

Chapter 14: Medical Emergencies

1 Anaphylaxis

1.1 Learning objectives

By the end of this lesson you will be able to:

- Explain the term anaphylaxis and its common causes
- Describe signs and symptoms that a patient with anaphylaxis may present with
- State the management of anaphylaxis including the administration of adrenaline using the patient's own auto-injector.

1.2 Introduction

Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death [Sampson, 2006]. Its hallmark is rapidly developing life-threatening airway/breathing/circulation (or any combination of the three) problem(s) and it is usually associated with skin and mucosal changes [Soar, 2008].

The exact incidence of anaphylaxis is unknown as many episodes are not reported, but it is thought that around 1 in 1,333 of the population have an anaphylactic reaction at some point in their lives [Soar, 2008]. Approximately 3,000 people a year are admitted to hospital in England [DoH, 2006b] (600–700 in Scotland [SG, 2009]) with anaphylaxis, and it is estimated that there are 10–20 deaths per year in England and Wales [DoH, 2006b].

The most common causes (triggers) are food, medication and insect stings [Lee, 2011]. In children, food is the most common cause of allergy, whereas in adults, it is medication [Capps, 2010]. Death is unlikely more than 6 hours after exposure to a trigger, but cardiac arrest can occur in minutes, particularly if the trigger is medication that has been administered intravenously. Envenomation typically causes cardiac arrest within 15 minutes, and food takes a little longer on average, at around 30 minutes [Pumphrey, 2000].

1.3 Signs and symptoms

Anaphylaxis is highly likely when any one of the following criteria are fulfilled [Sampson, 2006]:

1. Acute onset of an illness (minutes to several hours) with involvement of the skin and/or mucosal tissue (e.g. generalised urticaria, pruritus or flushing, and swollen lips-tongue-uvula, also known as angioedema) and at least one of the following:
 - Respiratory compromise (e.g. difficulty breathing, bronchospasm, stridor)
 - Reduced blood pressure or associated symptoms of end-organ dysfunction (e.g. collapse)
2. Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours):
 - Involvement of the skin/mucosal tissue
 - Respiratory compromise
 - Reduced blood pressure or associated symptoms
 - Persistent gastrointestinal symptoms (e.g. crampy abdominal pain, nausea, vomiting, diarrhoea)
3. Rapid onset of reduced BP after exposure to a known allergen for that patient (minutes to several hours):
 - Infants and children: low systolic BP
 - Adults: systolic BP of less than 90 mmHg.

NOTE: Up to 20% of anaphylaxis cases do not have skin and/or mucosal changes, particularly reactions that occur intra-operatively in adults and food/insect sting induced reactions in children. Patients with severe anaphylaxis resulting in significant hypotension may not exhibit any cutaneous symptoms until their blood pressure is restored [Lee, 2011].

1.4 Management

Having conducted your standard ABCDE assessment and determined that your patient is likely to be suffering from anaphylaxis, you should identify the trigger and remove it if

possible (e.g. stop any drug infusions, remove bee stings). However, if this is not possible, then do not delay treatment. If you suspect food-induced anaphylaxis, encouraging the patient to vomit is NOT recommended [Soar, 2008].

Patients with A or B problems are likely to be more comfortable sitting up, whereas those with C problems are best managed recumbent with or without legs raised. It is important not to make patients sit or stand if they feel faint as this can cause cardiac arrest!

Administer high-flow oxygen at 15 litres per minute and, if local guidelines allow, administer intramuscular (IM) adrenaline as soon as possible (Figure 1.1) [BTS, 2008; AACE, 2013]. Patients who still have a pulse should not have adrenaline administered intravenously (IV), except by those who do this in normal clinical practice (e.g. critical care paramedics, anaesthetists). The preferred route is IM into the anterolateral thigh as there is a greater margin of safety, it is quick to administer (versus gaining IV access) and the peak plasma concentration is higher when adrenaline is administered in the thigh compared to the deltoid [Simons, 2001]. In the event of a cardiac arrest, however, the patient should receive their adrenaline IV [Soar, 2008]. Doses of adrenaline can be repeated every 5 minutes depending on patient condition.

Once IV access has been obtained, the senior clinician is likely to administer fluid and consider other second line treatments, such as antihistamines and hydrocortisone. In addition, you may be asked to set up a nebuliser to administer bronchodilators such as salbutamol and ipratropium [AACE, 2013].

NOTE: Adrenaline is also known as epinephrine, particularly in American texts.

1.4.1 Auto-injectors

Patients who are known to have anaphylactic reactions may have been provided with their own adrenaline auto-injector. Common systems in the UK include Jext® and Epipen® and are typically available as 300 microgram adult and 150 microgram child doses. Depending on your service, you may be authorised to administer these, but even if you are not, it is important that you are aware of the procedure and can ensure that patients administer their own adrenaline properly.

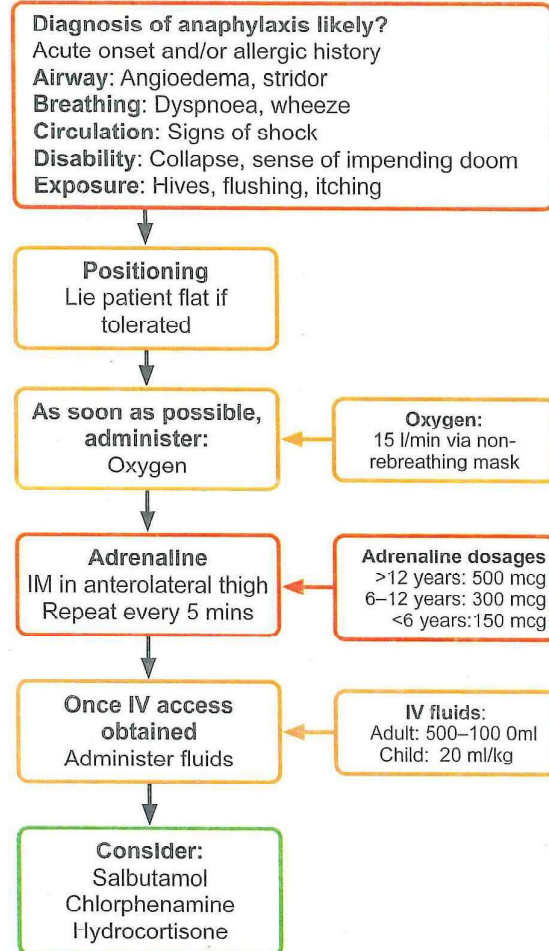
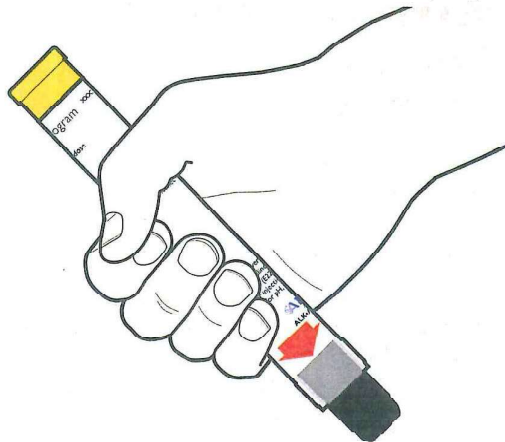
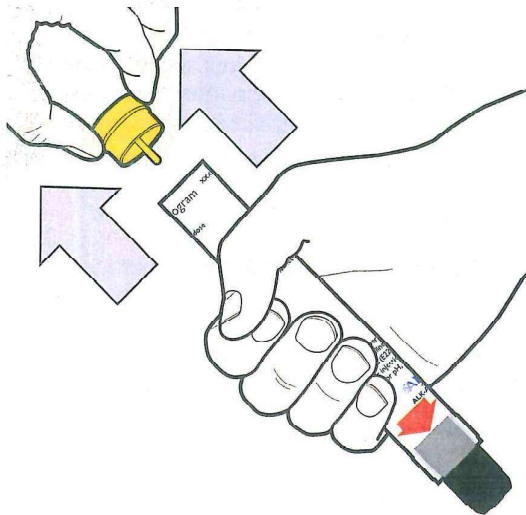


Figure 1.1 Emergency management of anaphylaxis

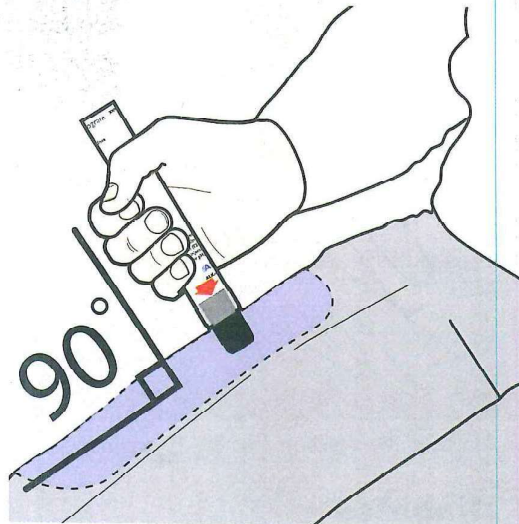
Procedure for Jext autoinjector [ALK-Abello, 2013]



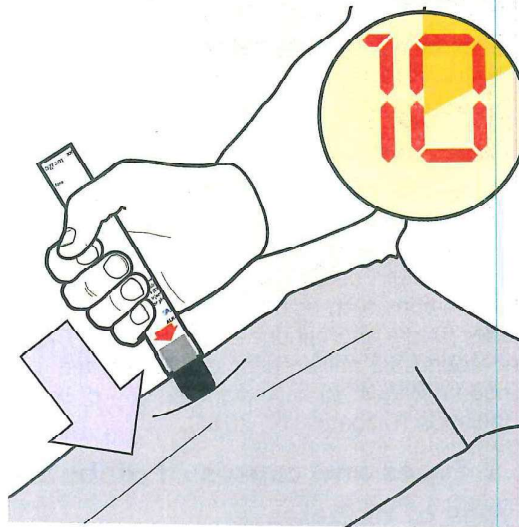
1. Grasp the Jext injector in your dominant hand (the one you use to write with) with your thumb closest to the yellow cap



2. Pull off the yellow cap with your other hand

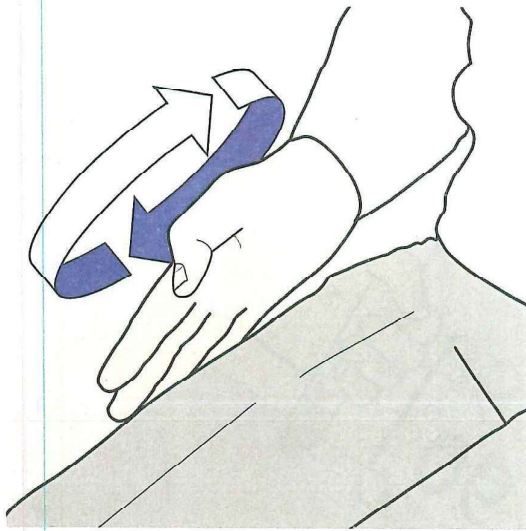


3. Place the black injector tip against your outer thigh, holding the injector at a right angle (approx 90°) to the thigh



4. Push the black tip firmly into your outer thigh until you hear a 'click' confirming the injection has started, then keep it pushed in. Hold the injector firmly in place against the thigh for 10 seconds (a slow count to 10) then remove. The black tip will extend automatically and hide the needle

Procedure continued →



5. Massage the injection area for 10 seconds

2 Diabetes

2.1 Learning objectives

By the end of this lesson you will be able to:

- Describe the types and causes of diabetes
- Describe two diabetic emergencies
- Explain how to record a blood sugar measurement.

2.2 Introduction

Diabetes mellitus is a common metabolic disorder typified by chronic high blood sugar (hyperglycaemia). It is a major cause of morbidity and premature death due to long-term complications such as heart attacks, stroke, kidney failure and blindness [Holt, 2010]. There are around 3.2 million people in the United Kingdom known to have diabetes, 6% of the population [Diabetes UK, 2014].

2.3 Types and causes of diabetes

Types of diabetes

There are two types of diabetes [WHO, 1999]:

- Type 1: Previously referred to as insulin-dependent diabetes (IDDM). Patients with type 1 diabetes are unable to produce any insulin, usually due to autoimmune disease which destroys the insulin-producing beta cells in the pancreas [Holt, 2010]. Insulin is a hormone that

increases transport of glucose across cell membranes and is released by the beta cells. It targets the muscle, fat and liver cells to promote the creation of glucose [Tortora, 2008].

- Type 2: Previously referred to as non-insulin dependent diabetes (NIDDM). Patients with type 2 diabetes have a relative insulin deficiency due to varying degrees of insulin resistance. This is by far the most common type of diabetes, accounting for around 90% of all people with diabetes in the UK.

Causes/risk of diabetes

Underlying causes of diabetes generally fall into four categories [Holt, 2010]:

- Genetic: A family history of type 1 diabetes or other autoimmune disease is linked to a higher risk of developing type 1 diabetes in the family. Likewise, type 2 diabetes also has a familial component, although this connection is rather more complicated
- Obesity: This increases the risk of developing type 2 diabetes, particularly in people with a body mass index over 25 kg/m² or large waist circumference
- Age: People are living longer and beta cell function declines with age, leading to a chance of developing diabetes in old age
- Ethnicity: Some ethnic groups are at higher risk of developing diabetes, particularly those of South Asian and Afro-Caribbean origin.

2.4 Diabetic emergencies

Blood sugar is typically maintained within a narrow range of 3.0 to 5.6 mmol/l [AACE, 2013]. Diabetic patients are generally encouraged to keep their blood sugar at 4.0 or higher, with a target range of 4.0–8.0 mmol/l for children and 4.0–7.0 mmol/l for adults [NICE, 2004].

There are two main types of diabetic emergency that you will encounter on an ambulance:

- Hypoglycaemia
- Severe hyperglycaemia.

2.4.1 Hypoglycaemia

Although diabetic patients are generally encouraged to keep their blood sugar at 4.0 or higher, some will experience symptoms of hypoglycaemia at blood sugar levels higher than

this, making recognition important. Some signs and symptoms of hypoglycaemia include [Deary, 1993]:

- Sweating
- Palpitations
- Shaking
- Hunger
- Confusion
- Drowsiness
- Odd/aggressive behaviour
- Speech problems
- Headache
- Nausea.

Management

If the patient is still conscious and able to take oral glucose, then administer 10–20g of glucose. You can find 10g of glucose in [BNF, 2014; AACE, 2013]:

- 55 ml Lucozade Energy Original
- 100 ml Coca-Cola
- 18 ml Ribena Blackcurrant (diluted to taste)
- NB: none should be diet/sugar-free varieties!
- 2 teaspoons of sugar
- 3 sugar lumps.

In addition, commercial preparations of glucose are available including Glucogel, DextroGel and Hypo-Fit. Administration of oral glucose can be repeated after 10–15 minutes, if required.

If the patient is unable to take oral glucose due to impaired consciousness, is uncooperative or there is a risk of aspiration, then either IM glucagon or IV glucose should be administered. This decision will be a judgement call by the senior clinician and will depend on whether IV access can be obtained.

2.4.2 Severe hyperglycaemia

Hyperglycaemia, or high blood sugar levels, is a classic symptom of diabetes. However, chronically high levels of blood glucose can lead to potentially life-threatening complications such as diabetic ketoacidosis and hyperosmolar hyperglycaemic syndrome. You don't need to know what these are, but you should appreciate that patients with these conditions can still appear reasonably well [Holt, 2010].

Signs and symptoms of severe hyperglycaemia include [AACE, 2013]:

- High blood sugar reading (compare to patient's normal value)
- Excessive urination (polyuria)
- Excessive thirst (polydipsia)
- Increased appetite
- Lethargy, confusion and ultimately, loss of consciousness
- Dehydration, dry mouth and, in severe cases, hypovolaemic shock
- Hyperventilation.

Management

These patients should be managed in hospital. The senior clinician may elect to administer intravenous fluids if the patient is showing signs of shock, but generally this will be undertaken while en route to hospital. Oxygen is also administered if the patient is suffering from hypoxaemia [AACE, 2013].

2.5 Blood sugar measurement

Procedure - Accu-Chek® Aviva blood glucose meter



1. Wash and dry your hands or use alcohol gel and put on gloves. Select an appropriate site, which is typically the side of a finger in an adult or older child and the heel of the foot in a younger child or infant. Clean the area with water or a water-soaked gauze. Insert the test strip into the meter and check that the meter turns on automatically

Procedure continued →



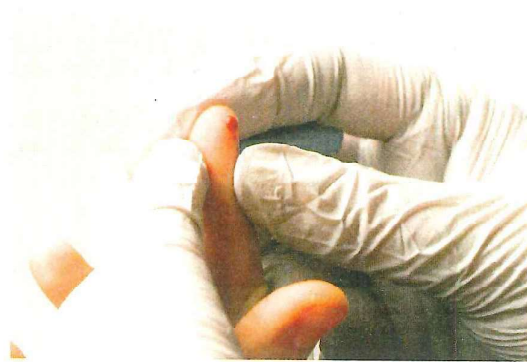
2. Ensure that the code number of the display matches the code number on the test strip container



3. On the screen, an icon showing the test strip and a flashing blood drop will appear. Ask the patient to dangle their arm down at their side to encourage blood flow to their fingertips



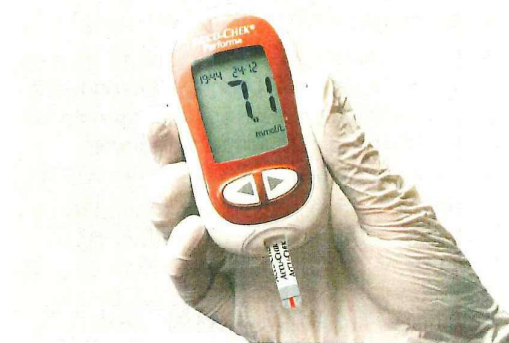
4. Prick the target area with a lancet, disposing of it in a sharps bin after use



5. With the patient's hand facing downwards, gently squeeze their finger to assist the flow of blood



6. Touch the blood drop to the front edge of the yellow window of the test strip. When you have enough blood, you will see an egg timer icon flash



7. The blood sugar result will appear on the display. Note this value on the patient report form

3 Sepsis

3.1 Learning objectives

By the end of this lesson you will be able to:

- Explain what sepsis and septic shock are and how they occur
- State how you would recognise a patient with sepsis or septic shock
- Describe the out-of-hospital management of sepsis.

3.2 Introduction

Sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs. It leads to shock, multiple organ failure and death if not recognised early and treated promptly [Czura, 2011]. Sepsis is estimated to cause 36,000–64,000 deaths a year, making it the third biggest killer behind cardiovascular disease and stroke, and responsible for more deaths than lung, bowel and breast cancer [Daniels, 2011a]. Around 90% of patients with sepsis arrive by ambulance, most commonly presenting with a respiratory tract infection [Gray, 2013; Daniels, 2011b] and 35–40% of these patients will die in hospital [Daniels, 2011a; Vincent, 2006; Levy, 2010].

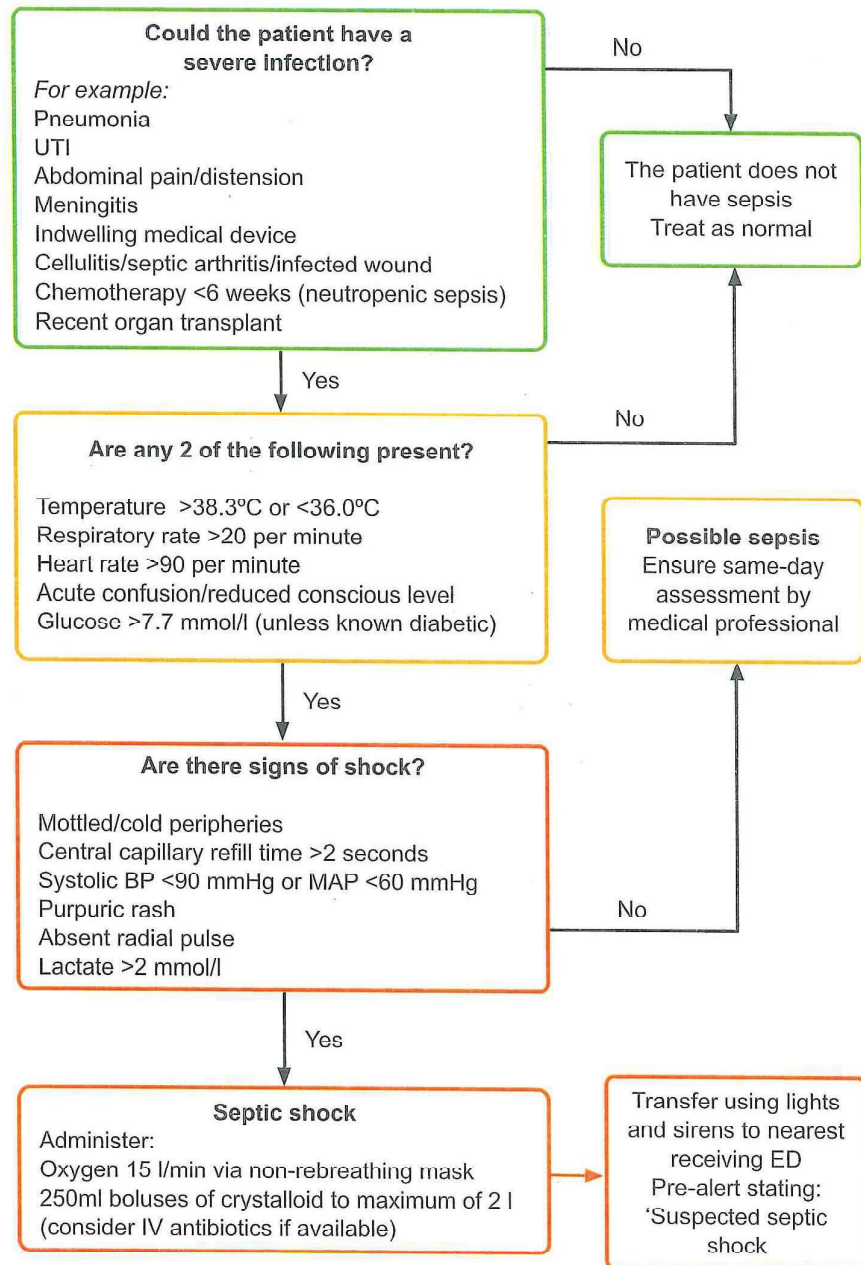
As the definition above implies, sepsis requires the presence of infection and a systemic

inflammatory response syndrome (SIRS), a whole body inflammatory process that can lead to organ dysfunction and failure. This distinction is important, as SIRS can occur in the absence of infection in cases of pancreatitis, burns and trauma, for example [Bone, 1992]. However, in order for a patient to be considered septic, an infection must be present.

A subset of sepsis is severe sepsis. A patient is said to be suffering severe sepsis if there is associated organ dysfunction, hypoperfusion or sepsis-induced hypovolaemia. If the patient has sepsis-induced hypotension despite adequate fluid resuscitation, and the presence of hypoperfusion, they are said to be in septic shock. [Bone, 1992]

3.3 Recognition and management

To simplify the identification of sepsis (particularly severe sepsis), a screening tool has been developed for in-hospital use and adapted for out-of-hospital use (Figure 3.1) [Daniels, 2011a]. The first two sections of the tool mirror the definition of sepsis, i.e. the need for the presence of infection and signs and symptoms of SIRS. Identifying sepsis before arrival at the emergency department (ED) and, even more importantly, ambulance crews stating that they suspect the patient has sepsis, reduces patients' time to receiving antibiotics and the sepsis care bundle in the ED [Studnek, 2012; Band, 2011].

**Figure 3.1** Sepsis screening tool