PRIOR to the availability of antimicrobial therapy, infective endocarditis (IE) was invariably fatal. Although approximately 80% of patients with endocarditis now survive their infection, one of every six patients with IE does not survive the initial hospitalisation, and up to one-third of patients infected with highly-virulent organisms such as *Staphylococcus aureus* may die as a direct or indirect result of their valvular infection.

A myriad complications can result from this infection and occur in the majority of patients with IE. In a review of 223 patients with IE: 57% had one complication; 26% had three complications; 8% had three or more; and 6% six or more.1

### Complications

Complications such as heart failure and stroke are relatively common and feared outcomes of IE, while other complications such as blindness and septic arthritis are thankfully rare in modern practice. The frequency and type of complications due to IE have changed with advances in diagnosis and therapy. Renal failure and uncontrolled intracardiac infection, which were previously common complications, are infrequent in the antibiotic era. The frequency of complications depends on variables such as the infecting pathogen, duration of illness prior to therapy and the type of treatment facility.

Complications can occur before, during and even after the end of therapy. The range of complications can include the following broad categories, but there are often significant overlapping features, for example patients with a neurological event can also have cardiac failure and be septic. Congestive heart failure and neurological events tend to have the greatest influence on the prognosis of IE.

- Cardiac
- Neurological
- Systemic emboli
- Sepsis
- Musculoskeletal
- Renal
- Associated with medical treatment.

#### Cardiac complications

Cardiac complications are the most common complications seen in IE, occurring in one-third of patients. Heart failure remains the most common cause of death with IE, and the most common reason for cardiac surgery for patients with IE. The usual cause of congestive heart failure in patients is infective induced valvular damage.

The aortic valve and its adjacent ring are more susceptible to abscess formation and the complications of paravalvular extension of infection than are the mitral valve and ring. Extension of the infective endocarditis beyond the valve predicts higher mortality, the more frequent development of congestive heart failure and the need for cardiac surgery. Extension of the infection into the septum may lead to various forms of heart block. Paravalvular abscesses should be suspected when fever persists despite appropriate antimicrobial therapy and/or when conduction abnormalities appear on electrocardiograph. Patients with paravalvular abscesses appear to have higher rates of systemic embolisation and fatal outcomes.

Other cardiac complications

- Pericarditis as a complication of myocardial infarction due to coronary artery embolisation which can (rarely) cause cardiac tamponade
- Intracardiac fistula due to extension of the infection from the valve to adjacent myocardium may result in large aneurysms, pseudoaneurysms or even myocardial perforation
- Aortic valve dissection.

#### Neurological complications

Neurological complications rank second to cardiac in importance, occurring in approximately 25%-35% of patients, the types of neurological complications are diverse and can include:
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- Acute encephalopathy
- Meningoencephalitis
- Purulent or aseptic meningitis
- Embolic stroke
- Cerebral haemorrhage (due to stroke or ruptured aneurysm)
- Brain abscess
- Seizures secondary to abscess or embolic infarct.

Patients with mitral valve involvement have a higher incidence of stroke than those with aortic valve endocarditis. Occasionally, neurological complications may be the presenting symptom in patients with IE, as a result the possibility of IE should be considered in all patients who present with strokes, meningitis or a brain abscess.

Recognising underlying IE in patients with these medical problems can be difficult, but unexplained fever accompanying a stroke in a patient with valvular abnormality may be an important clue in some patients.

Systemic emboli

Systemic embolism is a frequent complication of IE and can occur even after appropriate therapy is well underway. Emboli consisting of vegetation fragments can occlude or damage virtually any blood vessel, large or small, in the systemic or pulmonary artery circulation. As a result, emboli can produce:

- Stroke
- Blindness
- Painful or ischaemic extremities
- Splenic or renal infarcts
- Pulmonary emboli
- Paralysis, embolic infarcts of either the brain or spinal cord.

Endocarditis should be considered as a possible etiology in virtually all patients who present with signs or symptoms of systemic arterial embolisations. Although the vast majority of patients with acute stroke do not have IE, the occurrence of a stroke in a younger patient in association with arterial embolisation increases the possibility of IE.

Splenic abscesses have a particularly strong association with bacteraemia and IE. Patients usually do not have marked abdominal pain or splenomegaly; persistent fever during or after treatment for IE and occasionally recurrent bacteraemia after cure of the valvular infection may be the only clue to the presence of this complication.

Renal infarction, rarely renal abscess and acute renal failure may also occur in patients. Acute renal failure has been reported in up to one-third of patients in one recent study.

Musculoskeletal complications

Vertebral osteomyelitis is a well known but relatively rare complication of IE. Although the majority of patients with IE and back pain do not have vertebral osteomyelitis, protracted, severe back pain in any patient with IE should alert the doctor to this possibility. Osteomyelitis is more frequently a complication of Staphylococcus aureus endocarditis than IE due to other microorganisms.

Acute septic arthritis, involving one or more joints, may be the first clue to the presence of IE in a small percentage of patients. IE should be strongly considered in patients presenting with selected cases of septic arthritis: When organisms with a known propensity to cause IE (e.g., Staphylococcus aureus, Viridans streptococci or non-group A β-haemolytic streptococci) grow from a joint aspirate, particularly in patients without a history of recent surgery, joint infection, or trauma or when multiple joints are infected.

Predictors of embolisation

The size of the vegetation determined by echocardiograph has been assessed as a risk factor but considered an imprecise marker for the risk of embolisation. However, the risk of embolisation was significantly greater in patients who had:

- The presence of visible vegetations by both transoesophageal and transthoracic echocardiographs
- IE due to Staphylococcus aureus, Streptococcus bovis
- A vegetation size >10mm with severe vegetation mobility
- Higher incidence of embolic events noted with mitral valve vegetations rather than aortic valve vegetations.

The risk of embolic events is decreased following the initiation of antibiotics. In a study with 629 patients with left-sided endocarditis 21% had embolic events. Forty-two percent of those events occurred before the initiation of antimicrobial therapy; 13.5% occurred on the day therapy commenced; and an overall 82% of events occurred within 15 days of starting therapy. Anti-coagulation therapy has not been shown to prevent embolisation in IE and may increase the risk of intracerebral haemorrhage.

Prolonged fever

Fever associated with IE often resolves within two to three days after the start of appropriate antimicrobial treatment. The most common cause of persistent fever (more than fourteen days) is the extension of infection beyond the valve, often with myocardial abscess, focal metastatic infection, drug hypersensitivity particularly if the fever resolves and re-occurs, non-sosocial infection or other complication of hospitalisation such as pulmonary embolism.

Prevention

Approximately 15%-25% of cases of IE are a consequence of invasive procedures that produce a significant bacteraemia but only 10% of these can be prevented by the administration of pre-procedure antibiotics.

Maintaining good oral hygiene is probably more effective in the overall prevention of valvular disease as gingivitis is the most common source of spontaneous bacteraemia. The European Society of Cardiology recommends that the benefits of prophylaxis are likely to be considerable in high-risk patients (prosthetic valves, previous infective endocarditis, congenital cyanotic heart disease) and relatively small in low-risk groups such as patients with mitral valve prolapse.

Very recent publications have questioned the need for routine prophylaxis before dental procedures in many patients, though these views remain controversial. The importance of scrupulous dental and skin hygiene should be reinforced in all patients at risk of infective endocarditis. Procedures that require antibiotic prophylaxis in moderate to high-risk patients include:

- Invasive manipulation of the respiratory tract (Rigid bronchoscopy, Tonsillectomy)
- Gastrointestinal surgery (Biliary tract surgery, dilatation of the oesophagus)
- Prostate surgery, cystoscopy and urethral dilatation
- General (hysterectomy, vaginal delivery, insertion of intrauterine devices, endoscopies with or without biopsies, urethral catherization).

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References on request from nursing@medmedia.ie (quote: Lowry A. WIN 2007; 15(9): 43-44)