Diagnosis, management and nursing care in acute coronary syndrome

Every three minutes one person is admitted to a UK hospital with acute coronary syndrome (British Heart Foundation, 2017), a common and life-threatening condition associated with coronary heart disease. ACS (Box 1) refers to a range of conditions affecting the blood supply to the heart muscles (myocardium); these include unstable angina, non-ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial infarction (STEMI).

ACS can result from a sudden drop in blood flow through the coronary arteries supplying the different regions of the myocardium. This can compromise the myocardium, leading to reversible ischaemia or a complete loss of blood supply, which in turn leads to myocardial infarction and ultimately myocardial cell death (necrosis).

In-hospital mortality from ACS has fallen from 20% to around 5% over the past 30 years, which may be due to better drug therapies, prompt recognition and treatment protocols (National Institute for Health and Care Excellence, 2013a). Timely management is crucial to reduce the risk of mortality and further cardiac events.

Treatments aims to ease symptoms, improve coronary artery blood flow and prevent complications. Immediate management, combined with cardiac rehabilitation and secondary prevention, can improve patients’ outcomes and quality of life. Nurses have a key role in:

- Facilitating and administering prompt treatment to patients;
- Promoting the swift recognition of deterioration;
- Providing holistic care and psychosocial support;
- Encouraging patients to engage in healthy secondary-prevention behaviours.

Pathophysiology
Most ACS cases are caused by atherosclerosis, which takes place in the coronary arteries, often decades before a cardiac event. The formation of an atherosclerotic plaque begins with low-grade inflammation in the inner layer of blood vessels. The endothelial cells lining blood vessels sustain injury, change shape and become increasingly permeable to fluid, lipids and white blood cells. Circulating cholesterol...
Nursing Practice
Review

Infarction

Review

carriers, especially low-density lipoprotein (LDL), can enter the arterial wall and undergo oxidation. White blood cells are involved and transform into macrophages, which engulf LDL; when they become lipid laden they are referred to as foam cells. These lipid-rich plaques contain inflammatory cells, cellular debris, smooth muscle cells with cholesterol, and a fibrous capsule. Over time they can progress and cause luminal narrowing of the blood vessel, thereby limiting blood flow.

ACS is usually triggered by the rupture of an atherosclerotic plaque in the wall of a coronary artery; this causes activation, adhesion and aggregation of platelets and the clotting systems, leading to the formation of a thrombus. If the thrombus completely occludes the coronary artery, the section of the myocardium supplied by that artery is starved of oxygen, leading to myocardial cell necrosis, and typical ST elevation changes are seen on an electrocardiogram (Fig 1). In addition, cardiac enzymes are released from damaged myocardial cells (troponin I and T, creatinine kinase MB isoenzyme), which can be measured in the blood.

Risk factors for ACS

ACS is more common in men, older people and those with a family history of ischaemic heart disease. Modifiable risk factors include smoking, obesity, hypertension, dyslipidaemia and poor diet. Lifestyle changes such as smoking cessation, weight loss, exercise, adherence to blood-pressure drugs, tight glucose control in patients with diabetes, and management of dyslipidaemias can be useful in both primary and secondary prevention.

Signs and symptoms

Patients typically present with central chest pain or tightness described as dull or crushing; it can radiate to the jaw or down the left arm and normally lasts for >15 minutes. Some patients, however, such as those with diabetes, older people or women, may not have chest pain.

Mnemonics, such as SOCRATES, can be used to assess patients’ chest pain:

- **S** – site of pain;
- **O** – onset of pain;
- **C** – character of the pain;
- **R** – any radiation;
- **A** – associated factors;
- **T** – timing of the pain;
- **E** – exacerbating/alleviating factors; for example, position or inspiration;
- **S** – severity of the pain using a rating scale of 1-10 (10 being the worst pain).

Shortness of breath, palpitations, syncope or autonomic symptoms such as sweating, nausea, tachycardia or vomiting may also occur (with or without chest pain). Close attention to vital signs is critical as patients can deteriorate and become haemodynamically unstable or develop heart failure and arrhythmias.

Diagnosis and first investigations

A thorough clinical history and physical examination should be undertaken and supported by an ECG. This helps delineate the treatment pathway and, in cases of STEMI, decide whether the patient needs urgent reperfusion. If ACS is suspected, the emergency services should be called and, on arrival, paramedics should perform an immediate ECG. Many paramedics are trained to recognise ECG changes seen in STEMI, which include ST elevation of >1mm height in two adjacent chest leads, ST elevation of >2mm in two adjacent limb leads, and new left bundle branch block.

If STEMI is suspected, paramedics will aim to take patients directly to a ‘heart attack centre’ that offers primary percutaneous coronary intervention (PCI). Often they will communicate with the cardiology team before arrival, which will facilitate urgent coronary reperfusion strategies (coronary angioplasty with/stent placed in the affected coronary artery) once the patient has arrived in hospital.

Primary PCI has become the first-line treatment in patients with STEMI presenting within 12 hours of onset of symptoms, provided it can be given within 120 minutes of the time in which thrombolysis could be given (NICE, 2013a). If primary PCI is not available or there is a delay, thrombolysis may be performed (using drugs such as alteplase and reteplase) after discussion with the on-call cardiologist – if there are no major contraindications.

If the ECG does not reveal an MI but cardiac ischaemia is suspected, patients should be admitted and have serial 12-lead ECGs to assess any dynamic changes. If there is myocardial damage, cardiac enzymes (typically troponins T and I) are raised, which can help confirm the diagnosis. NICE (2013b) advises that troponin be included in the initial assessment on admission and a second sample be taken 12-12 hours after symptoms began.

Increases or decreases of troponin above or below the normal limit on the repeat test can confirm NSTEMI. A negative troponin and no ECG changes can support a decision to discharge patients who may have unstable angina. These patients should receive follow-up in a rapid chest pain clinic or in cardiology; their risk of adverse cardiac events is 0.2% (Weinstock et al, 2015).

Fig 2 outlines the principles of ACS diagnosis and management.

Risk prediction

Adults with NSTEMI or unstable angina should be assessed for their risk of future adverse cardiovascular events using an established risk scoring system that predicts six-month mortality (NICE, 2013b). This helps to plan clinical management and decide on the best place of care (for example, 32
Unstable angina

Several tools are available to stratify mortality risk in ACS, including:
- Global Registry of Acute Coronary Events score (GRACE; Bit.ly/GRACERiskScore) (Granger et al, 2003);
- Thrombolysis in Myocardial Infarction (TIMI) score (Antman et al, 2000).

Table 1 compares GRACE and TIMI for risk scoring in ACS.

**Pharmacological management**

**Pain relief**

Patients presenting with chest pain may need sublingual or buccal glyceryl trinitrate (GTN) to relieve pain; those with intractable pain may need a GTN infusion (NICE, 2013a). GTN promotes venodilation and dilatation of the coronary arteries. It can be given to patients with ischaemic chest pain provided their systolic blood pressure is >90mmHg. It is contraindicated in patients with an inferior MI or suspected right ventricular involvement, as it can cause haemodynamic deterioration.

Some patients with nitrate-refractory pain receive opioids, such as intravenous morphine, at small doses every few minutes until they are pain free.

**Oxygen**

Patients with acute chest pain and presumed ACS do not need oxygen unless they present with hypoxia or heart failure.

There is some evidence that giving supplemental oxygen to patients with uncomplicated MI can be harmful (Stub et al, 2015).

**Antiplatelet agents**

Platelets play a pivotal role in clot formation after an atherosclerotic plaque ruptures, so dual antiplatelet therapy is crucial in ACS management – both in NSTEMI and STEMI.

Aspirin is linked to reduced mortality in ACS, with sustained effects at 10 years (Baigent et al, 1998), so it is standard practice to give patients 300mg of non-enteric coated aspirin on presentation. Alongside aspirin, the P2Y12 antagonist group of antiplatelet drugs is used. This drug class includes clopidogrel and the faster-acting prasugrel and ticagrelor. Antiplatelet agents are associated with potentially life-threatening bleeding. NICE recommends using ticagrelor, as risk of bleeding is lower than with the others (NICE, 2013a). The European Society of Cardiology recommends ticagrelor with aspirin in patients with moderate-risk NSTEMI (Roffi et al, 2015). Many patients will have to continue dual antiplatelet treatment for 12 months after an MI regardless of how it was managed.

**Anticoagulation agents**

Anticoagulation is used to prevent clot formation. Fondaparinux, an antithrombin agent, reduces ischaemic events and improves long-term morbidity and mortality; 2.5mg should be given subcutaneously once daily (Fifth Organization to Assess Strategies in Acute Ischemic Syndromes Investigators et al, 2006). It is associated with a reduced risk of major bleeding compared with other anticoagulants – bleeding risk being a concern with most of them (NICE, 2013b).

In patients with renal dysfunction (serum creatinine >256μmol/L), unfractionated heparin is used. The decision to give an anticoagulant, and which one, revolves around whether and when the patient is due to have PCI, as well as their bleeding risk and cardiovascular risk score.

**Glycoprotein IIb/IIIa inhibitors (GPIs)**

GPIIb/IIIa receptor activation is the last step in platelet aggregation when a clot is forming, so GPIs can be effective but, again, are linked to bleeding. NICE (2013b) recommends a GPI (for example, eptifibatide or tirofiban) be considered in patients:

<table>
<thead>
<tr>
<th>Table 1. Risk scoring in ACS: GRACE versus TIMI</th>
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<tbody>
<tr>
<td><strong>TIMI</strong></td>
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<tr>
<td>History</td>
</tr>
<tr>
<td>● Age</td>
</tr>
<tr>
<td>● Hypertension</td>
</tr>
<tr>
<td>● Diabetes</td>
</tr>
<tr>
<td>● Smoking</td>
</tr>
<tr>
<td>● Dyslipidaemia</td>
</tr>
<tr>
<td>● Family history</td>
</tr>
<tr>
<td>● History of ischaemic heart disease</td>
</tr>
<tr>
<td>Presentation</td>
</tr>
<tr>
<td>● Severe angina</td>
</tr>
<tr>
<td>● Prior aspirin use (&lt;7 days)</td>
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<tr>
<td>● Elevated cardiac markers</td>
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<tr>
<td>● ST-segment deviation</td>
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<tr>
<td><strong>GRACE</strong></td>
</tr>
<tr>
<td>History</td>
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<tr>
<td>● Age</td>
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<tr>
<td>Presentation</td>
</tr>
<tr>
<td>● Heart rate</td>
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<tr>
<td>● Systolic blood pressure</td>
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<tr>
<td>● Elevated creatinine</td>
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<tr>
<td>● Heart failure</td>
</tr>
<tr>
<td>● Cardiac arrest</td>
</tr>
<tr>
<td>● Elevated cardiac markers</td>
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<td>● ST-segment deviation</td>
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</tbody>
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ACS = acute coronary syndrome. GRACE = Global Registry of Acute Coronary Events. TIMI = Thrombolysis in Myocardial Infarction.

Sources: Adapted from Granger et al (2003) and Antman et al (2000)
Nursing Practice

Review

Box 2. Discharge and secondary prevention post MI

Diagnosis and arrangements for follow-up

Include in every discharge summary:
- Confirmation of acute MI diagnosis
- Investigation results
- Future management plans
- Secondary prevention advice

Patients should be given a copy of their discharge summary.

Cardiac rehabilitation (CR)

Advise patients about CR and encourage them to attend. CR consists of:
- Physical activity
- Travel and health advice
- Psychological and social support
- Advice on sexual activity
- Support with lifestyle changes

Cardiac risk factors and lifestyle changes

- Control blood pressure
- Reduce LDL cholesterol
- Maintain glycaemic control
- Stop smoking
- Maintain a healthy diet
- Take up appropriate physical activity
- Restrict alcohol use to safe levels
- Maintain a healthy weight

Drug therapy for secondary prevention

Offer all of the following drugs:
- ACE inhibitor
- Dual platelet therapy
- Beta-blocker
- Statin

 Ensure the GP is aware of the timing of drug titration and the need to monitor renal function and blood pressure.

ACE = angiotensin-converting enzyme. LDL = low-density lipoprotein. MI = myocardial infarction.

Source: Adapted from National Institute for Health and Care Excellence (2015)

- With intermediate or high cardiovascular mortality risk who are due to undergo PCI within 72-96 hours;
- Who have had PCI with difficult lesions in the coronary arteries.

Antihypertensives and statins

Hypertension is a major cardiac risk factor that contributes to ACS risk, and antihypertensive drugs such as beta-blockers, angiotensin-converting enzyme (ACE) inhibitors and aldosterone antagonists are associated with improved outcomes. Beta-blockers (for example, metoprolol, bisoprolol, carvedilol) should be started as early as possible provided there is no hypotension, signs of heart failure, bradycardia or heart block. They reduce the workload on the heart, decrease ischaemia and limit the development and/or size of an infarct.

The NICE pathway on MI secondary prevention (NICE, 2017) recommends that ACE inhibitors (such as ramipril, lisinopril and enalapril) are also started as early as possible – normally within 24 hours. Evidence suggests they are associated with a reduced incidence of major adverse cardiovascular events when given within the first days of ACS onset, and can lead to improvement in left ventricular ejection fraction, thereby reducing the risk of heart failure (Køber et al, 1995). Patients who have had symptoms or signs of heart failure with ACS can be started on an aldosterone antagonist such as eplerenone; this is initiated a few days after ACE inhibitors and has been shown to reduce morbidity and mortality after acute MI (Pitt et al, 2003).

Statins, aimed at lowering cholesterol, are crucial to secondary prevention; the Scandinavian Simvastatin Survival Study and follow-up studies confirmed their beneficial effects on morbidity and mortality by lowering LDL cholesterol levels (Pederson et al, 2000). However, their action may go beyond lowering LDL and raising high-density lipoprotein cholesterol; Cannon et al (2004) confirmed benefits of high-dose atorvastatin and NICE (2013b) recommends that patients with confirmed ACS receive atorvastatin 80mg for secondary prevention, provided there are no contraindications.

Coronary reperfusion strategies

STEMI

All patients with NSTEMI should receive antiplatelet and anticoagulation therapy. Definitive coronary reperfusion strategies are also required – NICE strongly recommends that GRACE or TIMI are used to determine the level of risk. Patients at intermediate or high risk should be offered coronary angiography, followed by PCI if needed, within 72 hours of admission. Patients with NSTEMI or unstable angina who are clinically unstable should have angiography (followed by PCI if indicated) within 24 hours of becoming clinically unstable (NICE, 2014).

Nursing care priorities

Acute hospital admission

Keeping clear and comprehensive notes is crucial to ensure all nurses caring for patients with ACS know the patients’ clinical status, areas of concerns and management plan. Nurses caring for patients who recently had coronary angiography should monitor radial or femoral access sites and be able to recognise complications. Close communication with cardiac catheterisation laboratory staff and the coronary care unit is crucial. Nurses receiving these patients need clear information about the type of procedure they had, any complications, medications and IV fluids, and whether they have received anticoagulants or GPIs, which will put them at greater risk of bleeding (Macdonald et al, 2016).

General priorities for patients with ACS are haemodynamic monitoring and close observation of vital signs. A review of fluid status can provide information about renal perfusion, as some patients may present with, or develop, heart failure. In patients with diabetes, capillary blood glucose levels should be regularly checked; some may be put on IV insulin if their blood glucose is >11mmol/L. Patients recently diagnosed with diabetes should be referred to the diabetes specialist nurse.

Symptom monitoring is important to achieve pain relief with GTN or morphine. Swift recognition of any cardiac changes on the serial ECGs is also a key aspect of nursing care. Patients considered at high risk should be managed where continuous cardiac monitoring is available as they are at risk of arrhythmias, which can precede a cardiac arrest. Patients at intermediate risk may be managed in a medical assessment unit, where they are likely to receive serial ECGs. Nurses caring for patients with ACS should have ECG interpretation skills, as ECG changes or arrhythmias are signs of potential deterioration.
Other elements of nursing care include ongoing management of IV cannulas, central venous pressure lines, urinary catheters and wounds and dressings.

Patients are likely to be anxious and frightened. Nurses should be calm and reassuring, and ensure pain and other symptoms are well controlled. They play a central role in providing psychosocial support; when possible, they should give patients a chance to speak about their experiences, address their concerns and relay these to the multidisciplinary team.

Discharge and secondary prevention in MI patients

There are several things to consider when patients with a confirmed MI (either NSTEMI or STEMI) are ready to be discharged home (Box 2). Secondary prevention should be at the heart of nurses’ strategies. Patients need to understand their condition and be encouraged to make any lifestyle changes needed, which will be crucial to prevent recurrence. They will be discharged with much information, but the priority is for them to understand:

- They have had an acute MI;
- Results of any investigations;
- How their condition will be managed.

Patients are likely to go home with several drugs and many will need to take them for the rest of their lives. These drugs usually comprise dual antiplatelet therapy, beta-blockers, statins and ACE inhibitors. Some patients will also need aldosterone antagonists. Nurses must ensure patients:

- Understand the dosages and administration routes;
- Know not to discontinue treatment without medical advice.

Where possible relatives should be involved in discussions, as they can often help with lifestyle changes. Patients should receive advice on travel and be made aware of the rules about driving after an MI. They should also be advised to seek urgent medical assessment if any chest pain recurs.

Advice can be reinforced with written information, such as booklets from the British Heart Foundation (bhf.org.uk), and patients can be signposted to support groups and websites such as NHS Choices (nhs.uk) as appropriate (Scottish Intercollegiate Guidelines Network, 2016).

Nurses should address patients’ concerns and refer them to cardiac nurses or dietitians for specialist advice, as well as the primary care team for ongoing secondary prevention. They should also encourage them to attend a cardiac rehabilitation programme; this is particularly so for hard-to-reach groups – older people, women, some ethnic groups, people in rural areas, those of lower socioeconomic status – in which attendance is lower than average (NICE, 2015; Dalal et al, 2015).

Specialist nurses

The development of chest pain specialist and ACS specialist nurse roles has improved care for ACS patients, particularly those with NSTEMI. These nurses can perform acute triage assessments and facilitate early access to specialist services and cardiologists. Studies are starting to show that nurse-led early triage can help identify patients early, facilitating rapid intervention (O’Neill et al, 2014; Alfakih et al, 2009).

Conclusion

ACS is a common, life-threatening condition and, in our ageing population, its incidence is likely to rise. Nurses have a crucial role in the clinical management of patients with ACS, by helping them understand their condition and care, and promoting secondary prevention.

References

British Heart Foundation (2017) CVD Statistics: BHF UK Factsheet. BHF/BCVS/DatstatsUK