Abstract

Acute limb compartment syndrome (ALCS) is a serious complication of traumatic injury. Although ALCS can occur in any limb, it most commonly occurs following injury to the lower leg, particularly in fractures of the tibia. Practitioners should recognise and treat ALCS as early as possible to prevent the development of further, potentially serious, complications. Most of the literature recommends that patients at risk of ALCS should be carefully monitored, with a focus on pain as the main symptom. However, patients in the intensive care unit (ICU) who are unconscious or sedated may be unable or unreliable in reporting pain, therefore it is necessary to consider alternative assessments for ALCS. This article provides an overview of the evidence and guidelines in relation to ALCS in the lower leg and how to undertake an effective assessment for the condition in patients in the ICU. This will enable practitioners to make evidence-based clinical decisions to improve practice and patient safety.

Keywords
acute limb compartment syndrome, compartment syndrome, fasciotomy, intensive care, lower leg injuries, musculoskeletal trauma, tibial fractures, trauma

Aims and intended learning outcomes

The aim of this article is to explore the care of patients in the intensive care unit (ICU) who have experienced traumatic injury and are at risk of acute limb compartment syndrome (ALCS), specifically in the lower leg. It discusses how to recognise the symptoms of ALCS and assess the condition effectively. After reading this article and completing the time out activities you should be able to:

» Describe the pathophysiology of ALCS in patients who have experienced traumatic injury to the lower leg.
» Outline the main symptoms and potential adverse effects of ALCS in the lower leg.
» Identify the challenges associated with assessing the symptoms of ALCS in the lower leg in patients in the ICU.
» Discuss the use of compartment pressure monitoring (CPM) of patients in the ICU who are at risk of ALCS.

Relevance to The Code

Nurses are encouraged to apply the four themes of The Code: Professional Standards of Practice and Behaviour for Nurses and Midwives to their professional practice (Nursing and Midwifery Council (NMC) 2015). The themes are: Prioritise people, Practise effectively, Preserve safety, and Promote professionalism and trust. This article relates to The Code in the following ways:
Introduction

Trauma can result in life-changing injuries, and in some cases death, and can have serious consequences for the patient and their family (National Confidential Enquiry into Patient Outcome and Death 2007). The aims of trauma care are maintaining life and preventing death, while avoiding disability and enabling recovery. This includes recognising potential and actual complications of traumatic injury (Heaney and Santy-Tomlinson 2014).

ALCS is a potentially life and limb-threatening condition that is caused by raised pressure in a muscle compartment, which results in local tissue hypoxia and ischaemia. Acute compartment syndrome can occur in the lower limb, upper limb and abdomen, although the focus of this article is ALCS in the lower limb. Although 70% of ALCS occurs after trauma to the upper or lower limb, it can also occur following burns, infection or long periods of unconsciousness or sedation with a limb in one position, or as a result of constricting casts or bandages (von Keudell et al 2015). In the ICU, ALCS is most common following trauma to the lower leg, particularly following fractures of the tibia, and in association with other serious injuries; therefore, this is the main focus of this article.

ALCS leads to a group of symptoms that are central to the diagnosis and subsequent management of the condition (Royal College of Nursing (RCN) 2014, British Orthopaedic Association (BOA) 2015, von Keudell et al 2015). All practitioners, particularly those caring for patients who have experienced traumatic injury, should be able to recognise developing ALCS. The condition often presents ‘silently’ in patients who are critically ill, because assessment can be challenging when the patient has an altered state of consciousness and may be unable or unreliable in reporting symptoms, especially pain. Therefore, it is essential that practitioners recognise the presenting signs and symptoms of ALCS so that treatment can be undertaken as soon as possible to maintain patient safety and improve patient outcomes.

Pathophysiology of acute limb compartment syndrome in the lower leg

Limb muscles are bound into bundles by inelastic connective tissue known as fascia. Each bundle of muscles forms a compartment that also accommodates, deep within the compartment, the main blood and nerve supply to that section of the limb and its peripheries (Figure 1). Following traumatic limb injury or surgery there will be bleeding, inflammation and swelling which, if severe, can lead to an increase in the contents of the compartment; however, the space is unable to expand to accommodate it. This can lead to increased pressure within the compartment and may result in ALCS (Mabvuure et al 2012).
Trauma to the lower limb often results in complex fractures of the tibia with significant bleeding and swelling of the surrounding tissue, making the lower leg the most common site of acute compartment syndrome (Wall et al 2010). ALCS can also be caused by decreased compartment size as a result of prolonged limb compression following burns or crush injury (when tissues are compressed between two surfaces) (Gourgiotis et al 2007), or because of casts or constricting bandages. Increased compartment contents, or decreased compartment size, reduce the amount of space in the compartment and increase the compartment pressure, compressing blood vessels and nerves, compromising the circulation and resulting in insufficient blood supply to the nerves and muscles (Harvey 2001). Suboptimal perfusion results in hypoxia of the tissues, which can lead to muscle necrosis. This can also lead to acidosis, which slows down nerve conduction (Mauser et al 2013, von Keudell et al 2015). The layer of fascia surrounding limb muscle compartments has limited stretch, and pressure rises quickly and significantly in this confined space, even with a small amount of bleeding into, or swelling of, the tissues in the compartment (Figure 2).

ALCS can develop in the first 30 minutes to one to two hours following injury or surgery (Wall et al 2010, von Keudell et al 2015). Changes in muscle function are evident in four to 12 hours, and neuromuscular damage becomes irreversible at more than six hours (Wall et al 2010, von Keudell et al 2015). If ALCS is suspected, any bandages, casts or splints should be split down to the skin or released immediately. The limb should be elevated to the level of the patient’s heart, if possible, to reduce swelling by assisting venous return. However, higher elevation of the affected limb in patients with ALCS is contraindicated because this reduces vascular perfusion. The patient should be reassessed at least every 30 minutes and urgent medical review should be undertaken (BOA 2015).

Confirmed ALCS requires immediate surgical intervention, with fasciotomy and decompression of the affected compartment.
by incision and opening the skin and muscle fascia. This releases the enclosed muscle and decreases the compartment pressure, enhancing blood flow to the tissues and resolving ischaemia (Figures 3 and 4) (Mauser et al 2013). However, risk of infection and complications with wound healing are associated with fasciotomy, as well as other complications of surgery, and the wound usually requires a skin graft (von Keudell et al 2015).

ALCS is considered a medical emergency. It is a serious life and limb-threatening condition that should be considered a possible complication for every patient following musculoskeletal trauma (RCN 2014), and it is a significant patient safety issue. If the condition is not recognised quickly and managed effectively, it can result in permanent nerve and muscle damage, loss of the limb, sepsis, rhabdomyolysis and possible death (von Keudell et al 2015). Skeletal muscle can break down as a result of ischaemia and necrosis. Rhabdomyolysis occurs when some of the products of damaged muscle, such as myoglobin, are released into the bloodstream. Such large proteins are toxic, and therefore harmful, to the kidneys and other organs; thus rhabdomyolysis can result in acute renal failure, multiple organ failure, and in some cases death (Duckworth and McQueen 2011).

TIME OUT 1
Define ALCS in your own words and think about how you would discuss the condition with a relative of an unconscious patient with a lower leg injury. Ensure that you use terms that they can easily understand.

Assessment and diagnosis of acute limb compartment syndrome
ALCS commonly occurs when there is a fracture of the tibial shaft, radius or ulna (Newton and Love 2007). Any patient who has sustained such an injury should be considered at risk of ALCS. Patients who are at increased risk of ALCS tend to be young males who have sustained an injury to the lower leg (Wall et al 2010, Ali et al 2014, BOA 2015). Although the reason for this is not fully understood, one explanation is that young men have larger calf muscles than older men or women, resulting in an increased likelihood of bleeding and increased pressure. Nevertheless, other age groups and women are also at risk of ALCS.

Recognising ALCS is challenging for practitioners because its diagnosis is not always clear and straightforward (Mauser et al 2013) and its assessment varies (Wall et al 2007). Many of the signs and symptoms of neurovascular compromise in a limb are often first reported by the patient, who will usually describe an increase in pain or a change in sensation. However, patients who are critically ill and unconscious or sedated may not be able to report pain; therefore, monitoring the limb by other means is paramount. UK guidelines for ALCS do not specifically consider patients who are critically ill in detail (RCN 2014, BOA 2015), although this is explored in other guidance and literature (Wall et al 2010, von Keudell et al 2015). ALCS is diagnosed by observing clinical signs of the condition and patient-reported symptoms. In the past, the clinical presentation associated
with a diagnosis of ALCS has been referred to as the ‘5Ps’: pain, pallor, paraesthesia, paralysis and absence of pulses. The 5Ps were established through the symptoms observed in vascular injuries, and have been used to describe the clinical signs and symptoms associated with ALCS for many years (Mauser et al 2013); however, their appropriateness is increasingly questioned (von Keudell et al 2015). Ali et al (2014) and Wall et al (2010) conducted literature reviews to examine the available evidence on the assessment and diagnosis of ALCS, risk reduction and early recognition, as well as to identify limitations of the existing evidence. These literature reviews found that the main clinical features of ALCS include: pain, pressure, paraesthesia, absence of pulses and paralysis, but that some of these symptoms are more important in diagnosis than others. Both of the literature reviews concluded that pain is the earliest and most important symptom of ALCS and that pain should be the focus of assessment, while other symptoms tend to occur later and are less useful in early diagnosis of the condition (Wall et al 2010, Ali et al 2014). However, it is important that practitioners understand the relevance of each of the symptoms of vascular injury and why pain is the most important symptom in recognising ALCS.

**Pain**

In patients who are conscious, the most frequent, and earliest reported symptom of ALCS is pain caused by ischaemia of the tissues, and this is considered the most important indicator of the condition (BOA 2015). However, pain cannot be reported by patients who are unconscious or sedated, thus alternative methods of identifying ALCS are necessary, and are discussed later in this article. Where it can be reported, pain indicating ALCS is often described by patients as severe, unremitting and disproportionate to the injury sustained or the surgery performed (Gourgiotis et al 2007). The pain is aggravated by stretching or flexing of the muscles of the associated compartment. Significantly, pain is not relieved with analgesia (Gourgiotis et al 2007), including opioids.

Frequent pain assessment using appropriate assessment tools should be undertaken to enable recording of accurate pain scores to monitor the patient’s condition (RCN 2014) and how pain changes over time. The same pain assessment tool should be used consistently by the multidisciplinary team to ensure the scores are reliable and comparable. It is essential that the patient’s experience of pain is considered as a potential sign of ALCS, and if it is suspected that the cause of worsening and/or unresolved pain may be neurovascular compromise, it is essential to alert an appropriate medical practitioner and ensure prompt action is taken.

While pain has many causes, ALCS is one of the most serious conditions in patients who have experienced traumatic injury, and a high index of suspicion is required. von Keudell et al (2015) emphasised the importance of focusing on pain rather than other symptoms of vascular injuries that might be misleading, because they are more often signs of arterial ischaemia. von Keudell et al (2015) stated that: ‘If the patient is awake, the 5Ps to consider are pain, pain, pain, pain and pain.’ However, it
is important to note that undertaking other limb observations can assist the practitioner in identifying other vascular conditions, even if they are less likely to be useful in diagnosing ALCS.

Paraesthesia, paralysis, absence of pulses and pallor
Swelling and rising pressure in the muscle compartment can lead to tenseness of the limb with characteristic shiny skin and firmness to the touch, in comparison to the unaffected limb (Ozkayin and Aktuglu 2005). Paraesthesia, paralysis and absence of pulses are also reported symptoms of ALCS, but are considered late signs of the condition (Harris et al 2006). Paraesthesia may also be a sign of other neurovascular complications, and may include tingling, pins and needles, numbness or decreased sensation as a result of compression of the nerves in the compartment. Patients who are conscious should be asked to report any unusual sensations in the limb that is injured or has been operated on. Findings should be compared bilaterally with the unaffected leg (Flynn et al 2015). Paraesthesia may progress to paralysis; the patient loses the ability to use the muscle as a result of nerve damage or necrosis of muscle tissue. To assess for paralysis, patients should be regularly asked to move the digits of the affected limb if they are able to do so.

Pulses may be weak or absent, although a pulse will only be absent when the relevant artery is enclosed in an affected compartment (Shears and Porter 2006) and is compressed by the increase in pressure; therefore, it is essential to palpate all limb pulses. However, weakness or absence of pulses is a late sign of neurovascular compromise. Pallor and/or mottling of the limb may also occur, although this is an unreliable sign of ALCS because it is more likely to indicate other types of vascular compromise (Gourgiotis et al 2007).

It is important for practitioners to observe and record the colour of the entire limb frequently. Change in colour can be an indication of suboptimal perfusion, especially if the limb is blue, mottled, pale or dusky in appearance and feels cold, indicating the possibility of other neurovascular complications. Anti-embolism stockings, bandages and splints should be removed, if possible, to aid visual assessment of the limb, including the skin. Such assessment may not be possible in the presence of casts, so these should be split or bivalved.

TIME OUT 2
Write down the steps you would take if you thought a patient may be displaying signs of ALCS. Share and discuss this information with your colleagues.

It is important to remain vigilant to the symptom of pain in patients who are conscious, because it is the earliest sign of ALCS and should be the main focus of assessment. Nevertheless, documenting other neurovascular observations is important to identify symptom patterns in patients who are at risk of other causes of neurovascular deficit.

TIME OUT 3
Reflect on how you undertake limb assessment for patients who have experienced traumatic injury in your practice area. How might you improve limb assessment for these patients? Discuss ways you could develop practice in this area with your colleagues.

Compartment pressure monitoring
To assist in the diagnosis of ALCS, it is suggested that CPM should be used in conjunction with the assessment of clinical signs to measure the pressure in the muscle compartments (Duckworth and McQueen 2011). CPM involves placing a catheter into the affected limb compartment to enable recording of pressure readings from within the compartment and was initially discussed in seminal work by McQueen and Court Brown (1996a). Reviews and guidelines have asserted that CPM is a useful method of diagnosing ALCS and have specifically recommended its use in patients who are confused, uncooperative, sedated or unconscious, because patient-reported symptoms are absent or unreliable, as is

Terminology relating to intracompartmental pressure is summarised in Box 1.

‘Normal’ pressure in a muscle compartment (intracompartmental pressure) is frequently reported to be 10-12mmHg (Garner and Handa 2010). It is suggested that pressure levels that rise above this can reach a threshold at which the circulation is threatened. Without medical intervention, the intracompartmental pressure will continue to increase, compromising intracompartmental perfusion and resulting in infarction of the tissue (Uliasz et al 2003).

The threshold at which intracompartmental pressure is considered to be high is controversial and there is debate about at what pressure measurement fasciotomy is required (Gourgiotis et al 2007), resulting in controversy about the true value of CPM for ALCS. There is concern that CPM might over-predict ALCS, leading to unnecessary fasciotomy. Some authors base recommendations for the threshold for fasciotomy on absolute compartment pressure, whereas others advocate using a perfusion pressure (Box 1) of <30mmHg as the threshold. Most studies recommend that fasciotomy should be considered when the intracompartmental pressure is >30mmHg (Blick et al 1986, McQueen and Court-Brown 1996a, 1996b, McQueen et al 2000). However, BOA (2015) guidelines state that: ‘If the absolute compartment pressure is greater than 40mmHg, with clinical symptoms, urgent surgical decompression should be considered unless there are other life-threatening conditions that take priority.’ These issues reflect a lack of consensus among practitioners, as well as a lack of reliability of the research on which practice is based, meaning that guidance is unclear. Therefore, practice is likely to be led by local healthcare organisations rather than the evidence base.

Many of the studies on which guidelines for CPM are based are dated, but are still considered relevant and are frequently used in reviews of the literature. Blick et al (1986) conducted a retrospective review of 180 patients admitted to a multiple-trauma centre over a three-year period. They found a 9.1% incidence of ALCS. Each case was documented by intracompartmental pressure measurements that were obtained using a saline-injection technique. The authors suggested that fasciotomy and decompression should be performed if the differential pressure drops to <30mmHg. In one seminal study, McQueen and Court-Brown (1996a) conducted a prospective analysis of 116 patients with fractures of the tibial shaft with CPM in place for 24 hours. Three patients developed ALCS. In the first 12 hours of monitoring, one patient had a differential pressure of <30mmHg. In the second 12-hour period, two patients had differential pressures of <30mmHg and also underwent a fasciotomy. The authors recommended that decompression should be performed if the differential pressure is <30mmHg, although this was based on only three patients who developed ALCS.

**BOX 1. Terminology relating to intracompartmental pressure (ICP)**

- The pressure in a muscle compartment is referred to as ICP, but this can be measured in several ways and is affected by a variety of factors: ICP can either be an absolute value (simply one direct measurement of pressure in mmHg) or a ‘derived value’ from a combination of measurements that relates to the compartment perfusion pressure.
- Perfusion pressure is derived from subtracting the ICP from the mean diastolic arterial pressure.
- The advantage of using perfusion pressure is that it accounts for physiological differences in patients’ blood flow or differences between muscle compartments, because it takes into account the ability of the blood vessels to supply nutrients to the muscles.
- Most importantly, the ‘critical pressure’ above which fasciotomy is required is controversial, and differences in the way in which ICP is measured means the results from different research studies cannot be compared.

(Adapted from Garner and Handa 2010)
Ozkayin and Aktuglu (2005) studied 39 patients with tibial fractures and also suggested that fasciotomy should be performed when the differential pressure is <30mmHg, although the sample size was relatively small. They measured the anterior absolute compartment pressure every 12 hours for 72 hours, as well as recording differential pressures. Three patients had differential pressures of <30mmHg, and all underwent fasciotomy. It is suggested that measuring compartment perfusion pressure is more reliable than absolute compartment pressure (Box 1) because it takes into account physiological variation and aims to avoid unnecessary fasciotomy (Garner and Handa 2010, Ali et al 2014). However, the method of measuring perfusion pressure relies on Whitesides and Heckman’s (1996) theory that the blood pressure can decrease or increase the effect of absolute compartment pressure on tissue perfusion (Ozkayin and Aktuglu 2005). Using perfusion pressure as a basis for clinical decisions may be unreliable in the ICU because many patients are haemodynamically unstable, especially those who require inotropic support, and this may result in false readings. Few studies have assessed the functional outcomes in patients who have been treated with fasciotomy for acute compartment syndrome in comparison to those who have not (von Keudell et al 2015); therefore, the available research is not useful in identifying if long-term outcomes are affected by the decision to use CPM.

CPM involves an invasive procedure to position a catheter or cannula into the limb compartment. An electronic monitor is used to record the pressure readings (Shadgan et al 2008) and should be used in conjunction with other clinical observations (Wall et al 2010). Garner and Handa (2010) identified that if the catheter or cannula is not sited correctly, it may result in inaccurate readings; patients may undergo unnecessary fasciotomy as a result of over-diagnosis of ALCS, while underestimated readings could result in underdiagnosis of the condition. Boody and Wongworawat (2005) evaluated three intracompartmental pressure-monitoring devices: the Stryker intracompartmental pressure monitor, Whitesides’ apparatus and the arterial line manometer. They found that slit catheters and side port needles were more accurate than straight needles, and that the Stryker monitor and the arterial line manometer were the most precise devices. For intracompartmental pressure to be accurate, it is vital that the catheter or cannula is inserted within 5cm of the fracture line and that practitioners who record these observations are familiar with the intracompartmental pressure monitoring device (Gourgiotis et al 2007). This may be challenging for practitioners in the ICU, where intracompartmental pressure monitoring is uncommon.

Some studies have recommended the use of CPM in patients who are unconscious only (Harris et al 2006, Al-Dadah et al 2008), while others have recommended CPM for patients who are unconscious as well as for those who are confused or uncooperative, resulting in no or unreliable patient-reported symptoms. It is suggested that the benefits of CPM outweigh the risks, because failure to use CPM may lead to unrecognised ALCS (Wall et al 2010). However, it is important to note that the presence of the catheter, which is an invasive device, may result in infection at the insertion site, so its use should be carefully considered and meticulous care of the insertion site be prioritised.

Harris et al (2006) and Al-Dadah et al (2008) studied patients who were unconscious and recommended the use of CPM. Harris et al (2006) randomised 200 consecutive patients with tibia fractures into monitored and non-monitored groups. The monitored group received CPM for 36 hours with no cases of compartment syndrome identified, and the non-monitored group had standard post-operative observations completed with five cases of ALCS identified. The diagnosis of ALCS was made clinically in patients who were alert, while patients who were unconscious were diagnosed using the intracompartmental
pressure reading. One criticism of this study is that indications for fasciotomy in alert patients in the monitored group were different to those of the patients who were unconscious, because they were also able to report signs and symptoms themselves; therefore, the two groups were not equal, potentially biasing the results. The authors concluded that CPM is not indicated in alert patients if they are appropriately observed, and this is confirmed in some clinical guidelines (Wall et al 2010, RCN 2014).

Al-Dadah et al (2008) reviewed a cohort of 109 consecutive patients with a tibial fracture who received continuous CPM and compared them to a historical group of the immediate previous 109 patients who were clinically monitored. In total, 33 patients underwent a fasciotomy for acute compartment syndrome. Seventeen of these patients had continuous CPM and 16 patients had clinical assessments alone. The mean time delay between injury and fasciotomy was 23 hours in the clinical assessment group and 22 hours in the CPM group. The results indicated that CPM did not increase the rate of unnecessary fasciotomies (Al-Dadah et al 2008).

It is suggested that CPM aids the diagnosis of ALCS when used in conjunction with assessment of clinical signs and symptoms, especially in patients who are unconscious (Wall et al 2010). However, the evidence is not high quality and is largely dated. Additional robust studies are necessary to determine the effectiveness of current clinical practice and provide guidelines for patient care (Ali et al 2014). In patients in the ICU, readings and interpretation of the intracompartmental pressure may be inaccurate. Patients may have other life-threatening emergencies and can be too critically ill to undergo surgery should they reach the threshold for fasciotomy if CPM is in place. However, it is important to monitor patients for ALCS while addressing other priorities. Therefore, the use of specific guidance and a neurovascular observation chart would be beneficial, particularly for patients in the ICU who are relatively stable.

**TIME OUT 4**

If you already use CPM in your practice, discuss with your colleagues its potential limitations. If you do not currently undertake CPM in your practice, discuss with your colleagues whether you feel this would be beneficial and its potential limitations.

**Development of practice in the intensive care unit**

There are no national protocols or guidelines to inform the diagnosis and management of ALCS specifically in patients in the ICU, and instructions and parameters established by medical consultants initiating treatment for ALCS can vary. The way in which the risk of ALCS is managed in the ICU requires careful consideration. Stabilising life-threatening injuries is often prioritised, and ALCS and subsequent tissue damage may occur if this is not assessed and managed at the same time. Monitoring patients who have sustained musculoskeletal trauma is central to the safe care of patients who are conscious and unconscious. Patients with musculoskeletal trauma whose consciousness is impaired are at increased risk of unrecognised ALCS, and require care from practitioners who have comprehensive knowledge of the pathophysiology, aetiology and physiological responses associated with ALCS. Since CPM is rarely used in most trauma units, including the ICU, practitioners may have limited knowledge of it, especially if there is no local protocol or guideline available.

It is important to ensure practitioners receive adequate education and training to provide safe and effective care to patients who have experienced traumatic injury. Guidelines should be established for the use of CPM for patients at risk of ALCS, such as those with lower leg injuries. In patients who are conscious and cognitively able, limb observations should be supported with evidence-based assessment tools. Nurses should be competent and vigilant in monitoring the patient’s vital signs, as well as in recognising the risks of musculoskeletal complications following traumatic injury. Education and training is necessary to ensure practice is effective and
It is important that practitioners in the ICU liaise with the orthopaedic team to establish a standardised plan of care for patients considered to be at risk of potential complications following a musculoskeletal injury. Patients require an extended care plan, including a pain assessment chart, as part of a general limb observation strategy to enable frequent monitoring and assessment.

**TIME OUT 5**
Write an action plan for your future practice and further learning relating to ALCS. Use a reflective model to assist you to write about a patient who was at risk of ALCS and how the care you provided reflects the knowledge you have gained.

**Conclusion**
ALCS is a limb and life-threatening complication of musculoskeletal trauma that can be unrecognised in patients in the ICU, particularly those with an altered state of consciousness who are unable to report pain. Guidance and appropriate documentation are necessary to support staff to monitor patients for ALCS in the ICU so that the condition can be recognised and acted on quickly. Further research is necessary to identify the most effective approaches to monitoring patients at risk of ALCS in the ICU. Practitioners require education and training to enable them to recognise patients at risk, diagnose ALCS and act on the findings of assessment. Specific guidance and validated documentation for neurovascular assessment in patients in the ICU are also required to enable practitioners to recognise the condition and provide effective treatment.

**TIME OUT 6**
Nurses are encouraged to apply the four themes of The Code (NMC 2015) to their professional practice. Consider how knowledge of the assessment and management of ALCS relates to the themes of The Code.

**TIME OUT 7**
Now that you have completed the article you might like to write a reflective account as part of your revalidation.

**References**


