Using infection specialists

Introduction

Approximately one third of hospitalized patients are on antibiotics at any given time (Seaton et al, 1999) and in the year 2008–9 presentations to primary care physicians resulted in a prescription for an antimicrobial 38 million times. Infections can affect any patient regardless of his/her demographic and occur in all systems, therefore every medical and surgical speciality will encounter infectious processes in their patients.

In every acute NHS trust in the UK there will be a consultant microbiologist to oversee microbiological investigations sent by clinicians and to provide advice on a variety of infection-related queries. In larger specialist centres there are infectious diseases physicians who run both inpatient and outpatient services managing infective syndromes. In a few of the very large centres (London, Liverpool, Oxford and Sheffield) there are tropical infection units involved in academic research and care of patients with imported infections. This article provides a structured framework for referral to an infection specialist in order to gain the best possible advice on patient management.

Reasons for referral

Interactions with infection specialists can be divided into two main areas – solicited (those where advice or clinical review is requested) or unsolicited (a sample is sent and the organism found triggers a review or discussion from the infection specialists).

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In terms of solicited referrals there are several key clinical reasons for involving an infection specialist. These include:

- Advice related to a specific infection in a specific patient
- Advice relating to a fever of unknown origin
- Advice relating to a patient with raised levels of inflammatory markers without discernible cause or in patients failing to respond to current antimicrobial therapy
- A diagnostic sample has identified an organism and the relevance to the patient is unclear
- Infection control issues such as patient isolation or post-exposure prophylaxis for a range of pathogens
- Advice relating to antimicrobial therapy in patients with allergies where hospital guidelines cannot be used.

Unsolicited interactions from infection specialists will vary according to local protocols and pathogen trends. Common triggers for which an infection specialist will make contact include:

- Positive blood cultures
- Positive mycobacterial cultures
- Culture of a multi-drug resistant pathogen
- Isolation of a highly transmissible pathogen or an organism with public health importance.

Useful resources

The first point of reference in seeking infection advice will usually be local policies which may be organization wide or specific to certain specialist units. All NHS trusts are required to have an antimicrobial prescribing policy and it is advisable to become familiar with this on joining a new trust. Antimicrobial choices vary between trusts based upon clinical confidence in drugs, pharmaceutical factors and local antimicrobial resistance patterns.

Patients with suspected or confirmed communicable diseases may have a condition that needs notification to the local health protection unit. This is a legal requirement and a list of notifiable conditions can be found on the Health Protection Agency website (www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/NotificationsOfInfectiousDiseases/ListOfNotifiableDiseases/). The responsibility for notification lies with the clinician responsible for the patient and a doctor tasked with notification can also find reporting procedures on this website.

A comprehensive document giving advice on immunizations and use of immunoglobulins in infectious diseases is available from the Department of Health (2007). This is particularly useful when considering post-exposure prophylaxis for various infectious diseases and for indications and contraindications to various vaccinations. For commonly encountered scenarios such as needlestick injuries and tetanus vaccination local trust protocols are often available on the intranet or held in the accident and emergency department. In the case of rabies exposure national guidelines are available through the Health Protection Agency portal but if there is concern local infection specialists should be contacted.

The British Infection Association provides guidelines on numerous clinical conditions and specific pathogens. The guidelines relating to endocarditis, malaria, meningitis and fever in the returning traveller are downloadable in PDF format from their website (www.britishinfection.org/drupal/content/clinical-guidelines).

The Health Protection Agency Primary Care Guidance provides advice on diagnosis, use of the microbiology laboratory and management of infectious diseases (www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/PrimaryCareGuidance/).

Telephone advice or patient review?

This depends on the patient's condition and the clinical question. If the diagnosis is unclear then patient review may be beneficial; where it involves formulating a treatment plan a telephone conversation may suffice. Microbiologists get referrals from all specialities within the hospital and also from the community. It is not possible to review all the referrals and you will be guided by the specialist as to whether it is needed.

There are several conditions that are best managed by infection specialists, but on the whole there is a degree of overlap

between specialities where patients have single system infections. *Table 1* contains a list of conditions that should at least be discussed with an infection specialist.

Information to have at hand

Antibiotics are often the definitive treatment for many infective syndromes, and therefore antibiotic choice is crucial. In order to make the best possible decision the infection specialists need to know specific information. Soliciting a consult from an infection specialist without the information in *Table 2* is much less likely to provide a result beneficial to the patient.

Information that may require further investigation before soliciting the advice includes travel and sexual history which are often omitted from initial clerkings. In the case of enteritis a dietary history may well be pertinent in establishing likely pathogens.

Important microbiology specimens

There are numerous specimens that are sent to microbiology laboratories that can aid diagnosis and treatment of patients. All are relevant dependent upon circumstances, but some samples are particularly important.

Blood cultures

Blood cultures taken before antimicrobial administration can provide diagnoses without expensive or time-consuming further investigations. Numerous clinical and laboratory parameters are independently correlated with bacteraemia. These include rigors, hypoalbuminaemia, acute kidney injury and diagnosis of upper urinary tract infection (Bates et al, 1997); other criteria are new-onset pyrexia, leucocytosis or neutropaenia, and signs of haemodynamic compromise.

Fever appears to be more sensitive than leucocytosis in predicting bacteraemia hence the need to take blood cultures when fever is detected (Groeneveld et al, 2001). However, in some states bacteraemia can occur unrelated to rises in temperature and so blood cultures should be taken in the absence of fever when clinical judgement dictates. Two or more blood cultures are recommended not only to increase sensitivity but also specificity as growth of organisms in both sets provides stronger evidence of pathogenicity (Weinstein et al, 1983).

Always read local guidelines or the side of the blood culture bottle to find out how much blood should be inoculated into the each bottle. It is important that blood cultures are taken via an aseptic technique as bacteria isolated in contaminated sets may trigger unnecessary therapy that has potential adverse effects and could be to the detriment of the patient (Dhillon et al, 2009).

Table 1. Conditions that should solicit an infection specialist consult

Meningitis or encephalitis
Endocarditis
Fever in the returning traveller
Pyrexia of unknown origin
Tuberculosis
Tropical conditions, e.g. malaria, typhoid, parasites
Septic patients
Soft tissue infections – Fournier's gangrene, necrotizing fasciitis
Deep tissue infections and osteomyelitis
Infections related to multi-drug resistant pathogens – meticillin-resistant *Staphylococcus aureus*, vancomycin-resistant Enterococci, extended spectrum beta-lactamases
Clostridium difficile infection

Table 2. Information to have when consulting an infection specialist

Name, age, gender, hospital number, location
Who you are and your contact details (bleep number)
Duration of admission
Presentation and clinical progression
Past medical history predisposing to infection (e.g. immunosuppression, prosthetic medical devices)
Imaging findings
Inflammatory markers (white blood cell count, neutrophils, C-reactive protein) and the trend
Antibiotic history – pre-hospital and during admission
Current clinical status – all observations not just temperature
Allergies
Known carriage of resistant organisms, e.g. meticillin-resistant *Staphylococcus aureus* or extended spectrum beta-lactamase

In most trusts a positive blood culture will prompt the infection specialists to contact the clinical team responsible for the patient in order to discuss further management.

Patients who have central venous catheters should have blood cultures taken both peripherally and from the catheter to help determine the source of sepsis, but ensure this complies with local recommendations.

Cerebrospinal fluid

Diagnosis of meningitis is confirmed through laboratory examination of the CSF. Other infectious indications for CSF sampling include inexplicable agitation in HIV positive individuals (often an early sign of cryptococcal meningitis) and fever with confusion in the unwell individual (signs of meningism do not appear in all individuals, particularly the elderly).

Therapy should not be delayed pending CSF microscopy or culture and this may even begin before the sampling of CSF with further management decisions based on the cell count and Gram stain (Gray and Fedorko, 1992). Ideally 2–3 ml of CSF should be sent to microbiology, more if multiple tests are going to be requested, and ideally over 6 ml if culture for *Mycobacterium tuberculosis* is required (Thwaites et al, 2004). Each drop of CSF equates to 60 µl therefore 16 drops equate to 1 ml (McIntyre, 2007). CSF polymerase chain reaction is available for viral causes of meningitis and mengingoencephalitis (Petitjean et al, 2006). A bacterial blood polymerase chain reaction is available and from most trusts requires an EDTA (ethylenediaminetetraacetic acid) sample to be couriered by the local lab to the Health Protection Agency laboratory in Manchester (Schuurman et al, 2004). This allows diagnosis of *Neisseria meningitidis* or *Streptococcus pneumoniae* as the causative agents when the CSF fails to provide an organism (for example when antimicrobials have necessarily been given before CSF sampling) or when CSF cannot be obtained because of fear of cerebral herniation or bleeding diatheses.

Sterile site samples

These are usually obtained in theatre at surgery or by interventional radiologists. The logistics of getting these samples processed appropriately can be frustrating. To make these diagnostic tests as profitable as possible

for the patient undergoing the procedure, the following points should be observed.

Liaise with the microbiology department to clarify exactly what sample (e.g. bone biopsy, deep tissue), how many samples (for example in the case of prosthetic joint infections five samples are advocated) and in what containers (e.g. universal container, liquid culture bottle, viral transport media) the sample should be sent.

Print the request forms for the tests required and send the request forms with the patient to the procedure. A verbal discussion with the person doing the procedure and re-enforcement of which, if any, samples need formalin and which a plain universal container helps avoid disappointing laboratory results.

If this fails, and microbiology samples are accidently placed in formalin there is still a potential for diagnosis. While the formalin will preclude culture of any organisms, the histopathology department may well be able to indicate the presence or absence of granulomas in cases of tuberculosis and can also perform some specialist stains for fungi. The microbiology laboratory may also have access to 16S polymerase chain reaction investigations to look for a range of anticipated pathogens (Imrit et al, 2006), although sensitivity for this is often poor. This must always be discussed on a case by case basis with the microbiology department.

Serological samples

Serum samples taken in the acute setting can be stored and used in conjunction with samples taken in the convalescent period to enable retrospective diagnosis in some cases. This is particularly important in presentations of fever in the returning traveller and in fever of unknown origin.

Other infection specialities

In addition to microbiologists and infectious diseases physicians, two other infection specialists are present in most trusts – genitourinary medicine and HIV physicians. In most centres these are covered by the same medical professionals but in others these are separate disciplines.

Genitourinary medicine is predominantly an outpatient specialty, although some sexually transmitted diseases do manifest systemic presentations (such as pelvic inflammatory disease and disseminated gonococcal infections) and solicited consults from genitourinary medicine physicians can be useful not only in optimizing management but also in suggesting further investigations and in follow up both of the patient and partners.

HIV is a complex disease and infections in people living with HIV and AIDS can be difficult to diagnose and to manage. Common infections can present in atypical ways and opportunistic infections can present with signs and symptoms confusing to those inexperienced in HIV. Local HIV physicians should always be made aware when people living with HIV and AIDS are inpatients, not only to aid with pointing out common super-added infections but also with anticipating likely complications or interactions between HIV medications and other pharmaceutical agents that may be being started.

Specialists in virology, parasitology and mycology are available in some centres and can provide invaluable advice particularly on difficult to treat or rare pathogens. However, local infection specialists should be involved in cases before seeking expert opinions from further afield.

Conclusions

Infections are a ubiquitous part of clinical practice and knowledge of when, from where and how to most successfully solicit infection advice can improve patient outcome. Sources of information include local policies, national guidelines and local infection specialists – most frequently microbiologists and infectious diseases physicians. Understanding the clinical picture and having the correct information to hand when soliciting an infection specialist consult is key in obtaining the most appropriate advice for the patient and achieving resolution of the infection problem. **BJHM**

Conflict of interest: none.

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TOP TIPS

- There are infection emergencies such as malaria, meningitis, necrotizing fasciitis, septic arthritis and septic shock. Treat them as such!
- Blood cultures should be taken from all patients with suspected sepsis regardless of whether they have a fever.
- Treat the patient not the CRP.
- Positive cultures do not always require antibiotics.
- Review all antibiotics daily and stop if they are inappropriate.

KEY POINTS

- Read local guidelines and familiarize yourself with the antimicrobial policy.
- Cultures should be taken before antibiotic therapy in septic patients if clinically appropriate.
- Ensure all relevant information is to hand before telephoning for advice.