INVESTIGATIONS

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Objectives

- Define the aims of investigation used in surgical practice.
- Understand the principles underlying selection of appropriate investigations.
- Determine the limitations of commonly used investigations.
- Consider appropriate sequences and timing of multiple investigations.
- Highlight important principles of investigations most commonly used in clinical practice.

Introduction

The use of investigations in surgical practice is no substitute for clinical skill. An investigation is only worthwhile when it is requested in order to answer a specific question, or to confirm a clinical impression prior to intervention. There is an ever-expanding range of investigative modalities available and unwary surgeons who are clinically uncertain can easily find themselves overwhelmed with information if too many poorly considered investigations are requested.

This presentation outlines some of the principles that should be applied before investigations are requested in surgical practice, highlights the limitations and discusses the practical use of common investigations.

AIMS

Confirm the diagnosis

Use investigations to confirm a suspected clinical diagnosis, if clinical features are equivocal. Remember that investigations are only worthwhile when they direct management.

Exclude alternative diagnoses

Perform specific investigations in order to exclude an important alternative or additional diagnosis (frequently malignancy). Treat all patients on an individual basis when considering tests to exclude alternative diagnoses.

Confirm the need to intervene in the absence of a diagnosis

In an emergency you may need to act after investigations confirm a need for emergency treatment without knowing the specific cause.

Determine the extent of disease and staging

It is considered best practice to map out the extent of the disease before surgery, especially in the elective setting. In fact when treating patients with neoplasia, staging is essential.

AIMS-contd.

Evaluate comorbidity

Assess fitness for anaesthesia using a well thought out plan of investigations.

Risk to others

Consider all patients to be at high risk for blood-borne infectious disease so that the risk of needlestick injury is minimized.

Medicolegal considerations

Although you may be certain in your own mind about the diagnosis and appropriate management, you may need to protect yourself against future claims of incompetence against you, or the patient may wish to have objective evidence
available in claims against a third party following, most commonly, an accident

SELECTION

There is often more than one modality that may be used to answer the clinical question the surgeon is faced with, in which case you need to consider the selection of the most appropriate investigation, which varies on an individual basis. Various factors influence this choice.

Sensitivity and specificity

If one test is known to be more sensitive than the alternative, this is obviously a good reason to choose it. The investigation must be specific for the disease when alternate diagnoses are to be excluded.

Sensitivity: number of cases of the condition **detected by the test/total number of cases in population studied.**

Specificity: number of truly negative results/total **number of negative results.**

Simplicity

A simple investigation may be the first line of investigation and may be all that is needed.

Safety

Think carefully about the complications of an investigation.

SELECTION-contd.

Cost

When using investigations it is vital to understand the need to manage risk while at the same time remaining accountable to the patient and to society for the way in which money is spent.

Acceptability

In general the less invasive the investigation the more acceptable it is to the patient. Unacceptable tests suffer from poor compliance and a screening programme may achieve poor results in this situation.

Availability

The gold standard may be the ideal choice of investigation for a patient but may not be possible.

Routine

Surgical departments may have their own series of investigations set out within a protocol.

LIMITATIONS

Remember that all investigations have limitations that need to be considered when ordering tests and interpreting results.

Incorrect result

Do not discard your clinical impression, if the result of any investigation conflicts with your clinical judgment, without considering the possibility that the test may be misleading. Check that the correct procedure was performed and the procedure was performed correctly. Take into account any problems encountered with the procedure when interpreting results.

Do not blindly read a test result without considering the clinical picture.

Many investigations are operator dependent - subjective opinions, not objective proofs.

If an investigation does not conform with your firm clinical impression, first discuss it with the investigator before embarking on more complex tests, and consider repeating the test.

Complications

An investigation may be associated with a significant complication rate, an issue that may not only influence one's choice of its use, but also may have medicolegal implications if it has not been discussed at the time of consent.

SEQUENCE AND TIMING OF INVESTIGATIONS

Organization

Do not collect data indiscriminately when you are investigating a patient prior to surgery or during follow-up. Always organize the flow of information you require so that it follows a logical sequence that will culminate in you being able to discuss the patient's condition and management, with any attendant risks, in a fully informed manner and from a position of strength. During the preoperative process of diagnostic confirmation, determination of the extent of disease and exclusion of specific alternative diagnoses, you will frequently need more than one special investigation. In these circumstances thought must be given to determining the appropriate order of such investigations.

Avoid the temptation to arrange all investigations at one sitting to prevent the patient having to come back repeatedly to the clinic. It is obviously inappropriate to arrange cardiology and pulmonary function tests to assess fitness for surgery at the same time as determining the primary disease and any spread. If the surgical problem turns out to be inoperable, then the other investigations undertaken have usually been a waste of time and resources as well as putting the patient at potential risk. Patients often understand the need for a logical sequence of investigations and the time this may require.

SEQUENCE AND TIMING OF INVESTIGATIONS-contd

Urgency

Consider the urgency of each individual investigation and request appropriately. For the patient with a potentially curable carcinoma, investigations must be carried out quickly and efficiently. Conversely, there is no sense in flooding the radiology department with urgent requests that are to determine the cause of problems that have dragged on for many years.

Protocols

Often the sequence and choice of investigations is presented in the form of protocols, where guidelines are set out enabling all staff to follow the preferred investigative methods of a department. These are useful in common conditions, both as a diagnostic tool (such as the investigation of rectal bleeding) and as a preoperative work-up regimen (in the case of complex surgical procedures, such as complex aneurysm surgery or cardiac surgery, where a number of preoperative investigations must be performed). Protocols are invaluable in the procedure of audit as all staff must work to a standard, which they are expected to maintain. They also prevent unnecessary and costly investigations being performed. A rigid protocol has a number of advantages but you must remember that they are no substitute for clinical acumen and all cases must be dealt with on an individual basis, with investigations directed to a particular patient.

PRACTICAL USE

Blood tests

Most laboratories use automated analysers that give all the common haematological and biochemical indices. You only need ask for a full blood count to receive a full set of haematological parameters. Interpret the results in the light of the patient's general condition.

Levels of substances may be affected by the timing of blood sampling.

There is a diurnal rhythm with hormones such as cortisol that may produce misleading results.

Binding proteins and plasma proteins affect hormone, enzyme and drug levels, so allow for this when interpreting results.

Remember the biochemical picture is obtained from just a sample of plasma. You are only indirectly discovering what is going on inside cells.

Discuss unusual cases with an expert. Further investigation of the patient may also be influenced by an opinion from an expert.

PRACTICAL USE-contd.

Microbiology

- A pus swab only briefly contains a representative sample of organisms from an infected source. Organisms die because they are anaerobic (e.g. *Bacteroides), because they are delicate* (e.g. *Neisseria) or because the other organisms in the* sample proliferate faster and overwhelm them. Therefore lose no time between taking the swab and transferring it to an appropriate medium for culture.
- If pus is available, collect a quantity and send that, rather than a swab, to the microbiologist. Store pus swabs (in appropriate transport medium) at 4°C when taken at night and ensure that they are sent to the laboratory the next day.
- Remember that prior consultation with a microbiologist may increase the yield of relevant positive cultures obtained.
- Taking many swabs for culture without clinically assessing the patient or careful thought may cause you to miss the diagnosis. Inform the laboratory of all relevant clinical information and antibiotic treatment so that the microbiologist can read the results sensibly.
- In the patient with no sign of sepsis, it is sensible to wait for the full report from the bacteriologist.
- Always seek the help of the microbiologist whenever you deal with superadded infection, especially in transplant patients and in the immunocompromised (as in HIV infections or in patients on chemotherapy).

PRACTICAL USE-contd.

Radiological investigations

- X-ray examinations are one of the simplest and cheapest radiological investigations to perform. Use these as a firstline investigation in cases of suspected perforation and obstruction before more expensive and complicated tests.

- Think whether introduction of a contrast agent into a cavity or lumen would improve the diagnostic accuracy of the test if initial plain films are inconclusive.

- For most patients the radiation experienced from X-rays will not cause problems but the dose is cumulative, so when possible avoid repeated tests that use radiation, especially in the case of long-term screening.

PRACTICAL USE-contd.

Histopathology

A biopsy is a representative sample of tissue that may be examined by a histopathologist. The tissue may be obtained in a variety of ways and biopsies are classified according to how they are obtained

Excision biopsy remove the entire lesion and undoubtedly provide the best tissue for histopathological examination.

Wedge biopsies provide a section of tissue from a lesion,

Core biopsy is performed with a Tru-cut biopsy needle to take a small core of the lesion.

Be careful when taking a biopsy to include a representative sample of the lesion. From the histologist you want to know what the lesion is, whether the lesion is malignant and the prognostic indicators. When taking a biopsy, therefore, be careful to take tissue and not only the necrotic centre; when obtaining samples from polyps sample the stalk, so that you may find out the degree of invasion; and when sending resected specimens orientate them appropriately. Talk to the pathologist, relay important clinical information and find out about resection margins, the grade and stage of disease.

Fine needle aspiration does not give the same architectural detail as histology but it is quick, relatively painless, requires no anaesthetic, the complications of biopsy are avoided and it can provide cells from the entire lesion, as many passes through the lesion can be made while aspirating. Cytological specimens can also be obtained from spun down samples of fluid from a patient. Urine, pleural aspirate and sputum can all be examined for malignant cells.

PRACTICAL USE-contd.

Invasive diagnostic procedures

The use of endoscopy provides a direct method of visualization of pathology and also allows biopsy or definitive treatment of lesions. A negative endoscopy is usually more reliable than a negative contrast study, but remember that it is operator dependent and that subtle lesions may have been missed (ask about the seniority and experience of the operator if you did not perform the investigation yourself). It may need repeating in cases of doubt.

Diagnostic laparotomy, and more commonly laparoscopy, is used as a diagnostic tool in specific circumstances such as preoperative staging of certain cancers. The need for diagnostic procedures of this kind has fallen with the advent of high-resolution scans such as CT and MR.

PRACTICAL USE-contd.

Physiological assessment

Use this type of assessment when you require information on the physiological workings of an organ or part of an organ. Motility disorders may be investigated effectively by oesophageal or rectal manometry, which will supplement anatomical and pathological information that has been gained. Manometry will quantify the problem, as well as facilitate the selection of operative therapy.

SUMMARY

- ❑ Do you understand the purpose of each investigation ordered in common conditions?
- ❑ How do you decide which investigation is the most appropriate?
- ❑ Can you name investigations with a limited reliability?
- ❑ Which tests have serious complications?
- ❑ Can you formulate sensible investigation plans for complex diagnostic problems?

Thanks