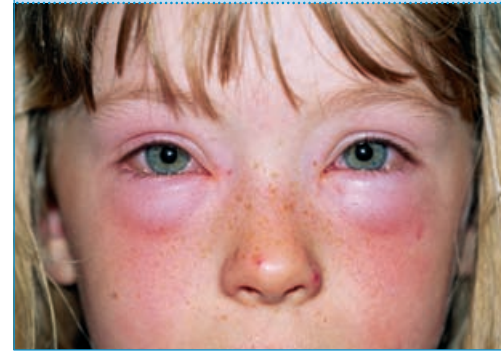


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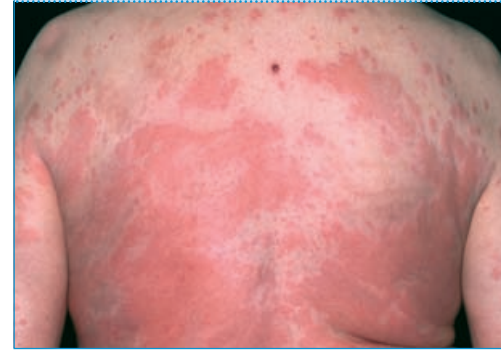
FIGURE 3

Urticaria



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CRT is considered to be within two seconds. To check CRT press the patient's skin or nail bed using either a finger or a thumb for five seconds. A CRT of more than two seconds indicates poor peripheral perfusion. A pulse check is essential, checking for regularity, quality and equality of pulses, such as radial or brachial (Ahern and Philpot 2002). If peripheral pulses are hard to detect then check the carotid pulse. Check heart rate and blood pressure. Determining tachycardia followed by hypotension should indicate that urgent treatment is required because of a failing cardiac output.

Disability Assessment of disability can be used to determine a patient's conscious level or neurological function. Use of the Glasgow Coma Scale has been acknowledged nationally yet the Resuscitation Council (UK) (2006) suggest AVPU as a simpler scoring system for acutely ill patients. AVPU identifies alertness, voice responsiveness, pain response and unresponsiveness:

- Alertness may involve checking if the patient is fully awake (this does not indicate orientation).
- Voice responsiveness indicates that a noise or response is gained from the patient.
- Pain response establishes if the patient responds via this stimulus (following a skin pinch).
- Unresponsiveness identifies that the patient does not respond to either vocal or pain stimulus.

Exposure This enables physical observation. It is important to consider a patient's privacy and dignity but in this emergency situation it may be necessary to remove the patient's clothing. In doing so you can observe the patient's skin for colour, pallor, urticaric rashes (Figure 3) and/or swelling.

It is important to emphasise the rapid nature and urgency required in using such a structured assessment tool. A structured assessment by the nurse using good communication and organisational skills will help the patient and not delay treatment.

Time out 4

Consider the public's awareness in recognising an anaphylactic reaction. Consider what information would be required if you were to put together a public or patient information sheet or leaflet.

Treatment

Treatment of the anaphylactic reaction will vary according to the severity of the symptoms. However, it is important to stress the importance of determining the causative agent. Not removing this can have a major bearing on patient outcome. Gavalas *et al* (1998) state that this is often overlooked in the rush to treat the anaphylactic symptoms.

Nurses working in the UK should be advised to follow the most recent evidence-based guidelines for treatment (Project Team of the Resuscitation Council (UK) 2005). Awareness of advanced life support guidelines is also recommended because where there are no signs of life cardiopulmonary resuscitation must be delivered. Figure 4 provides an algorithm for treatment of adults experiencing anaphylactic reactions by first medical responders such as nurses.

The management of anaphylaxis in children differs from that in adults. Therefore, nurses must consider the difference in drug dosage before treating children as they are titrated according to age.

Figure 5 provides an algorithm for treatment of children experiencing anaphylactic reactions.

Adrenaline (epinephrine) is the most important drug to be administered because of its key role in the treatment of anaphylaxis (Fisher 1995). Ellis and Day (2003) consider adrenaline to be the cornerstone of anaphylaxis management. Adrenaline can reduce oedema and reverse peripheral vasodilation. Its beta receptor activity dilates the airways and increases the force of cardiac contractibility. It also suppresses the release of histamine and leukotrienes (Project Team of the Resuscitation Council (UK) 2005).

TABLE 1

Conditions with a similar presentation to anaphylaxis

Condition	Vasovagal attack	Anxiety attack	Asthma attack
Similarities	Hypotension, anxiety and respiratory distress	Tachycardia, palpitations and shortness of breath	Respiratory distress and tachycardia
Differences	Patient likely to be bradycardic and pale in colour	No urticaria or hypotension	No facial flushing or urticaria

Time out 5

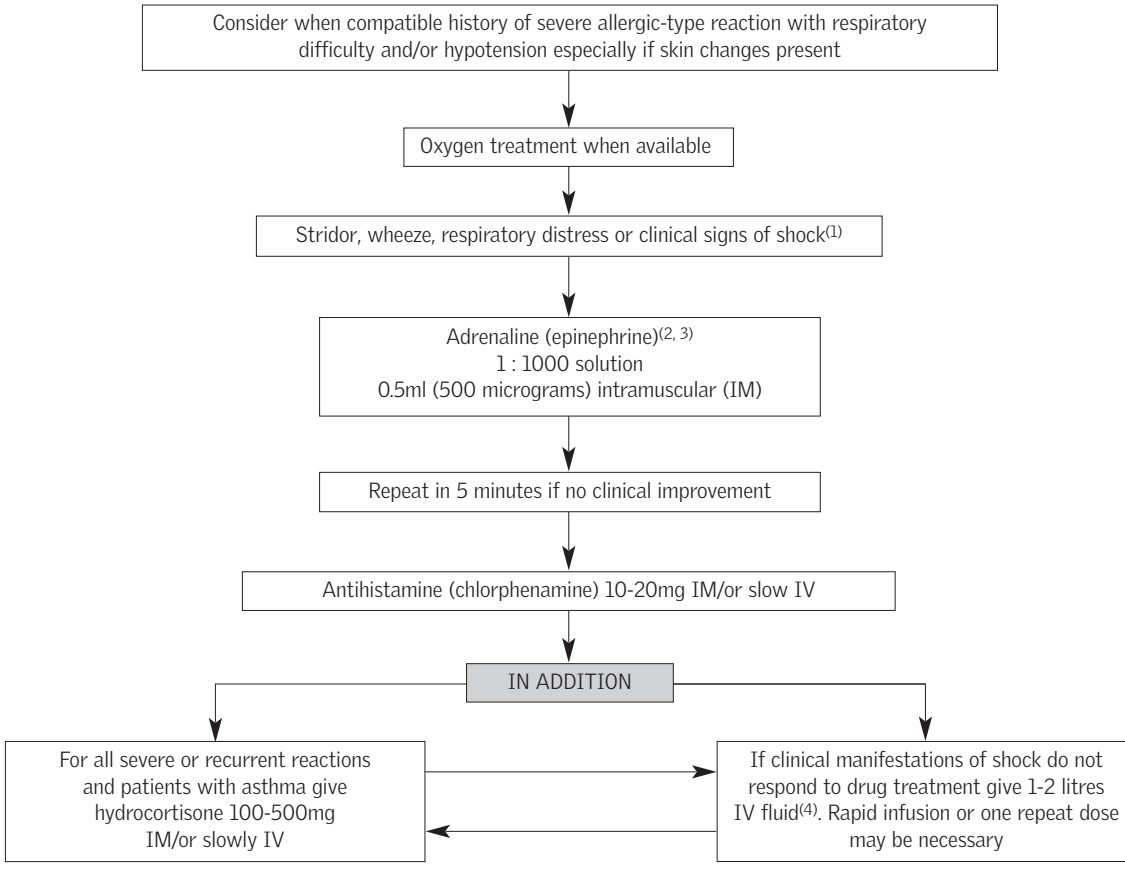
After you administer a flu jab to an outpatient, he waits for 15 minutes before leaving without incident. Five minutes later he returns to you distressed, flushed and complaining of itching. Consider if this constitutes a diagnosis of anaphylaxis. What would be your initial approach to this patient and what action would you take?

Management

Following successful treatment that leads to reversal of the anaphylactic reaction, patients should be instructed on how to avoid reoccurrence of the symptoms. Ideally the causative agent will have been identified and therefore can be highlighted in medical notes as an allergy, so as to be avoided in any form in the future. Ellis and Day (2003) suggest an observation period of up to 48 hours before a

FIGURE 4

Anaphylactic reactions: treatment algorithm for adults by first medical responders



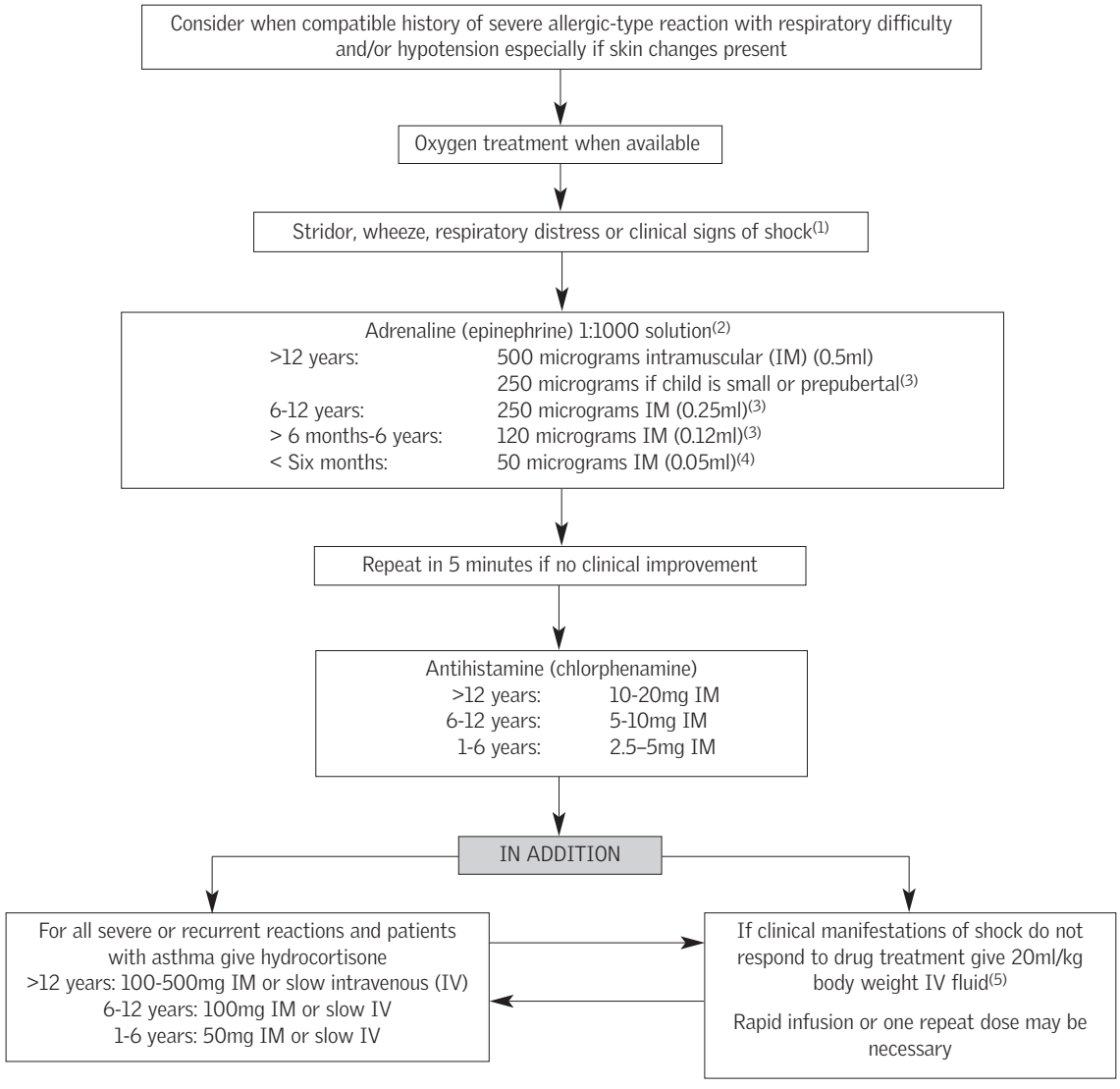
1. An inhaled beta$_2$-agonist such as salbutamol may be used as an adjunctive measure if bronchospasm is severe and does not respond rapidly to other treatment.
2. If profound shock judged immediately life threatening give cardiopulmonary resuscitation/advanced life support, if necessary. Consider slow intravenous (IV) adrenaline (epinephrine) 1 : 10,000 solution. This is hazardous and is recommended only for an experienced practitioner who can also obtain IV access without delay. Note the different strength of adrenaline (epinephrine) that may be required for IV use.
3. If adults are treated with an adrenaline auto-injector, the 300 micrograms will usually be sufficient. A second dose may be required. Half doses of adrenaline (epinephrine) may be safer for patients on amitriptyline, imipramine or a beta blocker.
4. A crystalloid may be safer than a colloid.

(Resuscitation Council (UK) 2005a)

patient is discharged. The causative agent can have a major bearing on whether symptoms reoccur, that is, if ingestion had caused the reaction then further absorption could trigger a delayed response. Discharge details that reach the patient's GP would highlight the need to issue the patient with an auto-injector device, sometimes described as an EpiPen® because it is a similar

FIGURE 5

Anaphylactic reactions: treatment algorithm for children by first medical responders



1. An inhaled beta$_2$-agonist such as salbutamol may be used as an adjunctive measure if bronchospasm is severe and does not respond rapidly to other treatment.
2. If profound shock judged immediately life threatening give cardiopulmonary resuscitation/advanced life support, if necessary. Consider slow intravenous (IV) adrenaline (epinephrine) 1 : 10,000 solution. This is hazardous and is recommended only for an experienced practitioner who can also obtain IV access without delay. Note the different strength of adrenaline (epinephrine) that may be required for IV use.
3. For children who have been prescribed an adrenaline auto-injector, 150 micrograms can be given instead of 120 micrograms and 300 micrograms can be given instead of 250 micrograms or 500 micrograms.
4. Absolute accuracy of the small dose is not essential.
5. A crystalloid may be safer than a colloid.

(Resuscitation Council (UK) 2005b)

shape and size as a pen, and administering the drug adrenaline (epinephrine). The GP or nurse also has a responsibility to ensure that the patient fully understands the importance of carrying the device at all times and understands how to use it. Auto-injector devices are a fully assembled syringe for single intramuscular usage and can administer 300mcg of adrenaline in the adult device and 150mcg in children (Jevon 2006). Where possible the patient can also be referred to an allergy clinic which can eliminate further causes of allergic reactions through safe and structured assessment. Nurses are also ideally placed to offer support and education to the patient's family. Advice on preventive measures and techniques for first responders can help alleviate anxiety for the family of those susceptible to an allergic reaction.

Conclusion

Anaphylaxis is a medical emergency with the number of reported cases continuing to rise. Health professionals need to be aware of the many different ways and reasons that this allergic reaction can present. The treatment and management of anaphylaxis have been unified because of the guidelines set out by the Resuscitation Council (UK). In providing set algorithms for first responders, the Resuscitation Council (UK) has enabled all nurses to be familiar with how to manage this emergency situation. However, recognition, treatment and management of anaphylaxis are advanced nursing roles, requiring advanced nursing knowledge to achieve prevention, the key purpose of anaphylactic management **NS**

Time out 6

Now that you have completed the article you might like to write a practice profile. Guidelines to help you are on page 60.

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Anaphylaxis

TEST YOUR KNOWLEDGE AND WIN A £50 BOOK TOKEN

HOW TO USE THIS ASSESSMENT

This self-assessment questionnaire (SAQ) will help you to test your knowledge. Each week you will find **ten multiple-choice questions which are broadly linked to the learning zone article.**
Note: There is only one correct answer for each question.

Ways to use this assessment

- You could test your subject knowledge by attempting the questions before reading the article, and then go back over them to see if you would answer any differently.
- You might like to read the article to update yourself before attempting the questions.

The answers will be published in *Nursing Standard* two weeks after the article appears.

Prize draw
Each week there is a draw for correct entries. Send your answers on a postcard to: Nursing Standard, The Heights, 59-65 Lowlands Road, Harrow, Middlesex HA1 3AW, or via email to: zena.latcham@rcnpublishing.co.uk

Ensure you include your name and address and the SAQ number. This is SAQ No 393. Entries must be received by 10am on Tuesday June 5 2007.

When you have completed your self-assessment, cut out this page and add it to your professional portfolio. You can record the amount of time it has taken you. Space has been provided for comments and additional reading. You might like to consider writing a practice profile, see page 59.

1. Anaphylaxis is characterised by which of the following:
a) Urticaria ❑
b) Angio-oedema ❑
c) Respiratory distress ❑
d) All of the above ❑

2. Which drug is the most common cause of anaphylaxis?
a) Aperients ❑
b) Penicillin ❑
c) Anxiolytics ❑
d) Antidiarrhoeals ❑

3. Which class of immunoglobulin (Ig) is associated with anaphylactic reactions?
a) IgG ❑
b) IgA ❑
c) IgD ❑
d) IgE ❑

4. In early phase anaphylaxis patients may present with:
a) Skin flushing ❑
b) Laryngeal obstruction ❑
c) Cardiac arrest ❑
d) Stridor ❑

5. Why is adrenaline (epinephrine) the cornerstone of anaphylaxis management?
a) It reduces oedema ❑
b) It reverses peripheral vasodilation ❑
c) It dilates the airways ❑
d) All of the above ❑

6. How many micrograms of adrenaline are contained in auto-injector devices for children?
a) 50mcg ❑
b) 100mcg ❑
c) 150mcg ❑
d) 200mcg ❑

7. Which foods may trigger an anaphylactic reaction?
a) Nuts ❑
b) Dairy products ❑
c) Eggs ❑
d) All of the above ❑

8. In late phase anaphylaxis patients may present with:
a) Pruritus ❑
b) Hypotension ❑
c) Respiratory arrest ❑
d) Coughing ❑

9. The mnemonic AVPU means:
a) Alertness, voice response, pain response, unresponsive ❑
b) Airway, vision, pulse, urticaria ❑
c) Awareness, vocal, placid, unresponsive ❑
d) Airway, vomiting, pruritus, urticaria ❑

10. Normal capillary refill time is considered to be within:
a) Two seconds ❑
b) Two minutes ❑
c) Six seconds ❑
d) Six minutes ❑

This self-assessment questionnaire was compiled by Lisa Berry

Report back

This activity has taken me ____ hours to complete.

Other comments:

_____
_____
_____

Now that I have read this article and completed this assessment, I think my knowledge is:
Excellent ❑
Good ❑
Satisfactory ❑
Unsatisfactory ❑
Poor ❑
As a result of this I intend to:

_____
_____
_____

Answers

Answers to SAQ no. 391

1. c 2. c 3. a 4. a 5. b
6. d 7. d 8. c 9. a 10. d