# Clinical Methods

# A Handbook of Clinical Methods for Students in Medicine


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# CONTENTS

# INTRODUCTION

The notes which follow are intended to assist you in developing sound clinical skills. They should be studied in conjunction with the audiovisual material covering the physical examination made available to you by the Division of Medicine as well as your tutorials.

> ***IMPORTANT***
>
> *These notes should be read in conjunction with the audiovisual material demonstrating the correct application of your clinical skills which is available to you on the University LAN.*

Throughout the notes, you will encounter three types of advice box. The following box alerts you to an area of the examination which commonly trip up students during their clinical assessments.

 **Warning**: Students frequently neglect this in the examinations. FAIL!

The following box advises you that some clinicians make use of alternative techniques, which are also acceptable.

 **Info**: Some clinicians prefer to examine the trachea from behind.

The following box instructs you to ensure that you understand the pathophysiology which underlies that particular part of the examination. You must pay careful attention to this. *This material will be examined*.

 **Pathophysiology**: Explain the pathophysiological mechanism behind each of these signs.

The key to sound diagnostic skills in Medicine are:

- That you can carry out examination techniques competently
- That you can recognise both normal or abnormal signs
- That you understand the basic science (principally pathophysiology) underlying each technique and sign
- That you can interpret the resulting signs, in order to build up a formulation of what is wrong with the patient.

In the third and higher years, you will be explicitly; examined on each of these points in all three of your assessments: directly observed short cases, portfolio exam and MCQ assessment.

# THE DIAGNOSTIC INTERVIEW

## THE DIAGNOSTIC PROCESS

Adequate assessment of a patient requires a disciplined approach. It entails the following two steps *in equal measure*:

### Acquisition of data. This consists of:

- The taking of a history
- A competent physical examination
- And the use of special investigations such as X-rays and blood tests.

### Processing of this data into a form which allows:

- The drawing of conclusions
- The formulation of a differential diagnosis
- Construction of a problem list
- The planning of further management
- And meaningful communication of the problems to colleagues.

This second step is *every bit as vital* to successful clerking as the first and yet is often neglected. The notes which follow, though they give direction to your history taking and examination technique, will emphasise this second aspect at every turn.

## GENERAL PRINCIPLES

Firstly, no two patients are alike - either in themselves or in their disease. Clerking is *individualised* in every case. You will home in on the problems that appear to exist in each patient as you clerk them. There is no such thing as a “routine” clerk! Secondly, you will not take the history, examine the patient and *only then* try to work out what is going on. As you proceed, you will think about every item of information that emerges, make tentative hypotheses, and alter your approach so as to confirm or refute your ideas. In order to do this effectively, it is necessary to have a store of knowledge against which you can measure each item of information as it is elicited. Obviously, the wider your background knowledge of medicine, the more efficient your clerking will be.

EXAMPLE: If your patient complains of chest pain, you will not ask *where it is, when it began, what worsens it* and the like just because you have been taught that that is how it is done. You will question the patient in order to determine: *is it ischaemic?* or *pleuritic*? or *dyspeptic*? or *muscular*?

Similarly, if you find something on examination which makes you suspect thyroid disease, you will immediately go on to perform every test you know which may throw light on this, such as looking for tremor and lid lag, even though you may not routinely do this in every case.

Thirdly, always remember that the format for history taking and examination you read in books or are taught in tutorials is merely a guide, sanctioned by convention. *At times it is even inappropriate*. It must always be subordinated to an intelligent and thinking approach to each

patient. Make a habit of clerking your patient using the ordered approach which follows. This will assist you to work in the problem-oriented manner described above.

## THE CLERKING PROCESS

***Approach the patient***

Introduce yourself, ask if you may examine them, and check that they are comfortable.

***Take a history***

The technique is detailed in the section, *Taking a History*.

***Record the history***

If you are unsure of yourself, record your information in point form as you go along. Note that writing it all out laboriously in full sentences is a waste of time. If you are more confident, wait till you have finished taking the history, then do some preliminary editing before committing it to paper. For example, place the history in *chronological or logical order* and incorporate relevant data gleaned in the past or personal histories into the body of the main history. Full details on editing appear in the following chapter: *Summarising and presenting a patient*.

***Make a preliminary assessment of the problem, based on the history***

Jot down in a few words what you think the problems are. This may range from a full diagnosis such as *unstable angina* to a more guarded suspicion such as *shortness of breath - ?heart ?chest* depending on the helpfulness of the history. This step is very important in focusing your attention on relevant aspects during the examination.

***Examine the patient***

Pay particular attention to aspects which emerged from the history. You will however screen all systems in case something unexpected is also present.

***Record the physical findings***

Enter these on your clerking sheet. Use words only, not sentences; diagrams may be helpful.

***Look at any available special investigations***

These include X-rays and ECG. See how they fit in with your suspicions.

***Review your data critically***

Check for inconsistencies, e.g. a high-volume pulse with a murmur of aortic stenosis. If so, go back and check on these points! If something totally unexpected has come up, go back **and take additional relevant history if necessary.**

*EXAMPLE: If you unexpectedly find murmurs, ask your patient again whether they ever had a heart complaint, and whether they have any dyspnoea.*

***Revise your data into a format suitable for decision-making and for presentation.***

Your clerking sheet is *not suitable* for presentation in its present format. You must now:

- rearrange the order of your data into a logical order
- decide whether each item of data you have elicited is relevant, and important enough to be included in the presentation itself. Refer to the notes: *Summarising and presenting a patient*.

Write everything out now in brief point-form in suitable order to aid you as you present. if your work is to be prepared as a formal case report, you will write it out in full. As you become more practised, rewriting will not be necessary. You will record your initial data in an already edited form, and will sift out information as you speak. This takes practice, and while you are relatively inexperienced, the five minutes it takes you to rewrite your data under a few brief headings can make all the difference between a good presentation and a poor one.

***Formulate a problem list***

Commit yourself to a differential diagnosis and compile a problem list. Include under this all problems which require intervention or consideration at present. This includes not only physical ailments, but social and psychological factors as well.

# TAKING THE HISTORY

## THE IMPORTANCE AND PLACE OF THE HISTORY

A detailed and intelligently-gathered history is of vital importance in determining the presence of illness, in assessing its severity, in making a diagnosis and in determining the importance of other factors which may influence the patient's response to both the illness and its treatment. The conventional approach, which is sound, is to take a full history from your patient before examining them. This has the advantages of:

- Gaining the patient's confidence before launching into a physical "assault" on the patient
- Directing your attention decisively to the areas in which the patient's problems lie, thus allowing the examination to performed intelligently in an attempt to confirm or refute diagnostic possibilities, rather than as a mere fact-gathering exercise.

Indeed, in something like 90% of all your patients, the diagnosis will be apparent on history alone, even before you touch your patient.

The history is however a dynamic and ongoing process. You must always be prepared to return to it, to ask your patient further questions, at any stage of the examination or after it, even on ensuing days, should anything further come to light to which you gave insufficient weight during the original history

> *Hold on, Mr Ngcobo! I see you have a scar on your chest. Have you had an operation?*
>
> *Yes, Doctor. I had an open heart operation in 1995.*
>
> *Gee, I think you forgot to tell me about that, or maybe I didn't ask. Now tell me: what sort of heart problem did you have?*

And off you go on a full history of the cardiovascular system, even though you thought your patient had nothing more seriously wrong than their painful haemorrhoids!

Understand the importance of the patient's perceived problem, as opposed to their physical illness, and always be aware that many patients are driven to see a doctor by something other than real, life-threatening physical illness; for instance by fear of an imagined illness, by a minor problem seen as disproportionately threatening, or by a search for help with personal and emotional problems, or even as blatant malingering. Never close your mind to the possibility of such motivation; as you conduct the interview, assess the patient's sincerity, the congruence of their symptoms etc. and do not hesitate to steer the questioning in such a way as to allow a full airing of the actual and perhaps non-physical problem. Reread your notes *Interacting with patients: the three-stage patient assessment* and *Interviewing skills and psychiatric disorders* and attempt to structure your interviewing technique so as to maximise your chances of detecting clues to emotional factors.

## A REASONING APPROACH

For *every single question* you ask, you must be able to:

- Explain why you asked it
- Interpret the answer the patient gives intelligently.

Do *not* ask questions merely because you have been told to!

# THE FORMAT OF THE HISTORY

## Background information

Introduce yourself to the patient and find out such background information as their name, age, marital status, occupation and where they live.

## Determine the current problem

Determine the presenting complaints, using such questions as: *Why are you here?* and *What exactly is the problem?* It is not necessary to go into details yet. You just want to have an overview of the sort of problems you have to deal with. You may have to cut the patient short - politely - to establish the scope of the problems before allowing them to speak freely.

## Find out all you can about the current problem

Take a full history. Allow the patient to speak, but bring them gently back on course if they are clearly wandering off relevant matters. Sound them out fully, by direct questioning, on anything of interest which emerges. It is of benefit to focus on *one problem at a time,* and to find out all you need to know about that one first, before starting on the next problem.

> *Okay Mrs Moosa; I suggest we find out all we can about your chest problem first, but don't worry, I am going to ask you more about that pain in your hip a little later.*

Having determined what the presenting complaints are at the start helps both you and the patient to approach the history in this methodical manner. Do not stop until you are satisfied that you know *every important detail* about their symptoms - at least as far as they are able to tell you.

You must be aware at all times of what the symptoms could mean, and your questions directed at proving or disproving your suspicions. Remember the example given above: do not spend ages finding out *when the pain began, where it spread, what made it worse, what made it better*, etc., as an end in itself, but always with a question in mind: e.g. *is it ischaemic? is it pleuritic? is it dyspeptic?*

It is important to ask the patient directly if they think their condition is static, improving or deteriorating.

You may find the following hint on technique useful. Not every patient is able to answer "abstract" questions easily, and in such cases it is often satisfactory to give them "multiple choice" options and let them choose the most correct one.

> *How long have you been ill - a day? a week? a month? six months?*
> *When do you get the pain - in the morning? at night? when you work? when you cough?*

## Other medical history

Ask about other concurrent illnesses. Particularly important are: heart disease, hypertension, diabetes mellitus, asthma, tuberculosis. Ask too about any significant illnesses or operations in the past. Also ask about "any previous illness like this one".

## Systematic enquiry

The systematic enquiry is designed to elicit any additional symptoms which have not emerged during the history. It is thus a screening procedure. Note that if facts come to light which are relevant to the presenting complaints, it suggests that your original history was inadequate as you should already have explored all avenues arising out of these complaints.

The questions which follow form the minimum you will ask so as to be reasonably sure that you have not missed any serious problem in another system:

- **Chest and CVS**: cough, dyspnoea, sputum, haemoptysis, orthopnoea, PND, oedema, wheeze, chest pain.
- **GIT**: abdominal pain, appetite, change in weight (quantify weight loss where possible,) nausea, vomiting, alteration in bowel habit.
- **G-UT**: dysuria, frequency, haematuria, change in pattern of menses.
- **CNS**: headache (try to distinguish between a potentially serious headache and the "usual" headaches so many people experience,) change in vision (other than errors of refraction responding to glasses,) actual weakness (other than "generally weak,") paraesthesia.

If any positive responses emerge, you will treat them with the same importance as any other item of history by eliciting all further details relevant to that complaint.

Remember that these are the minimum questions. In the appropriate patient, you may well ask more.

It is essential to assess effort tolerance in all people with chest or cardiovascular disease. Record it in terms of what the patient can or cannot do. Useful indices are: being confined to bed, ability to walk about in the house, garden or street and to climb stairs. This is far more informative than merely stating, for instance, "Grade two dyspnoea".

## Family history

The family history does not contribute very much in most instances, other than where there is clear-cut genetic disease. However, a family history of such illnesses as early onset myocardial infarction is occasionally of some diagnostic importance. The usual diseases asked for are diabetes, early onset heart disease, hypertension, stroke, TB and any illness like the patient's own.

## Personal history

Take a personal history. Relevant are: details of cigarette and alcohol consumption, occupation, any stress factors in home or at work. Patients often underplay the amount they drink or smoke. A useful trick is to suggest a high figure, such as *30*? *40*? in which case they do not feel too bad saying 20!

In certain cases a full *occupational history* is necessary - such as where your patient has asthma or unexplained hepatitis. You will then ask carefully about exposure to chemicals, and the exact nature of their work.

## Medication

List the medicines being taken by the patient. Try to ascertain—tactfully—which of their medicines they are in fact not taking, and the reasons for this. This is vital information, which is elicited sympathetically and not by accusations.

## Recording and interpretation of the history

Details of the history are only important in that they give **clues to the presence, nature and severity of disease.** In themselves they are unimportant, and the "part" of the history under which they emerged (family history, systematic enquiry, etc.) is entirely irrelevant. Record and report the history in a logical order as discussed in the notes *Summarising and presenting a patient*.

# SUMMARISING AND PRESENTING A PATIENT

## UNDERSTANDING YOUR PATIENT'S ILLNESS IN PERSPECTIVE

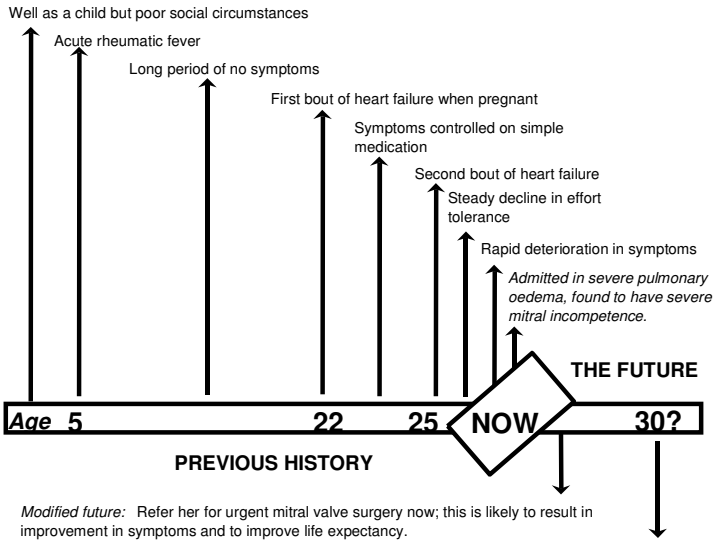
In order to present your patient adequately, you need to have a firm idea of where your patient is on a "timeline" of disease. This entails formulating a clear idea of your patient's illness under three headings:

- What has preceded the current presentation to the doctor.
- Details of heredity, birth, childhood illnesses or upbringing, occupation, habits or whatever that have established the soil in which the seed of the current illness has grown, as well as the course of that illness over the months or years preceding this presentation.
- The current presentation to the doctor.
- Details of the patient's illness and condition at present.
- The crystal ball; the immediate future.
- What future you foresee for the patient without treatment, and how your intervention should be planned to modify it for the better.

***Example***

Mrs Mthembu presents at the age of 27 with severe pulmonary oedema secondary to mitral incompetence.

*Timeline*



# SUMMARISING A CASE

## Purpose of the summary

When formally presenting a case to colleagues, one provides sufficient information for them to understand the factors which led to the present illness, something of the person in whom the illness is found, and sufficient detail of history, clinical findings and special investigations for the reasoning behind your diagnosis to be appreciated. This is described in detail below. However, it is frequently necessary to describe a patient's problems in outline only, without formally presenting the case. For instance, a student may describe the patient they have seen to their tutor, or a registrar may have to bring a consultant up to date on a patient seen previously. It is possible to do this quickly, elegantly and efficiently with a little thought; conversely, an unstructured description is likely to be wordy, confusing and unhelpful.

# HOW TO SUMMARISE YOUR CASE

- Give your patient's name, age and sex, and where appropriate, race and area of residence.

  *I saw Mr Smith, a 45 year old man living in Seaview.*

- List the factors which have predisposed to their current illness - such as relevant medical history or exposure to pernicious factors such as smoking. Keep this brief and relevant.

  *He has smoked 20 cigarettes a day for 40 years and has been in hospital with pneumonia three times this year.*

- Now give only the most relevant details of one or two more important presenting symptoms and physical signs as well as the diagnosis or provisional diagnosis.

  *He presented with fever, cough and severe shortness of breath and I found clear signs of consolidation in his chest. I diagnosed a lobar pneumonia. This is confirmed on chest X-ray.*

- In one or two sentences, bring the audience up to date with the patient's further course.

  *He has been treated with intravenous penicillin and is improving rapidly. We intend discharging him tomorrow.*

## Important points to remember

For a summary, make sure that *every* point you make is a *vital* point; do not be tempted to rehash the whole presentation.

Make sure the few points you choose to give are stated in a *logical order*; i.e. beginning with the factors which underlie the current illness, proceeding to the details of that current illness, and followed by subsequent course and plans.

For a summary, brevity is vital. Your summary should not require more than 4 or 5 sentences.

*Mrs Eunice Makhosi is a 22 year old mother of two from Umlazi. She has no past medical history of note and now presented to the hospital with a 1 week history of profuse bloody diarrhoea. She was ill and toxic on admission. We considered a differential diagnosis of dysentery or of inflammatory bowel disease, and decided to treat her with both metronidazole and ofloxacin. She is now improving rapidly, suggesting that the problem was indeed infectious in origin.*

*I examined an 80 year old man, a Mr Jones from Glenwood. He has been widowed for 15 years and lives alone in a flat. He was very anaemic with a haemoglobin of only 4 g percent. He admits to having a very poor diet and so we suspected that this anaemia might be dietary. We have no information at present but have asked for iron, B12 and folate levels to confirm our suspicion.*

# FORMAL CASE PRESENTATION

## Fundamental principles

The objective of a case presentation is to communicate data as efficiently and fluently as possible. *This is not the purpose of your clerking sheet*, which is designed to assist you to elicit and record *every* item of information which might conceivably be relevant to the patient's management at some stage. To sum this up: the clerking sheet is a *systematic* exposition of the patient's data; the presentation is a *logical*, *edited* one.

The clerking sheet is therefore *not* a suitable model for the presentation of this data to a colleague, whether verbally or in writing, and the content, the order and the style of your presentation should be altered appropriately.

In particular, the content should be restricted to information which is necessary to an understanding of the case: the mere fact that something appears on your clerking sheet is *not* reason enough to put it in your presentation. You may assume that your listener has accepted your bona fides: you do not have to prove you clerked your case thoroughly by reporting every last detail of it. They can question you if they wishes to know anything further.

Finally, the presentation is not a quiz-game. Tell your audience all you know from the beginning, and do not keep them guessing at the diagnosis till the bitter end.

## The order of your presentation

The following **are not appropriate** orders in which to unfold your story:

- The order in which it appears in the clerking sheet.
- The order in which the patient told their history.

Rather place your presentation in logical (which is often chronological) order, irrespective of the stage at which your patient mentioned a detail, or of the heading under which it appears in the clerking sheet. In most instances, the *medical background* should be reported first, even though it may only have been elicited under the so-called past medical history.

*This man was treated for tuberculosis in 1984. He now presents with haemoptysis and dyspnoea.*

*Do not wait until "past medical history" to tell your listeners about the previous tuberculosis, which is highly relevant to the present problem of haemoptysis.*

## Use of English and style of delivery

Presentation of a case at the bedside or to a meeting is a form of public speaking and is governed by similar rules. The presentation should proceed smoothly and in an intelligible fashion. It is not sufficient merely to say everything, any old how. Ensure the presentation is fluent. This can be improved by attention to the following:

- *Write out your presentation* very briefly in point-form beforehand;
- *Avoid verbal "headings"* such as Social History, Family History, and General Examination. This is how something is written, not spoken! Speak in full sentences: "His social history is as follows:" or better still, say it without the preamble: "Mr Smith is married and has two children." It is obvious that this is the social history, without you saying so!
- *Use proper English* and avoid slang. Do not pepper your presentation with "Okay," "Right," and other meaningless phrases. These normally indicate inadequate preparation.
- *Avoid repeatedly saying* "He said" or "The patient said." In most cases, it is obvious that it was the patient who said something.
- *Avoid hedging, guarding and prevarication*, as in this sentence: "I think that possibly it could be sinus rhythm." This conveys the impression of uncertainty no fewer than three times, yet the correctness of the fact itself is probably not in doubt at all! Reserve such qualifications for where real grounds for uncertainty exist; not to cover yourself against the vague possibility of saying something wrong.
- *Avoid jargon*, e.g. impressive-sounding codes or scales such as the Glasgow Coma Scale and grades of dyspnoea. Describe the degree of impairment in English.
- *Proceed confidently* to the end. Do not pause continually to peer at your listener as though you fully expect them to disagree with you.
- If at all possible, *do not read*, but speak with the aid of one-word "prompts" written out specially for the presentation, or, if you can, from memory.

## Preparation

All the above is only possible if you go through your clerking sheet, edit it and if necessary rewrite it before commencing your presentation. Remember; taking the history, examining your patient and recording the data is only 50% of the task. The other 50% comprises analysing it and reworking it into usable form. Only then is it suitable for making clinical decisions and for presenting to a tutor or a colleague. You should only be presenting data which has been reworked into this form.

## What to include and what to leave out

Only state that which is relevant to your case or diagnosis. If your patient has ischaemic heart disease, a prior history of angina is relevant, whereas one of a broken leg as a child is not. Mention the angina, but not the leg. However, relevant negative findings are important too. In

the patient above, the fact that they were not hypertensive would be relevant and would merit saying, as this is a risk factor for ischaemic heart disease.

Do not recite things off by heart where they are not relevant. The worst offender is: "No jaundice, anaemia, cyanosis, clubbing, oedema, lymphadenopathy" all rattled off in one giant word.

## THE PRESENTATION BY PARTS

### The Introduction

Introduce your patient by name, age, address and occupation, so that your listeners can picture the person behind the problem, but do not draw this out too long. State the presenting complaint - or the diagnosis, if you are confident enough. You are not trying to make the listeners guess the diagnosis, and there is no point in withholding it from them.

> *Mr Harold is 45. He is married and has three children. He is a plumber and lives in Wentworth. He has a background of hypertension and now presents in pulmonary oedema.*

### The History

Include relevant past history, family history and systematic enquiry in logical sequence. Remember that a fact is merely a fact, no matter where it emerged in the history-taking process, and it should be reported in the most logical place.

> *Mr Naidoo has smoked 40 cigarettes a day for the last 20 years. Over the past year, he has become increasingly dyspnoeic. Two months ago he was admitted to another hospital where he was told he had emphysema and pneumonia. He was discharged on medication - apparently Euphyllin Retard and an inhaler - but has been severely short of breath and has been unable even to leave his room unaided since then. His wife brought him to the Emergency Unit last night because she noticed that his sputum contained blood.*

You will note that the smoking is not relegated to the social history, or the story of the previous admission to the past medical history. This is best summed up by saying: *make a story out of your history*.

### Past medical history, family history, social history, drugs and systematic enquiry

Briefly report here any information which is not directly relevant to the presenting problem, and which you have thus not yet said, but which is of sufficient interest to be mentioned. Under no circumstances must you recite long lists such as: "No headaches, diplopia, weakness, paraesthesiae", etc. Avoid giving little headlines, e.g. *"Past medical history. He has a past medical history of diabetes."* Rather work it seamlessly into the presentation.

### The examination

It is useful to begin with a brief picture of the patient: e.g. *He was a well man; overweight, but not distressed*; and with the vital signs - pulse rate, blood pressure and temperature. Make sure that your general description is meaningful. Avoid meaningless statements like “A co-operative man who is sitting up in bed.”

Do not trot out negative findings in tedious detail. If signs were absent or systems normal, say so. If you find no evidence of disease in a system not relevant to your patient's condition, you need just say: *The CNS was entirely normal*.

### Special investigations

Report relevant items only.

### Summary

Your summary must not just represent an abbreviated repetition of the facts. It must tie the important facts in with your diagnostic thinking. Summarise in a few sentences only. Do not repeat half your presentation in the guise of a summary.

### Diagnosis and conclusions

Without waiting to be asked, discuss the significance of the available data in terms of a your *assessment*, and problem list.

## CONCLUSION

Presenting a case is far more than just reading from a clerking sheet. A case cannot be presented until you have formally rearranged the order of your data, weighed up the importance of each item and assigned an order of priority to each, and drawn up a tentative diagnosis. The biggest errors are: repetition, irrelevant (albeit, correct) details, sloppy speech, illogical order of information and a telegraphic style punctuated with staccato headings.

# EXAMINATION OF THE PATIENT

## APPROACH TO THE PATIENT

1. Introduce yourself to nursing staff and ask whether it is convenient to examine your patient. Introduce yourself to patient and any family or visitors accompanying them. Explain the purpose and format of the examination to them, and ask their consent. Decide whether it is appropriate or not for family to remain present during the examination. There is often no need to ask family to leave, unless the patient wishes it, or confidential or embarrassing issues are expected to arise.

2. Ensure privacy by drawing curtains.

3. Undress them as far as comfort and modesty permit. They certainly cannot wear a vest, pyjama top, jersey and dressing gown. They may, however, keep on something which can be easily slipped off at the appropriate time to allow full examination. Cover them with a blanket (for warmth, decency and security; all three aspects are important).

**Warning**: You cannot examine the patient properly without undressing them to the extent necessary to elicit signs and inspect the body properly. FAIL!

4. Adjust the bed so that they sit propped up at about 45 degrees. This allows you to examine them easily and is much more acceptable to them than is lying flat on their back, staring up at you. A common error is for the patient to be slumped down at the foot of the bed with only the neck flexed at 45 degrees.

**Warning**: You cannot examine the patient properly unless they are adequately positioned. FAIL!

5. Ask them if they are comfortable, and if not, correct the problem.

6. Begin by feeling the pulse at the wrist. This is a useful way of establishing physical contact with your patient in a warm, caring and non-threatening way.

## PRINCIPLE BEHIND THE EXAMINATION

The cardinal principle is this: *you are examining a specific patient with a specific problem*. Your examination is not done in a set, routine fashion but is geared to find signs which will throw light on the points which emerged in the history. At the same time, however, you will be screening all systems for abnormalities as yet unsuspected.

Throughout your examination, you must constantly ask yourself: What am I looking for? What does this sign mean? What other evidence to corroborate this particular finding should I look for?

Finally, remember that you do not have to be a doctor in order to be a good observer. Many of the points you will be advised to look to in the following sections require the making of simple, everyday observations.

***Example***

> ***Instruction***. *"Comment on the intensity of the first heart sound."*
>
> ***Your action***. *Listen to it and ask yourself: Does it sound loud or not? The first heart sound is after all, only a sound like any other, and it is either loud or it is not. The only difference is that you have to compare it with other first heart sounds you have heard to make a decision. You should be able to make a decision, provided you relax and listen receptively to it like any "normal" person making a judgement on the intensity of a sound. Certainly, there is no excuse for moving on without reaching a conclusion.*
>
> ***Your conclusion***. *Once you have decided, you can think like a doctor again: What does the fact that I think it is loud mean, and how does it fit in with my other impressions?*
>
> *Exactly the same approach can be applied to such observable phenomena as the loudness of the breath sounds, the volume of the pulse, the briskness of the reflexes and many other signs. Do not imbue such observations with a mysterious aura, somehow removed from everyday experience!*

## SOME IMPORTANT RULES

Never pass on from eliciting one sign to another until you have committed yourself to a decision. *Was that percussion note resonant or was it dull?*

Always perform each part of the examination properly, and do not omit the steps we teach you. For instance, do not pass on from the pulse to the JVP without commenting on *rate, rhythm, volume and character* - not one, two or three of these features, **but all four**. Similarly, do not commit yourself to a decision on cardiac auscultation until you have listened to all four areas while lying back at 45°, sitting forward and lying on the left side, in deep inspiration and deep expiration - not just during quiet respiration while lying flat!

**Warning**: Students often pass on to the next sign without properly completing all the aspects of the previous one, or without actually deciding what the result of the previous signs were. They therefore give a poor impression of themselves: they appear unsystematic, unpractised and unaware of the importance of doing the examination properly. FAIL!

# THE GENERAL EXAMINATION

Traditionally one starts off the examination by performing a so-called *general examination*. In time you may appreciate just how useful the clues gleaned from the general examination are in defining the nature and extent of illness in your patient. You must therefore train yourself rigorously to relate the findings on general examination to the findings in the systems, and, during the course of the examination, to refer back constantly to these "general" findings to confirm and enlarge upon your suspicions.

## BE RECEPTIVE

Always begin by specifically noting the patient's general appearance. Do not rush in to examine small details on the hands or eyes immediately. Are they thin, emaciated or obese? Are they chronically ill? Are they comfortable or distressed? And are they critically ill—even in danger of imminent demise—in which case you will begin emergency treatment after the briefest of inspections, and not after attempting an involved clerking!

**Warning**: Many students are very bad at this. Though they know about wasting, the don't actually recognise it when they see it, or else they guess. FAIL!

**Pathophysiology**:

What is wasting? Why is it seen on the temporal areas and backs of the hands, among other places? What are the molecular mechanisms underlying wasting?
What is obesity? Where is the fat predominantly deposited in obese patients?
What is the body mass index, how is it calculated and how is it interpreted?
What are the pathological consequences of being both underweight and overweight?

And always be receptive to other impressions - not oblivious to everything except the "set" things one is supposed to note. Draw every clue you can from the patient's dress, speech, attitude, appearance, the equipment and medicines in the room, the urinary catheter bag and how full it is, notices above the bed and the like.

**Warning**: Don't try to be clever though. The principal focus of your examination is the patient, not the equipment in the room. ANNOYING!

***EXAMPLE:*** *if the skin is rather dark, consciously note this. You will then be able to consider such conditions as haemochromatosis or Addison's disease before going further.*

## TWO IMPORTANT RULES

1. Never succumb to a mechanical recital of "No jaundice, anaemia, cyanosis, clubbing, oedema, lymphadenopathy".

2. Avoid meaningless statements which have no bearing on a diagnosis. "The patient is a delightful and co-operative lady sitting up in bed" says nearly nothing. By contrast, "The patient is elderly and frail, is neither confused nor demented and does not appear acutely ill" says a lot.

## NOW BE MORE SPECIFIC

On first approaching the patient, it is often helpful to commence by taking their hand, feeling the pulse and inspecting the hands. This is a simple and non-threatening approach which helps to relax both you and your patient. Thereafter it is easiest to proceed to inspect the hands, head, neck, mouth, throat, arms and ankles and the rest as you examine the chest and abdomen.

You must however at some stage gauge, inspect or examine:

- temperature
- skin
- adenopathy in neck, axillae and groin
- jaundice
- cyanosis
- pallor or plethora
- oedema
- clubbing
- head and neck, (including the mouth and throat)
- thyroid gland
- trunk (back and front)
- hands
- breasts
- all four limbs
- where appropriate, the male genitalia.

**Warning**: The general examination is frequently very badly done. It gives vital information. Do every aspect properly. FAIL!

Here are some general points about this part of the examination.

***The nails***

Look for pallor, indicating hypoalbuminaemia; the brown bands of renal failure; clubbing, koilonychia and splinter haemorrhages, which are described below.

***Temperature***

In the ill patient, check the temperature. Always note cold peripheries or clammy skin, which may point to a low cardiac output or poor circulation.

***Hydration***

The useful signs in children—decreased tissue turgor and sunken eyes—are unreliable in adults, whose skins are less elastic. Make use of: dry mucosae, a complaint of thirst, a postural drop in blood pressure and evidence of a decline in urine output.

**Pathophysiology**: Explain the principle behind a postural drop in blood pressure.

### *Cyanosis*

Peripheral cyanosis is of no importance whatsoever except when looking for Raynaud's phenomenon or a few similar conditions. In most cases, it is central cyanosis that is of consequence, and is looked for in the tongue. Note that this is often subtle: a bluish tinge is all that is needed to suspect it. Do not expect it to be strikingly obvious. On the other hand, do not diagnose it in everybody!

| | |
|---|---|
|  | **Warning**: A subtle sign which is usually missed. FAIL! |
|  | **Pathophysiology**: Explain how hypoxia results in a bluish tinge to the mucosae. |

### *Clubbing*

Interpretation is often difficult. It is unequivocal when the terminal phalanx is drumstick-shaped, but is usually more subtle. Probably the most useful sign is lifting of the base of the nail, leading to a convex, rather than the usual concave, nail angle, coupled with a "spongy" nail bed. This too is subjective: compare with your own nails. It is safest to report your findings as: *obvious clubbing, no clubbing* or *possible clubbing.* And, of course, the appropriate patient in which to be concerned about possible clubbing is the one who has a cause for it - such as a lung neoplasm.

| | |
|---|---|
|  | **Warning**: This seems easy but is frequently missed. FAIL! |
|  | **Pathophysiology**: Explain how clubbing is thought to come about.. |

### *Evidence of liver disease*

Signs of chronic disease are spider angiomata, palmar erythema, Dupytren's contractures - palpate the flexor tendons for this; testicular atrophy and gynaecomastia. This latter implies the presence of actual glandular breast tissue, which you can palpate, and not just fat in the breast area. Look for all these signs when you suspect liver disease. In more severe hepatic decompensation, note a metabolic flap, foetor and constructional apraxia (e.g. inability to copy a five-pointed star.) A metabolic flap is best elicited by having the patient hold their arms out straight, with the wrists dorsiflexed as far as possible. One then looks for a slight, irregular and non-rhythmic flapping of the hands.

| | |
|---|---|
|  | **Warning**: An easy way to catch out the weak student is to ask for these signs as they cannot remember or recognise them. FAIL! |
|  | **Pathophysiology**: Explain the pathophysiological mechanism behind each of these signs. |

### *Evidence of alcohol abuse*

Note: enlarged parotid glands, a pseudo-Cushingoid appearance, dilated veins on the face, signs of liver disease and of intoxication or of imminent alcohol withdrawal—tremor, sweating, tachycardia, marked anxiety and hallucinations.

| | |
|---|---|
|  | **Pathophysiology**: Explain the pathophysiological mechanism behind each of these signs. |

***Substance abuse***

Always consider the possibility of this in people presenting with such unexplained signs as confusion or inappropriate behaviour, sweating, tachycardia and pupillary abnormalities. Be alert to clues such as age and social background. Many a patient under the influence of Mandrax or cannabis has had a label of medical or neurological illness attached to them, only to recover completely by the following day!

### *Thyroid signs*

Where you suspect hyperthyroidism, look for tremor, sweating, lid lag and lid retraction. Similarly note signs of hypothyroidism. These are hair loss, thinning of the outer part of the eyebrows, a hoarse voice, a dry, coarse skin and a delay in the relaxation phase of the tendon reflexes. But note that many elderly people have coarse dry skins and hoarse voices. It is right to be suspicious in these circumstances; wrong to be dogmatic.

**Pathophysiology**: Explain the relationship between excess thyroid hormones, the adrenergic system and the signs of hyperthyroidism.

### *Hyperlipidaemia*

The skin manifestations of hyperlipidaemia include tendon thickening, which is best appreciated in the Achilles tendons; xanthelasma, an accumulation of yellowish material at the inner canthus of the eye; and eruptive xanthomata, which appear very similar to acne. Also described is a corneal arcus or white ring around the eye. However, this is quite normal in the elderly and you should only comment on it if it appears in those middle-aged or younger.

### *Gout*

One may see tophi—hard, knobbly protruberances—over the elbows, knees and knuckles. They may also occur on the pinna of the ear, and are more delicate here.

**Pathophysiology**: What is the relationship between hyperuricaemia, arthritis, tophi and renal calculi?

### *Infective endocarditis*

Suspect endocarditis in anyone with a heart valve problem who is unwell, especially if febrile. The signs you must carefully look for are: fever, pallor, haematuria, splenomegaly and evidence of major embolisation, such as stroke, myocardial infarction or absent peripheral pulses. The traditional peripheral signs are as follows, but it must be clearly appreciated that they are seen only in a minority of patients and that the condition can be diagnosed in their absence. These are: clubbing, splinter haemorrhages, retinal haemorrhages (called Roth spots) and Osler's nodes - which are small infarcts felt in the palps of the fingers as tender nodules. Janeway palms are uncommon and less important.

**Pathophysiology**: Explain the relationship between the presence of vegetations, these peripheral signs and the systemic inflammatory response.

### *Shock and heart failure*

Note coolness, sweating and a clammy skin as a sign of shock or of poorly compensated heart failure.

**Pathophysiology**: Explain the relationship between a poor cardiac output, the blood pressure, capillary filling, skin temperature and heart rate.

This list is by no means exhaustive. In every instance, tailor your examination to the patient and their complaints. Where specifically indicated by your history or suspicions, other signs should be sought.

# EXAMINATION OF THE CHEST

## ORDER OF EXAMINATION

Perform a general assessment.
Assess the type of breathing.
Inspect the chest.
Inspect the adequacy and symmetry of inspiration.
Assess chest expansion by palpation.
Percuss the chest.
Auscultate.
Where appropriate, test vocal fremitus and resonance.

## GENERAL ASSESSMENT

- Look specifically for distress, cyanosis and clubbing.

## ASSESS THE TYPE OF BREATHING

***Acceptable Terminology***

- Tachypnoea or rapid breathing
- Prolonged expiration
- Distress
- Use of accessory muscles
- Paradoxical chest movement
- Acidotic breathing
- More subjective description, where necessary.

## INSPECTION

### Preparation

The chest cannot be adequately examined with the patient lying flat. Sit them comfortably at 45°.

| | |
|---|---|
|  | **Warning**: Students frequently neglect this in the examinations. FAIL! |
|  | **Pathophysiology**: Explain how sitting the patient up improves diaphragmatic function and therefore enables better respiration. |

The torso should be completely accessible. *Never try to examine anybody with a night-gown or jersey hanging around their neck,* no matter how rushed you are. You are likely to miss something.

| | |
|---|---|
|  | ***Warning***: Students frequently neglect this in the examinations. FAIL! |

- Complete the chest examination in its entirety over the anterior aspect of the chest, then sit the patient forward and complete the examination over the back.

## Inspect the chest

- Comment on abnormal chest shape - particularly kyphoscoliosis and the barrel chest of emphysema.
- Comment on surgical scars which may suggest chest surgery.

### *Respiratory distress*

Is the patient in respiratory distress? Any patient who is **tachypnoeic and dyspnoeic** is in respiratory distress and you must comment on this. *Additional* but not necessarily present signs of respiratory distress are alar flaring, chest recession and grunting.

| | |
|---|---|
|  | ***Warning***: Students frequently fail to recognise the increased respiratory rate indicating distress. POOR! |
|  | **Pathophysiology**: Explain how each sign of respiratory distress comes about.. |

### *Chest expansion*

- Inspect the pattern of chest expansion. Look at the chest from the end of the bed and ask the patient to breathe in deeply. See if expansion is adequate and symmetrical, and describe it as detailed below under *Palpation*.
    - Then assess the pattern of expiration as follows:
    - Get the patient to take a full inspiration followed by a slow, complete expiration to assess vital capacity
    - Then a full inspiration followed by a forced expiration as fast and hard as they can. Prolonged expiration, a wheeze or stridor may then indicate airways obstruction.

| | |
|---|---|
|  | **Warning**: Students frequently fail to examine—by both inspection and palpation—while the patient takes a slow deep breath. Obviously you cannot assess expansion if the patient does not try to expand as much as possible. . FAIL! |

## Palpation

### *Feel for deviation of the trachea*

- Place the palm of the hand either flat on the patient's upper sternum or just above it. Slide the middle finger into the suprasternal notch to rest on the trachea. By slipping the finger off the trachea to left and right, gauge whether it lies more to one side or the other. The normal trachea in fact often lies slightly to the right of the midline.

| | |
|---|---|
|  | **Info**: Some examiners like to assess the trachea from behind. |
|  | **Pathophysiology**: Explain whether, why and how the trachea is deviated in pleural effusion, pulmonary fibrosis, COPD, consolidation and pneumothorax. |

***Palpate for chest expansion***

- Place the palms of the hands on the lower ribs *laterally* (not near the sternum) and feel the expansion - even with your eyes shut!

You must assess **three** aspects of expansion:

- State whether it is symmetrical
- If not, which side (or both) is abnormal
- State the degree of expansion

| | |
|---|---|
|  | **Info**: A common alternative is to measure expansion by placing the thumbs near the midline and measuring how far apart they move during full expansion |
|  | **Pathophysiology**: Explain the mechanisms whereby expansion is reduced in pneumonia, emphysema, pleural effusion and pneumothorax? |

***Acceptable terminology***

- Normal, reduced or absent.
- Decreased on right, left or symmetrically.

| | |
|---|---|
|  | **Warning**: Remember to assess and explain **both** of these properties. FAIL! |

# PERCUSSION

## Technique

- The percussed fingers must be *tightly stretched* across the chest wall - the knuckles should be white and the terminal phalanx bent back off the chest.
- The percussing hand must flex freely at the wrist; all movement takes place at the wrist and not at the elbow.
- The percussion note is both felt in the finger and heard.
- Always locate the upper border of the liver by percussion; if it is lower than the fifth intercostal space, it suggests hyperinflation.
- The chest is percussed symmetrically in the intercostal spaces, comparing one side with the other. Describe the result as below:

| | |
|---|---|
|  | **Warning**: Being able to assess percussion is essential. Poor percussion leads to incorrect assessment. FAIL! |
|  | **Pathophysiology**: What mechanisms explain the percussion note in different disease? |

## Acceptable terminology

- Resonant (this is the normal character)
- Dull
- Stony dull
- Hyperresonant.

In normal people there is an area to the left of the lower sternum which is dull to percussion. This so-called *cardiac dullness* represents the portion of the heart which is not covered by lung. In emphsyema it is often reduced or absent because of the hyperinflated lung.

## AUSCULTATION

- Show the patient by example how you wish them to breathe; moderately slowly and deeply, but not noisily, and through an open mouth. They must not pant or voice the breaths.
- Listen to all parts, including the axillae. Describe the breath sounds as follows:

### Acceptable terminology

- Normal vesicular
- **Bronchial breathing**. This is higher-pitched and "breathy". It should be instantly recognised, once you have heard it a few times. Trying to recognise it by analysing it into length of inspiration/expiration is **unhelpful**. Amphoric breathing is very marked bronchial breathing, low-pitched and hollow, and implies the presence of a cavity.
- **Wheeze**. This is a high-pitched, continuous musical sound associated with obstruction. Expiration is always prolonged.
- **Stridor**. The sound of upper airway obstruction. It is maximal over the trachea and central airways.
- **Crackles**. Coarse crackles imply fluid (pulmonary oedema) or infective secretions, which may clear on coughing. Crackles may therefore imply the presence of bronchitis, bronchiectasis or indeed pneumonia. Fine crackles suggest parenchymal lung disease, such as fibrosing alveolitis. If you suspect bronchiectasis, listen over the open mouth with your stethoscope, where coarse crackles may be audible.

| | |
|---|---|
|  | **Warning**: Do not guess. Make sure you can identify these sounds. FAIL! |
|  | **Pathophysiology**: What is the mechanism underlying each type of breath sound? |

### Vocal (tactile) fremitus and vocal resonance

These two signs are of limited value. If you suspect consolidation, you may wish to confirm an increase in vocal fremitus and resonance. This is done by asking the patient to intone "one one" while you respectively feel over or listen to the area of interest. Similarly, these are diminished over a pleural effusion or pneumothorax.

| | |
|---|---|
|  | **Pathophysiology**: What is the mechanism underlying increased and decreased vocal resonance and fremitus? |

## PEAK FLOW AND VITALLOGRAPH

If equipment is available, the examination is not complete without use of the Vitallograph in any case of restrictive or obstructive lung disease. This will give you an objective measure of the degree of restriction or obstruction, and should be done as a matter of course in all such cases. The peak flow meter is particularly useful for taking serial measurements in patients with obstructive lung disease such as asthma and emphysema, so as to gauge the severity of airflow limitation.

## PRESENTING YOUR FINDINGS

The manner in which you present your chest findings is important. Do not present them sign by sign. Rather present them area by area and suggest the underlying pathological process.

> *Example*
>
> *There is stony dullness with absent breath sounds at the right base, suggesting a pleural effusion; and bronchial breathing with dullness at the left apex in keeping with consolidation.*

Do not come up with obvious inconsistencies. Do not describe increased resonance to percussion in consolidation (unless you are very sure), and do not describe a host of chest signs in a man who probably has no chest disease at all! Remember that wheeze *always* implies the presence of some obstruction: you cannot pass it off as a normal finding.

The physical examination can never rival the chest X-ray for the amount of anatomical pathological detail it provides, but it tells you more about physiological or functional impairment than does the X-ray.

**Warning**: Do not come up with obvious inconsistencies. Do not guess. FAIL!

# EXAMINATION OF THE CARDIOVASCULAR SYSTEM

Note throughout this section that the descriptive terms suggested are not intended to confuse you further or to take on some mysterious significance and authority in their own right. On the contrary, they are simple English words (high, low, rapid, slow, etc.) which are designed no more or less than to describe exactly what you feel or hear. Once you have so used them, they will however help to point you to a useful conclusion. This is in contrast to such terms as "anacrotic", "volume-overloaded" which you may read or hear about.

## ORDER OF EXAMINATION

1. Perform a general assessment.
Assess the pulse.
Measure the blood pressure.
Inspect the jugular venous pressure (JVP).
Palpate the praecordium.
Palpate the apex beat.
Auscultate.
Inspect the chest X ray and ECG, where appropriate.

## GENERAL ASSESSMENT

- Look specifically for distress, cyanosis, oedema, cool peripheries, and where appropriate, for clubbing and other features of infective endocarditis.

## PULSE

- Identify the radial pulse and time its rate.
- Then identify the brachial pulse in the antecubital fossa. This is a larger pulse, and the rest of your assessment is both easier and more accurate if you learn to recognise the various abnormalities at the brachial pulse.

| | |
|---|---|
|  | **Warning**: Assessing pulse rate alone is not enough! All aspects must be reported FAIL! |
|  | **Info**: It is essential to become adept at finding and assessing the brachial pulse. Being larger, it provides far more information that n the radial pulse. |

All the following are to be described

- Rate
- Rhythm
- Volume
- Character

| | |
|---|---|
|  | **Warning**: Students frequently neglect this in the examinations. FAIL! |

Some textbooks will suggest that you try to assess the hardness of the arterial wall for the presence of atherosclerosis. This is not a useful sign.

Where **atrial fibrillation** is suspected, the rate must be measured by auscultation and the pulse deficit calculated.

**Pathophysiology**

What is the explanation for a pulse deficit with atrial fibrillation? Which is worse for the patient: a low or a high pulse deficit?
Why is the pulse rate irregular with atrial fibrillation?

***Acceptable Terminology***

- Rate. *Rapid, normal* or *slow*; state the rate in beats per minute
- Rhythm. *Regular, irregular, regular with ectopics*
- Volume. *High, high normal, low*
- Character. *Rapid rise and fall, collapsing, slow rise and fall, (bisferiens)*

***How to describe the volume of the pulse***

- *High.* This does not necessarily imply abnormality. What it does mean is that the pulse is *not low*. In other words, there is unlikely to be significant aortic stenosis or a low cardiac output state. If it is very high, you may well consider a collapsing pulse.
- *Low*. Again, this does not necessarily mean it is abnormal. But it does make a high output state, or a condition such as aortic incompetence, very unlikely. It may point to a low output state such as aortic stenosis or heart failure, and you must consider this.

**Pathophysiology**:

Explain why the pulse volume is high with fever, aortic regurgitation and pregnancy.
Explain why it is low with shock, heart failure and aortic stenosis.

***How to describe the character of the pulse***

- *Slow rise and fall*. This points towards aortic stenosis.
- *Rapid rise and fall*. This may indicate a high output state such as fever or anaemia, or a situation of aortic runoff such as aortic incompetence.
- *Normal*.
- *Collapsing*. This is a high volume pulse with rapid rise and fall.

If your patient is hypertensive, you may check for radio- or brachiofemoral delay, scapular and renal artery bruits.

## If the pulse is collapsing

If you suspect the pulse is collapsing, confirm this by feeling for a pulsation palpable through the forearm muscles, and by taking the blood pressure which should show a wide pulse pressure (a wide gap between systolic and diastolic pressure.) These are the major signs of rapid aortic run-off and you should not place much store on such signs as a Corrigan's sign, pistol shot femorals or Quincke's sign. However, occasionally Duroziez's sign is of some usefulness. It confirms aortic incompetence of some severity. The sign is elicited by pressing on the femoral artery just below the groin with the left hand to occlude the femoral artery. Listen proximally over the artery with the diaphragm of your stethoscope. As you occlude the vessel, you will obviously hear a systolic bruit. This is a *normal* response. If the sign is positive, you will also hear a backward-flow, diastolic bruit as the blood falls back into the left ventricle. One therefore hears a *to-and-fro* murmur.

**Pathophysiology**: What is meant by aortic runoff? What are all the causes of a collapsing pulse, and what is the mechanism whereby they cause the pulse to be collapsing?

## BLOOD PRESSURE

- Record the blood pressure. If blood pressure is elevated, repeat toward the end of the examination when the patient is more relaxed. Quote the lowest reading.

**Warning**: Students frequently neglect this in the examinations. FAIL!

### Postural drop in blood pressure

If you suspect hypovolaemia or dehydration, always check for a postural drop in blood pressure. This is a more reliable sign than decreased skin turgor. This is performed by taking the blood pressure with the patient lying flat and then repeating it with them sitting at 90°. A drop in systolic of more than 10 mmHg is indicative of a postural drop.

Warning: Do not comment on hypovolaemia without having assessed the patient for a postural drop in blood pressure. FAIL!

**Pathophysiology:**

What factors are responsible for maintaining a normal blood pressure?
How does blood pressure adjust when one rises from the lying to the standing position?
What is the mechanism for a postural drop in blood pressure?

### Pulsus paradoxus

In the setting of airways obstruction (e.g. asthma) or a possible pericardial syndrome, check for pulsus paradoxus. First feel for *palpable* paradoxus. Feel a major pulse. If its volume drops appreciably with each inspiration, the sign is present. Now check for paradoxus using the Baumannometer. Inflate the cuff above systolic pressure. Listen while very slowly deflating the cuff. Note the pressure at which any sounds appear. Only some will be audible - those during expiration only. (You will hear: *dup dup dup; pause; dup dup dup; pause*;.) Continue slowly deflating till you hear all the sounds, (*dup dup dup dup dup*.) The difference in pressures is the degree of paradoxus.

**Pathophysiology**: What is the explanation for pulsus paradoxus?

## JUGULAR VENOUS PRESSURE

- Identify the jugular venous pulse.

Do not touch the neck until you have identified the jugular venous wave by inspection. A pulsation which shows more than one wave, which is "soft" rather than "pushy", drops with inspiration or rises with pressure over the liver and is different to other, more obviously arterial, pulsations is venous.

You must see the JVP in all cases. If at first you cannot, it may be very low or very high. Check for this by sitting the patient upright and then slowly lying them flat while carefully observing the neck.

Pressure with a finger across the base of the neck will obliterate the venous pulsation but this *is for confirmation only.*

| | |
|---|---|
|  | **Warning:** Students commonly rush to place a finger across the neck to identify the JVP. This usually results in missing it. Look! Look! Look! It is usually unnecessary to touch the neck in order to identify the JVP. |
|  | **Pathophysiology**:<br>Why is the JVP normally seen just above the clavicle when the patient lies at 45°?<br>Why does the JVP rise with right ventricular heart failure? |

Record the JVP under the following headings:

***Height***

- Estimate the height in cm *vertically* above the sternal angle. Note that the vertical height of the JVP does not depend on the patient's position, and there is nothing magical about the angle of 45°. Sit the patient at whatever angle is necessary to see the JVP well.

| | |
|---|---|
|  | **Warning:** Inexperienced students are usually inaccurate at judging the height of the JVP. You must measure it with a ruler or tape measure. Fail! |
| | **Info:** The experienced clinician can estimate the height by eye only which is why you will not actually see your tutors measuring it with a ruler. |
|  | **Pathophysiology**: Why is the vertical height of the JVP always the same, no matter whether the patient lies at 20 degrees, 45 degrees or 90 degrees? |

***Distension***

- State whether veins are very **distended**. If so, are they **non-pulsatile**? This would suggest superior vena caval obstruction. Demonstrating distended forearm veins with the arms stretched above the head confirms this.

| | |
|---|---|
|  | **Pathophysiology**: Why is the jugular venous column non-pulsatile with superior vena caval obstruction? |

***Wave-form***

This is a very difficult assessment to make without a lot of experience. It is wisest not to be too dogmatic as to whether you are seeing *a* or *cv* waves at first, but to rely on the clinical context to put you right. But you must comment on apparently large waves. Experience and the context will reveal if it is the giant *a* wave of right atrial hypertrophy or the *cv* wave of tricuspid incompetence.

| | |
|---|---|
|  | **Pathophysiology**: What is the explanation for the *a* and cv waves seen in the jugular venous pulse? |

The large *X* and *Y* descents of pericardial constriction are a feature noted on cardiac catheterization. This is how they were named. Do not think that they are always easy to see

clinically. However, with practice the presence of large descents can be suspected in some cases. The thing to look for is a rapid falling of the pulsation away *into* the neck - not up and down the neck. It is not necessary to differentiate *X* and *Y* descents.

## PALPATION OF THE PRAECORDIUM

- Palpate the praecordium. Identify any abnormal impulse or thrill as systolic or diastolic by timing against the carotid pulse.
- Note the presence of any parasternal lift, i.e. an obvious lifting movement alongside the sternum and not just a vibration or a thrill, and in the epigastrium. These may signify right ventricular hypertrophy.

**Pathophysiology**

What is the explanation for the parasternal lift associated with right ventricular hypertrophy?
Are right ventricular hypertrophy and right ventricular failure the same thing?

- Also note any other movement to the left of the sternum. This may denote a dyskinetic segment.

**Pathophysiology**: What is a dyskinetic segment?

- Feel in the pulmonary area for a palpable second sound suggesting pulmonary hypertension.

**Pathophysiology**

Why is the second sound both loud and palpable in pulmonary hypertension?
What is pulmonary hypertension? What are the causes and how do they cause the increased pressure?

- Note any thrills, and time them.

## APEX BEAT

- Locate the apical pulsation with the palm of your hand, then pin it down with the tips of a few fingers. If you cannot feel the apex, try with the patient lying on their left side. It will often now be palpable. If still impalpable, do not forget to consider a dextrocardia. Palpate and percuss to the right of the sternum to detect it. In all cases, record the apex as follows:

### Position

Ignore the vertical position in terms of rib space. Accurately determine the lateral displacement.

**Info**: Many clinicians also report the vertical position i.e. in which intercostals space it is felt. This is almost always of little importance. The horizontal position however is indeed important.

***Acceptable Terminology***

- In the midclavicular line

- Beyond the midclavicular line
- In the midaxillary line

You may qualify the above with terms such as *markedly displaced beyond*, or *2 cm outside* etc.

**Pathophysiology**

Why is the apex displaced with left ventricular failure but not with hypertrophy?
Explain the difference between a dilated left ventricle and a hypertrophied left ventricle.
Differentiate between the causes.

### Describe the apex

- **How well localised**. Comment if it is *diffuse* and difficult to tie down to one spot. This is often a sign of a weak, "myopathic" ventricle.
- **Character.** This is similar to the pulse, and carries similar significance. Use the terms:

***Acceptable terminology***

How well localised*:*

- *well-localised*
- *diffuse*
- *impalpable*

Character*:*

- *Rapid rise and fall*. As with the pulse, this does not necessarily mean it is abnormal. It does mean that aortic stenosis is unlikely, and may point to conditions such as fever or anaemia, as well as disease states such as aortic or mitral incompetence.
- *Slow rise and fall*. This may point to aortic stenosis or hypertension. It makes predominant aortic incompetence unlikely.
- Whether a *single* or *multiple* impulse is felt.

**Pathophysiology**: Explain why the apex is rises and falls rapidly in aortic regurgitation, and slowly in aortic stenosis and severe hypertension.

If severe, the terms *volume-overloaded* and *pressure-overloaded* are sometimes used to describe the rapid and slowly-rising apex beat respectively. These always imply an abnormal situation.

**Warning**: Assessing the apex requires experience and practice. Do not neglect it.

## AUSCULTATION

### Positioning the patient

♦ Auscultate with the patient in all the following positions:

- **Lying at 45°** - listen briefly over the aortic, pulmonary, tricuspid and mitral areas with the diaphragm.

- **Sitting forward** - now listen carefully over the aortic, pulmonary and tricuspid areas with the diaphragm, in both deep inspiration and in expiration.
- **Lying on the left side** - listen over the mitral area with the bell in deep expiration.

**Warning**: Students frequently fail to auscultate in all four areas, in both inspiration and expiration, and with the patient in all three positions. FAIL!

## Listen for a gallop

This *rudderdup rudderdup* cadence is easier to pick up as a general impression rather than as a deliberate detection of a third or fourth sound.

## Describe the first sound

Listen at the apex and at the lower end of the sternum with the patient lying back and also on the left side.

### *Acceptable terminology*

- *Loud*. This implies underfilling of the ventricle. Though it may be found in the presence of a tachycardia, it is classical in mitral stenosis, where the first sound may even be palpable. You must consider mitral stenosis in every case where the first sound is loud.
- Soft.
- *Varying in intensity*. This is typical of atrial fibrillation.

**Pathophysiology**: Explain why the first sound is loud in mitral stenosis. Explain why the heart sounds are irregular and vary in intensity in atrial fibrillation.

## Describe the second sound

- Listen in the pulmonary area, with the patient leaning forwards.

### *Acceptable terminology*

- Loud, normal or soft.
- If it is loud, is it within normal limits, or does it have the ringing or snapping quality of systemic (loud A2) or pulmonary (loud P2) hypertension?

## Listen for third or fourth heart sounds.

- Listen specifically before the first sound and after the second sound in the mitral and tricuspid areas for fourth and third sounds respectively.

**Pathophysiology**: How do third and fourth sounds come about?

## Listen for murmurs

If there are any, proceed as follows. Get a general impression of them—it may even be helpful to imitate them aloud. Do they conform to one of the more characteristic patterns? For example:

- The *fffitt-ta-ta-roooo* of mitral stenosis (loud first sound, second sound, opening snap and diastolic murmur.)
- The *whit-wheeeeee* cadence of aortic incompetence, where an early diastolic murmur follows the forward (ejection systolic) flow murmur.
- The loud, harsh *rooo, rooo* of mitral incompetence.

Now proceed to analyse the murmurs more formally.

- Systolic or diastolic
- Intensity
- Length and quality of the murmur. Initially, use the terms long and short systolic - only classify as pan- or ejection systolic once you have analysed its behaviour.
- Where heard best
- In which position heard best (Sitting forward, lying down, on the left side.)
- Louder on inspiration or expiration.
- Radiation, to the neck, the axilla, or the back.
- Correlate with any associated thrill; this may help to time the murmur and will aid grading of severity.

Describe every murmur in the following standard way:

> *I heard a murmur which is: systolic, intensity 3/6, pansystolic, heard best in the mitral area, on lying on the left hand side, in expiration and which radiates to the axilla. These are the features of mitral incompetence.*

Often a murmur will be heard well in two areas. If murmurs have the same quality and behave the same in two areas, assume that they represent only one valve lesion.

The murmur of severe mitral incompetence may be widely heard over the back.

**Pathophysiology**: Why are innocent systolic flow murmurs encountered in young people, pregnant women, those with anaemia or fever and sportspeople?

## SOME SPECIFIC TYPES OF MURMUR

### *Systolic flow murmurs*

These are common and are benign. They do not imply any disease whatsoever. They are ejection systolic in type, are heard best at the left sternal edge, are never accompanied by a thrill, and are the only murmurs heard. They are particularly common in young people, pregnancy, with fever and with anaemia.

### *Two common murmurs in the elderly*

*Aortic stenosis*, resulting from thickening of the aortic valve cusps. This gives rise to a harsh ejection systolic murmur at the base with radiation to the neck. If severe, peripheral features of aortic stenosis such as a slow-rising pulse will be present.

*Mitral incompetence* secondary to papillary muscle dysfunction. A harsh, blowing murmur (but sometimes quite musical) heard at the apex. It can be either long or short.

***Diastolic murmurs***

The early diastolic murmur of aortic or pulmonary incompetence is an easy murmur to recognise once you have heard it. It is clearly early - occurring right after the second sound - and has an obvious decrescendo character. Occasionally, however, it can be soft and hard to hear. Suspect it where you have a collapsing pulse and Duroziez' sign.

But the diastolic murmur of mitral stenosis is one of the easiest to miss. Listen at the apex with the patient on their left side in expiration, and consciously make yourself listen for an extremely *low-pitched* noise - much lower in pitch than the other murmurs, and usually much softer. Often you have to convince yourself that you are not just hearing the usual hiss one hears with a stethoscope in one's ears. The presence of the typical cadence *fit-ta-ta-rooooo* of murmur, loud first sound and opening snap is very helpful in recognising mitral stenosis, and helps to distinguish organic mitral stenosis from diastolic flow murmurs such as the Austin-Flint murmur (an apical diastolic murmur in aortic incompetence) or the mitral flow murmur of a ventricular septal defect.

### Listen for extra sounds

These include:

- **Clicks.** These sound just as the name implies - a short, clicking sound usually heard at the left sternal edge. It is not uncommon in people with hypertension, in which setting it occurs early in systole - a so-called *ejection systolic click*. A click occurring later is called a *midsystolic click* and is typical of a prolapsing mitral valve, where it *may* be accompanied by a systolic murmur of mitral incompetence. Prosthetic valves also give rise to clicks.
- **Pericardial friction rubs.** These have a typical rub-like quality, have the same timing as the heart sounds, and are distinguished from murmurs by extending through both systole and diastole, varying considerably with position, inspiration and with time.

## SYNDROMES TO LOOK OUT FOR

### Pulmonary hypertension

These are the signs of pulmonary hypertension:

- loud P2;
- a parasternal lift;
- tricuspid and pulmonary incompetence;
- right heart failure.

Young women in particular often have an apparently loud P2, so, as always, be selective and make the diagnosis only if the signs are unequivocal, or the clinical setting right - for instance, mitral stenosis, chronic lung disease or severe pulmonary symptoms which are otherwise unexplained.

### Pericardial syndromes

These are constrictive pericarditis and pericardial effusion, causing tamponade. The signs include:

***In constrictive pericarditis***

- Ascites without much peripheral oedema;
- A loud third sound known as a diastolic knock;
- A diastolic lift - that is an outward movement of the praecordium to the left of the sternum in *diastole*;
- Proteinuria.

***In cardiac tamponade***

- Dullness beyond the point where the apex is palpable;
- Diminished heart sounds;
- A pericardial friction rub.

***In both***

- An elevated JVP with marked descents;
- A low-volume pulse;

- A small pulse pressure;
- Pulsus paradoxus.

**Pathophysiology**

Explain why the JVP is high in cardiac tamponade
Explain how the pulsus paradoxus comes about.\Explain why the heart sounds are soft.
Explain why the pulse volume and blood pressure are low.

# EXAMINATION OF THE ABDOMEN

## ORDER OF EXAMINATION

1. Perform a general assessment.
Inspect the abdomen.
Perform a light palpation.
Inspect the genitalia where appropriate.
If ascites appears to be present, confirm it.
Delineate the extent of liver and spleen by percussion.
Assess hepatomegaly or splenomegaly by palpation.
Palpate for other abnormalities.
Auscultate where appropriate.
Perform rectal or vaginal examination where appropriate.

## GENERAL ASSESSMENT

- Look specifically for wasting, adenopathy, anaemia, jaundice, features of liver disease or renal disease.

## INSPECTION

- Note any distension, dilated veins, or scars. Look for a fullness in the flanks suggesting ascites.

**Warning**: Students frequently place too much emphasis on surgical scars and not enough on the other aspects of inspection. Scars are only relevant in a few circumstances, such as: intestinal obstruction, resulting from adhesions, or where the current problem and the earlier surgery are related to the same underlying disease, such as inflammatory bowel disease.

If dilated veins are present, exclude IVC obstruction from sinusoidal/presinusoidal obstruction.

***Technique***

- If distended veins are noted in the flanks and over the back, suspect IVC obstruction.
- Assess the direction of flow below the umbilicus only. If veins fill from the groins towards the umbilicus, suspect IVC obstruction.

**Pathophysiology**: Explain the direction of flow in superficial abdominal veins in normal people, in the presence of cirrhosis and in IVC obstruction.

### Inspect the genitalia

This need not be routinely performed; only where history and examination findings suggest it may be appropriate. If indicated, examine the male genitalia for testicular atrophy, masses, or evidence of infection. Inspect the external vulvae for evidence of infection.

## LIGHT PALPATION

- Begin by having the patient lie flat, and ask them to relax the abdominal muscles. Do not examine patients sitting up or with their heads off the pillows.

| | |
|---|---|
|  | **Warning**: Do not fail to place the patient, flat and straight and expose the abdomen properly. FAIL! |

- Palpate with two objectives in mind: firstly, to elicit any tenderness; secondly, to feel for masses or visceromegaly.
- Gently palpate all quadrants of the abdomen. If there is pain, very gently determine just where it is and look for signs of peritonism: guarding, where attempts at dipping the hand into the abdomen meet with reflex tautening of the abdominal muscles, and rebound tenderness, where pain is felt on sudden release of pressure by the palpating hand.

| | |
|---|---|
|  | **Pathophysiology**: Explain the relationship between peritoneal irritation and the signs of peritonism. |

Where there is some doubt as to the genuineness of the signs, a useful trick is to bump the bed with your knee. With true peritonism, this will cause pain.

## ASCITES

Confirm ascites where appropriate.

### Test for a fluid thrill

- Slap one flank with the palps of the fingers while the flats of the fingers of the other hand are held against the opposite flank. It is **not necessary** to have a hand held across the midline of the abdomen in the first instance. A positive result is a shock-wave or thrill detected by the other hand.

| | |
|---|---|
|  | **Info**: Another commonly used method is to flick the abdomen with the back of the finger. |

If a thrill is felt, but is not unambiguously due to fluid, then the patient or an assistant may be asked to place the edge of a hand along the midline of the abdomen, to damp down any thrill passing through the abdominal wall.

### Percuss for shifting dullness

| | |
|---|---|
|  | **Warning**: Shifting dullness is a favourite sign elicited in our assessments. For some reason it frequently trips up the less prepared student. You have been warned! FAIL! |
|  | **Pathophysiology**: Why is the presence of fluid accompanied by shifting dullness? Make sure you can explain exactly what happens as the patient rolls on to the left side, and on to the right side. |

- Lie the patient on one side, and percuss their belly from flank to flank. Percuss with the percussed fingers held longitudinally along the abdomen, not transversely. Mark, with a light pen mark, the transition from dull to resonant on both sides.
- Now lie them on the other side and repeat. Note to what extent, if any, the line of demarcation between resonance (the gas-filled bowel) and dullness (fluid) has shifted both in the lowermost flank and in the uppermost flank.

If a fluid thrill is unambiguously present, it is not necessary to test shifting dullness. Shifting dullness is a more sensitive test for ascites than a fluid thrill, may be present when a fluid thrill is absent, and will detect smaller volumes of ascites.

It is in fact not necessary to mark the transition on both the lowermost and the uppermost flank; one will suffice, if done properly. However, it takes little extra time to check both.

# PERCUSSION

## Liver

Determine the lower and upper margins of the liver by percussion.

- Percuss from the right iliac fossa upwards towards the right costal margin in the midclavicular line. Note the onset of liver dullness but do not stop percussing.
- Continue percussing upwards above the costal margin till you notice the disappearance for liver dullness.
- Note the following three observations:
    - The extent of liver dullness below the right costal margin
    - The position of the superior edge of the liver in terms of intercostal space
    - The total span of the liver.
- Measure the liver span, from top edge of dullness to bottom edge, using a tape measure.

 **Warning**: Use a tape measure. Estimation by eye is inaccurate..

Reduced extent of liver dullness is a useful indicator of a shrunken liver, e.g. cirrhosis or massive necrosis

If the top margin is pushed down by emphysema, then the size can only be assessed by considering the total span as above.

## Spleen

Gauge the size of the spleen by percussion.

- Percuss from the right iliac fossa upwards towards the let upper quadrant.
- Continue percussing across the costal margin on to the left **lateral chest wall, so-called Traub's triangle.**

If dullness is encountered in the left upper quadrant or even lower, splenomegaly is likely to be present, since this area is normally resonant as a result of gas in the stomach. It will however be necessary to differentiate a spleen from an enlarged left lobe of the liver.

If Traub's triangle is dull, suspect that moderate splenomegaly may be present; if resonant, splenomegaly is unlikely. Dullness in Traub's triangle is however merely a guide, and is not entirely accurate.

| | |
|---|---|
|  | **Pathophysiology**<br>What is the explanation for: the dullness of liver dullness, the fact that the left upper quadrant and left lateral chest are normally resonant but dull with splenomegaly?<br>Why are enlarged kidneys resonant to percussion? |

# PALPATION

## Palpation of the liver

Palpate the edge of the liver. Use the tips of the fingers, directed at 90° or perhaps 45° to the costal margin rather than the radial border of the index finger.

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|---|---|
|  | **Warning**: Palpation is crucial to the success of your examination and is usually badly performed by weaker students, leading to missed organs or to "invented" organomegaly where it does not exist. FAIL! |
|  | **Info**: Your tutor may use the radial side of his/her index finger for palpation. This is acceptable |
|  | **Pathophysiology**: Make sure you can list all the causes of both hepatomegaly and splenomegaly without hesitation |

- Begin just below the border of the liver as identified by percussion, or just below the costal margin if it was not.
- Use your hand to describe a "tick"; a long downwards-and-forwards descent into the abdomen followed by a short upwards-and-forwards movement which should slide over the edge of the liver.

Consider a meeting of two moving parts: your hand, and the patient's abdominal contents. Only *one* should move at a time; either you hold your hand still and he takes a deep breath, or he lies still and you gently dip your hand in further. In this way, you will be able to define an edge.

Always listen over an enlarged liver with your stethoscope to detect a bruit, which often indicates a hepatoma.

| | |
|---|---|
|  | **Warning**: Do not forget this! FAIL!! |

### *Terminology*

If you feel the liver, describe it as follows:

- Hard, firm or soft
- Tender or non-tender

- Regular or irregular.

### Palpation of the spleen

The spleen is most easily felt with the patient lying at 45° on their right hand side. Feel with one hand for the spleen while the other hand attempts to push it forward by pressing on the costal margin in their left loin.

**Pathophysiology**: Why is the spleen best felt in this position?

- Again begin just below the point where the edge was identified by percussion, or just below the costal margin if it was not.

Tenderness in the left or right hypochondrium in the absence of a palpable organ may indicate some minor enlargement or distension of the liver or spleen.

### Further palpation

- Palpate the entire abdomen for other organs or masses, particularly the bladder and uterus suprapubically (both of which are dull to percussion), and the kidneys (which are resonant, because the gas-filled bowel overlies them.)

In a thin person, the aorta is often prominent in the epigastrium. Endeavour to decide if this is merely pulsatile, which is normal, or whether it is expansile - expanding in all directions and hence possibly aneurysmal.

**Pathophysiology**: Explain why the aorta appears to pulsate or expand with each heartbeat.

## AUSCULTATION

Where there is any reason to suspect ileus or obstruction, listen to the abdomen. Comment on: increased, reduced or absent bowel sounds, and the presence of the tinkling bowel sounds of ileus.

**Pathophysiology**: What are the pathophysiological features of both ileus and obstruction? What are the effects on in terms of vomiting, constipation/diarrhoea and the associated bowel sounds?

## RECTAL EXAMINATION

This is performed for the following reasons:

- Where a pelvic problem is suspected, e.g. prostatic enlargement, prostatitis, rectal carcinoma;
- To obtain a stool sample - particularly for detecting melaena or the presence of occult blood. It is hence often necessary in the setting of anaemia or GIT symptoms.
- As a screening procedure, to detect occult rectal carcinoma, in older patients.

- Explain the procedure to the patient and ask their permission. Lie them on their left side with their knees drawn up as high as possible.
- Wearing a lubricated plastic glove, lay your index finger flat on the perineum and then slide it through the anus. Asking the patient to breathe in and out deeply helps them to relax. Pause a second and encourage the patient that it will not be painful.
- Now introduce your finger as far as possible and feel anteriorly and posteriorly, left and right. Note the prostate or cervix anteriorly, in men or women respectively. Do not confuse this with a mass. Comment on any other masses, and any specific area of tenderness.
- Collect some stool on the finger and remove it. Test it for the presence of occult blood. if appropriate. Under certain conditions, vaginal examination is indicated (e.g. ascites, or disseminated carcinoma which might arise from a pelvic tumour.) Internal examination is then very much part of the *medical* examination; it should not be considered something that only gynaecologists do.

# EXAMINATION OF THE NERVOUS SYSTEM

It is vital to have an ordered approach based on *what is likely* and what may *reasonably be expected.* In brief, the fine-print details of examination are reserved for those patients who do indeed have neurological disease, and a shorter, more appropriate screening system is needed for the examination of the patient whose major problem lies outside the CNS. The approach which follows is therefore intended as an introductory screening examination.

This examination format is appropriate to the clerking of a medical patient (such as the man admitted with angina pectoris) whose main problem lies outside the CNS, but also serves as a solid basis for the examination of patients with nervous system illness. Beneath each heading, the essential question being asked during that part of the examination is stated in italics. In the event of a problem coming to light, you will obviously investigate it further by examining that aspect in more detail, as taught in textbooks.

## ORDER OF EXAMINATION

1. Look at and listen to your patient.
Test the higher functions.
Examine the head and neck.
Examine the cranial nerves.
Test tone and reflexes.
Test power.
Test sensation.
Test co-ordination.

## LOOK AT, AND LISTEN TO YOUR PATIENT

***Is he confused or demented?***

The manner in which he gave the history is on its own usually sufficient to show any defect in higher functions. If in doubt, perform a detailed assessment as described in the notes *Assessment of higher functions*.

**Pathophysiology**: What are the differences between confusion, dementia and psychosis?

***Is he depressed, or is mood inappropriately elevated?***

Depression is a common concurrent of medical illness. Wherever it is suspected, gauge the patient's appearance and responses carefully, and question them about poor appetite, insomnia, early waking and crying.

## TEST THE HIGHER FUNCTIONS

If there is reason to suspect abnormality, assess level of consciousness.

***Acceptable Terminology***

- Fully alert

- Drowsy but rousable (i.e. by gentle shaking or calling)
- Responding appropriately to pain stimuli
- Responding inappropriately to painful stimuli
- Totally unresponsive

Then assess orientation, for person, time, place. If abnormalities such as delirium or dementia are suspected, test higher functions more fully. (Refer to the notes *Testing higher functions*.)

## EXAMINE THE HEAD AND NECK

***Test for neck stiffness***

♦ Place your hand beneath the occiput and attempt to bring the chin towards the chest. Normally this can be accomplished without pain. In meningitis, there is protective spasm of the neck extensor muscles, and any attempt to overcome this causes pain.

Kernig's and Brudzinski's signs, which you may read about, are of marginal importance and should not be stressed. They are occasionally useful in suggesting that pain on moving the neck is indeed due to meningism.

| | |
|---|---|
|  | **Warning**: Never omit to look for meningism. Missing it is catastrophic. FAIL! |
|  | **Pathophysiology**<br>What are the causes of meningism, and how do the physical signs come about?<br>What would the CSF show if a lumbar puncture is performed in meningitis? |

## EXAMINE THE CRANIAL NERVES

### The pupils

♦ Look for size and shape of the pupil. In the right setting, always remember *intoxication*, e.g. with cannabis or Mandrax, as a cause of pupillary abnormality.

♦ Test the pupillary light reflex. Shine a light in each eye, and assess the direct and consensual reflexes.

| | |
|---|---|
|  | **Pathophysiology**: Draw a diagram of the entire circuit—the papillary reflex arc. Explain what is meant by the afferent and efferent limbs of the arc and show how papillary abnormalities may occur with different diseases interrupting the arc at different points. |

### Visual acuity

If you have any reason to suspect visual impairment or intracranial mischief, examine visual acuity and fields.

Most visual disturbances you will encounter results from refractive errors, which are not evidence of "neurological" illness.

Use a Snellen's chart wherever possible. IF you really suspect a problem, it is best to have the patient properly assessed by an ophthalmologist or optometrist.

For gross disturbances of vision, you may however use the following crude scale. Test it using a book, objects, your fingers and a light.

- can read
- can recognise objects
- can count fingers
- can perceive a moving hand
- can perceive light
- can perceive nothing.

## Examine the fundi

*Are there signs of hypertension?*

These are narrowing of the arteries, arteriovenous nipping, or constriction of the vein where it is crossed by an artery, haemorrhages and exudates.

*Are there signs of diabetes?*

These include "dot" haemorrhages (known as microaneurysms), "blot" haemorrhages and proliferative retinopathy.

*Is there papilloedema?*

Look for a swollen disc, and blurring of the disc margins. If the margins are blurred, decide whether it is confined to the nasal side. If so, this may be normal. Blurring of the temporal margin is more sinister. Now identify a major vein near the disc and watch it. If it is pulsating, intracranial pressure is not raised. (But note that absence of venous pulsation on its own need not be abnormal.)

Take the time and trouble to see the fundi adequately. Darken the surroundings as much as possible, encourage the patient to keep their eye still, and be prepared to dilate the pupils with cycloplegic drops. *Cyclomiadril,* 1 drop in each eye, is effective. Above all, do not give up too soon.

**Pathophysiology**: What is the pathophysiological explanation for papilloedema? What are the causes?

## Eye movements

- Check movement in all directions, and ask the patient if he is not seeing double images. Watch for nystagmus at the extremes of lateral gaze.

**Pathophysiology**: Which cranial nerves innervate which extraocular muscles, and which movements of the eye does each cause?

Always exclude Wernicke's encephalopathy. The condition is common in alcoholic patients presenting to hospital. The clues are *nystagmus* on lateral gaze and, possibly, a lateral rectus palsy.

### Trigeminal nerve

- Touch the patient on the left side of their forehead and then the right; on the left cheek and then the right; on the left side of the chin and then the right. After each pair of stimuli, ask them: "Is *this* the same as *this*?"

**Pathophysiology**: What is the anatomy of the trigeminal nerve?

### Facial nerve

- Check power by getting the patient to shut their eyes tightly and to frown.

**Pathophysiology**: What is the anatomy of the facial nerve?

### Gag reflex

- This is appropriate in certain circumstances only; e.g. the elderly patient with pneumonia who may have aspirated. Open the mouth and ask the patient to say "Ah". The posterior wall of the oropharynx should move upwards and outwards if the ninth nerve is intact. Elicit a gag reflex by touching the back of the throat gently with an orange stick.

**Pathophysiology**: Describe the reflex arc accounting for the gag reflex. Which is the afferent and which is the efferent limb?

### Tongue

- Check that it lies centrally.

## EXAMINE TONE AND REFLEXES

**Warning**: Tone and reflexes are favourite assessment topics. Neglect them at your peril. Your technique must be confident and accurate. FAIL!

**Pathophysiology**

Describe the normal physiology accounting for the entity of tone.
Explain why tone becomes increased with upper motor neurone disease, and deceased with lower motor neurone disease.

### Test the tone

- Pronate and supinate the wrist a few times
- Flex and extend the elbow
- Roll the leg, on the bed, between positions of internal and external rotation.

The more gently and unobtrusively you grasp the limbs when you move them, the less your results will be confused by voluntary movement on the part of the patient.

If you detect any cogwheeling, check more carefully for Parkinsonism.

## Test the reflexes

- Elicit the biceps, triceps and supinator jerks in the arms, and the knee and ankle jerks in the legs.

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|---|---|
|  | **Info**: There are alternative ways of testing the reflexes. However the ones described here are simple and work well. |
|  | **Pathophysiology**: You must be able to provide a confident description of a reflex arc, apply it to a specific reflex, and explain why upper and lower motor neurone disease cause a brisk or a decreased reflex respectively. |

### *Technique*

- For both the biceps and the supinator reflex, the patient's elbow must not be supported, but must lie on the bed.
- For the triceps jerk, the hand should be held across the patient's chest so that the elbow is just off the bed.
- The knee jerks can be tested one at a time, or both together.

### *Acceptable terminology*

Reflexes are:

- abnormally brisk
- brisk but probably normal
- normal
- reduced
- absent

| | |
|---|---|
|  | **Warning**: Students frequently guess at the outcome of their reflex examination, or try to provide a finding after carrying out the test so badly that nobody could possibly provide an answer. Practise! FAIL! |

Brisk jerks in a young person, particularly an anxious one, are often normal; in an elderly person, they require explanation. The plantars should always be flexor.

Ankle jerks are often difficult to elicit, but should always be present except perhaps in the setting of the very old patient, without any other pointer to lower motor neurone abnormality.

Always consider the possibility of a peripheral neuropathy as a cause - particularly in the alcoholic or diabetic patient.

## Elicit the plantar response

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|---|---|
|  | **Warning**: Students frequently neglect this in the examinations. FAIL! |
|  | **Pathophysiology**: Explain the plantar response in terms of its pathophysiology. List other superficial reflexes which could be tested as well. |

## TEST POWER

- Test the power in a few representative muscle groups, both proximally and distally:
  - Proximal: check shoulder abduction in the arm and hip flexion in the leg
  - Distal: check elbow flexion and extension, wrist flexion and extension and grip strength in the arm; knee flexion and extension, ankle flexion and extension in the leg.

### Technique

- For larger joints, use the flat palm of the hand to steady and to move the patient's limbs. Do not grip the limb with your fingers.
- Place your hands on either side of the joint to be moved.
- Place your hands on opposite "surfaces" of the limb so that one steadies, while the other supplies the force for the movement.
- Always exhort your patient to try harder; most, out of politeness, will not provide maximum effort unless urged to do so.
- Check for a proximal weakness by asking the patient to rise from a chair or to attempt to sit up without using the hands to push themselves up. Make allowances for the obese and for those who are very unfit.

| | |
|---|---|
|  | **Info**: There are alternative ways of testing power. One may for instance ask the patient to move the limb while you resist him or her, as described here. Or one may ask the patient to keep the limb steady while you try to bend or straighten it. Either is acceptable. |

## TEST SENSATION

### Approach to sensory testing

Take a good history of any sensory symptoms to build up an idea of how the sensory disturbance is distributed. Use sensory testing to confirm or refute this distribution pattern. Once the pattern is confirmed, compare with the common sensory syndromes to decide on the anatomical site of the lesion.

In the routine screening of a patient without sensory symptoms, it is inappropriate to be faultlessly thorough. Test sensation with a sharp object only (i.e. pain sensation) and do not examine other modalities unless there is a pointer to such a problem. Use a snapped-off orange stick rather than a metal object to test pinprick sensation.

| | |
|---|---|
|  | **Warning**: Students frequently neglect this in the examinations. FAIL! |
|  | **Info**: A thorough neurologist with an hour at their disposal will examine sensation with a sharp object, a piece of cotton wool, a hot object and a cold object, as well as a tuning fork. |
|  | **Pathophysiology**: Why would a thorough neurologist examine sensation as above? |

#### *Is there a peripheral neuropathy?*

- Test the patient by pricking several times on in one spot on the hand, and then repeat on the dorsum of the hand. Ask them: "Is *this* the same as *this*?" Check by comparing the feet with the thighs. If there is no difference, you may assume there is no marked neuropathy. If there is, a difference, then examine more carefully for a line of demarcation.

***Is there a hemianaesthesia?***

- Again prick the patient repeatedly in one area on the left arm, and then repeat on the right. Check similarly on the leg. If there is no difference, there is no hemianaesthesia.

***Is there a sensory level?***

- Prick the patient repeatedly on the leg and repeat on the upper chest. Repeat on the other side. If there are no differences in the perception of the stimuli, there is no level.

Test more specifically only if there is a clue to a more complicated disturbance of sensation.

The other possible sensory disturbances, such as mononeuropathies and root problems, are likely to be symptomatic and so will already have come to your attention.

Note that this system is quick, structured, problem-oriented and does not confuse or overwhelm the patient with a barrage of stimuli and questions.

**Info**: Some examiners prefer to test sensation with the patient's eyes closed. This is meant to stop the patient "thin king" they feel the sensation because they can see the stimulus. This is however hardly ever a real problem in practice

## TEST CO-ORDINATION

Perform a few simple tests of co-ordination.

***Technique***

- Ask them to tap on the cover of a book with the fingers of the other, and then repeat with the other hand. They should do so rhythmically, with constant force and equally with both hands.
- Then perform rapid alternating movements, by having them slap the book alternately with the front and the back of the hand. Ask them to do so fast.
- Perform the finger-nose test. Sit your patient up, hold your finger an arm's length from them, point with your other hand to their index finger and say; "Put *that* finger on *my* finger." Then say: "Put that *same* finger on your nose." Repeat with your finger held in another position and then with the other hand. Look for past pointing and for intention tremor. If there is any difficulty with either of these tests, proceed to the heel-knee test.

### Further testing for cerebellar abnormalities

If there is reason to suspect cerebellar damage, perform the heel-knee test and tests of fine motor co-ordination (piano-playing, buttoning, touching fingertips to thumbs).

### Examine the gait

If there is any reason to suspect inco-ordination, you must get the patient out of bed and observe the gait.

**Pathophysiology**: What are the functions of the various parts of the cerebellum? How do they relate to the tests described above?

# ASSESSMENT OF HIGHER FUNCTIONS

Loosely we use this term to mean aspects of brain function such as wakefulness, orientation, memory, judgement, insight and reasoning, intellectual abilities such as calculating, memory and emotional appropriateness. Understand from the start that it takes a trained psychologist working unhurriedly through a structured examination process to pronounce definitively on the appropriateness or otherwise on the patient's higher functions. Again, what we outline here is a *screening examination* which will allow us to detect the more obvious deviations from normality; in many cases, such a diagnosis will be sufficient for our purposes; in others, more definitive analysis as outlined in a subsequent chapter will be appropriate.

## ASSESS WAKEFULNESS

This we also refer to "level of consciousness". Assess this by talking to the patient, attempting to wake them if necessary, and attempting to arouse them more vigorously if necessary. Describe your findings under one of the following headings:

- Fully alert
- Drowsy but rousable (i.e. by gentle shaking or calling)
- Responding appropriately to pain stimuli
- Responding inappropriately to painful stimuli
- Totally unresponsive

These stages suggest varying grades of coma from mild to deep. In practice, one assesses this state of wakefulness by proceeding as follows:

- Checking whether consciousness is normal. If not,
- Call the patient's name, pat them lightly on the face or hand
- If still no response, apply a more painful sensation such as grinding a knuckle into the sternum, squeezing the supraorbital ridges over the exits of the supraorbital nerves or forcing a pen or pencil down over the nail bed of a finger.

If the patient moves to knock away the hand causing the pain, or to protect themselves against it that is an appropriate response; if there is some sort of generalised posturing without an attempt to protect oneself against the pain, then that is an inappropriate response. The patient who fails to respond at all is unresponsive.

**Pathophysiology**: Which structures in the brain must be intact in order for consciousness to be maintained?

## ASSESS ORIENTATION

If it is clear while chatting to the patient and taking a history that he is fully in control of themselves in the situation, then one need proceed no further. If there is any hint of confusion, then ask the patient a few more leading questions to assess orientation. Traditionally, we assess orientation towards person, time and place:

- Who are you?
- What is your name?
- What day of the week is it? And what date, month and year?
- Where are you?

- What is the name of this place? Is it a school, a theatre, or a hospital?

## ASSESS MEMORY

Again, if it is clear from talking to the patient and taking a history that there is nothing wrong with memory, proceed no further. If there is however any doubt, and particularly where an element of dementia is suspected, proceed to test memory more precisely.

**Remote memory**. This is rarely impaired, but might be assessed by asking questions about the patient's childhood, etc.

**Recent memory**. This is memory for events of the last few minutes, hours and days. It is much more prone to become unreliable as a result of disease, particularly the dementias. This is worth testing in more detail.

### Technique

- Ask the patient to relate something which may have happened earlier during your interview, such as something you said to each other during the history or an interruption by somebody he might remember such as their doctor.

More formally, in order to lay down a short term memory, it is first necessary to register the facts to be remembered, i.e. to take it in and understand it. Therefore in testing short term memory, we must confirm registration before testing memory content itself.

- Ask the patient to remember an imaginary address:

  *Mr Smith, 47 High Street, Green Point, Cape Town*

- Ask the patient to repeat the address immediately, thus ensuring registration. Warn the patient that you are going to ask them to repeat the address at a later point.
- Now distract the patient by chatting about a few other things or examining something else.
- Now return by asking the patient to repeat the address he was given and ensure that this is done correctly.

The same may be achieved by giving the patient a list of 3 or 4 objects to recall, confirming registration and then asking to repeat them 5 or 6 minutes later.

> *Mrs Brown, I want you to remember the names of these three things. Concentrate now; I am going to ask you to repeat them to me later. Right?*
>
> House ..... tree ..... horse.
>
> *Have you got that? Say them to me. Right, that's fine. Now don't forget them.*

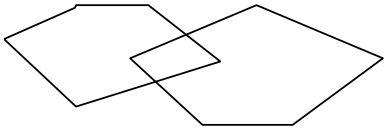
These three aspects: wakefulness, orientation and memory, usually suffice for a screening examination of the CNS. If abnormal in any way, it may be necessary to proceed to a more formal examination of these higher functions as outlined in a later section.

## THE MINI-MENTAL STATE EXAMINATION

The most efficient method of assessing higher functions is the use of the Mini-Mental State Examination (MMSE). Where you suspect cognitive impairment, conduct the full MMSE on your patient and score the answer.

The format of the MMSE is given overleaf.

## MINI-MENTAL STATE EXAMINATION

| **Orientation** | **Score** | **Max** |
|---|---|---|
| "What is the (year) (season) (date) (day) (month)?"<br>*Ask the date, then specifically inquire about parts omitted (e.g. season).*<br>Score 1 point for each correct answer. | ☐ | **5** |
| "Where are we (country) (province) (town) (hospital) (ward)?"<br>*Ask in turn for each place*<br>Score 1 point for each correct answer. | ☐ | **5** |
| **Registration** | | |
| "May I test your memory?"<br>*Repeat three objects (e.g. pen, watch, book).*<br>Score 1 point for each correct answer | ☐ | **3** |
| *Then repeat until patient learns all three.*<br>*Count trials and record separately - don't score (up to 6).* | | |
| **Attention and calculation** | | |
| "Count backwards from 100 by sevens". (Serial 7s test)<br>Score 1 point for each answer, up to 5. (93,86,79,72,65) | ☐ | **5** |
| *or*<br>"Spell 'World' backwards."<br>Score 1 point for each letter in correct order | | |
| **Recall** | | |
| Ask the patient to recall the three objects learnt in "Registration" above.<br>Score 1 point for each correct answer | ☐ | **3** |
| **Language** | | |
| Ask the patient to name two objects shown to him (e.g. pen, watch).<br>Score 0, 1 or 2 points | ☐ | **2** |
| "Repeat the following: 'No ands, ifs or buts.'"<br>Score 1 point if correct | ☐ | **1** |
| Ask the patient to follow a three stage command:<br>*e.g. "Take this paper in your right hand, fold it in half and put it on the table."*<br>Score 1 point for each correct step | ☐ | **3** |
| Write the following on a piece of paper; ask the patient to "Read and obey the following:"<br>CLOSE YOUR EYES.<br>Score 1 point if patient does so | ☐ | **1** |
| "Write a sentence"<br>*Do not dictate: sentence must be sensible, but punctuation and grammar not essential.*<br>Score 1 point for a correct sentence | ☐ | **1** |
| "Copy this design." | | |
|  <br>All ten angles must be present, and the two figures must intersect. Score 1 point | ☐ | **1** |
| **TOTAL** | ☐ | **30** |



Scores of 21-29 indicate mild cognitive impairment.
Scores below 20 suggest severe impairment, and are highly likely to be due to dementia, particularly if reproducible.

# ASSESSMENT OF THE BRAINSTEM, THE CEREBRAL HEMISPHERES AND THE CEREBELLA

## BRAINSTEM LESIONS

The brainstem can be thought of in several ways:

- A source of origin of LMN cranial nerves;
- A conduit for UMN and upper sensory neurones passing between from the periphery and the forebrain;
- A conduit for cerebellar fibres linking the cerebella with the body;
- The site of certain important vegetative functions, including consciousness, respiration and cardiovascular stability.

Lesions are therefore localised within the brainstem by identifying combinations of LMN cranial nerve, peripheral motor and sensory nerve, and cerebellar dysfunction.

## CRANIAL NERVES AND THE BRAINSTEM

### Concepts

The cranial nerves are of major importance in the localising of lesions within the CNS. A knowledge of their anatomy is essential.

Motor cranial nerves, like any other motor nerves, have both upper and lower motor neurones. A distinguishing characteristic, however, is that the cranial nerve nuclei receive bilateral innervation—the upper motor neurones reaching each nucleus arise from both hemispheres. Hence unilateral UMN disease does not cause paresis, whereas LMN disease will. With one exception, when looking for evidence of brainstem disease, one is looking for LMN cranial nerve disease.

The exception is the lower part of the face (all but the forehead) which receives unilateral innervation. Hence unilateral UMN disease of the seventh cranial nerve will result in weakness of the face but not of the forehead.

All the cranial nerves receive crossed innervation - the right hemisphere innervating the left nerve - except the eleventh nerve, which is exceptional.

The third, fourth and fifth nerves emerge from the midbrain, the sixth, seventh and eighth from the pons, and the remaining nerves from the medulla.

**Warning**: You must have a clear idea of the anatomy of the cranial nerves. Fine detail is not so important, but you must know where each has its nucleus, where emerges from the brain, where it ends up and some idea of how it gets there. FAIL!

# EXAMINATION OF THE CRANIAL NERVES

## The olfactory nerve

This is just about never tested in usual practice.

### *Testing*

It can however be tested by having the patient identify the odours of non-caustic substances placed under the nostrils, e.g. vanilla or almond oil. Only rarely is this a sign of neurological disease: most commonly loss of smell is a post-traumatic phenomenon; a shearing movement resulting in severing of the olfactory fibres as they cross the cribriform plate into the nasal passages.

## The optic nerve

This is described in the section *Testing Vision* below.

## The Third, fourth and sixth cranial nerves

These are best tested as a group. This testing has both a *subjective* component (a report of *diplopia*, or seeing double) and an *objective* component, which is the doctor seeing a malalignment of the eyes, or squint.

### *Testing*

- Have the patient sit up and hold your finger, or a pen, about an arm's length from them. Ask them to watch your finger, and then smoothly move your finger from extreme left to extreme right. At each extreme, move your finger right up, and right down. The following diagram illustrates these positions.

### *What to look for*

At the extremes of gaze, look for nystagmus. This is only of definite significance if: it is *sustained* (not just a few odd jerks which thereafter cease) and if it is not elicited at the *extreme position*, at which point even normal people may show some nystagmus.

**Pathophysiology**: What are the causes of nystagmus? How do they come about?

- Look for asymmetrical movement of the eyes and enquire after diplopia. If the patient sees two images, close one eye. One image will now disappear. Ask them which one. The weak eye is responsible for the image which lies most laterally.

**Pathophysiology**: Explain why the patient sees two images when one or more of the extraocular muscles are not working properly.

## The Trigeminal nerve

This has both a motor and a sensory component. The sensory branches supply sensation to the entire face via the three branches: the ophthalmic, maxillary and mandibular divisions. All three are easily tested. A special test of fifth nerve sensory function is the corneal reflex.

***Testing***

- **Sensation.** Test pinprick sensation in all three divisions, comparing left and right. Using a sharp object, touch the patient repeatedly on the left of their forehead, and repeat on the right. Ask them if both areas feel the same. Repeat with the cheek and chin. In exceptional circumstances, one may wish to examine other modalities of sensation too.
- **The corneal reflex.** Have the patient look straight ahead with the eyes open. Twist a piece of cotton wool into a little wisp and introduce it from the side of each eye, in such a way that he does not flinch or blink. Now touch the cornea lightly. The normal response is a brisk blink.
- **Motor function**. The trigeminal motor fibres supply the muscles of mastication - the masseters, lateral and medial pterygoids. Place the palm of the hand under the point of the patient's jaw and ask them to open their jaw against resistance. Then attempt to hold their jaw open as he is told to shut it. Finally get them to move their lower jaw to left and to right as you attempt to resist it by pressing against the side of their jaw with your palm.
- **Jaw jerk**. This is a typical motor reflex. Open the mouth slightly. Place your left index finger on the point of the jaw a though pulling it downwards. Tap on your finger with the hammer. The reflex is to snap the jaw back into a “shutting” position as the stress is applied.

In the normal patient, no reflex is commonly seen at all. The jaw jerk is really only of importance in bilateral cerebral disease, e.g. after bilateral strokes, where a typical upper motor neuron brisk reflex may be seen.

## The Facial nerve

Functionally this is divided into several parts: the motor nerves to the face, the chorda tympani supplying taste to the anterior two thirds of the tongue, and the nerve to stapedius. For practical purposes, only the first function is tested.

***Testing***

- Ask the patient to close their eyes as tightly as possible - often much encouragement is necessary to elicit maximum effort. Now observe how well the eyelashes are buried on each side: they should be well buried, and to an equal degree on each side. Thereafter attempt to open their eyes with your fingers while he resists. It should be very difficult to force their eyes open.
- Now test the upper part of the face - an important part of the examination because of the fact that the forehead is spared except in LMN lesions. Get the patient to frown, and to look up without moving their head, thus wrinkling the brow. See that it does so equally bilaterally.
- The strength of the circumoral muscles is assessed by getting the patient to purse their lips and to blow out their cheeks. Air should not leak out of the mouth and the tone of the cheeks can be assessed by poking them with a finger.

## The eighth nerve

This has two components: vestibular (balance) and cochlear (hearing). It is important to realise that disturbances of each are however uncommonly due to neurological disease. Local disease of the ear is far more commonly a cause.

In most cases history will give a clue to the presence of dysfunction: with complaints of tinnitus, hearing impairment, poor balance, dizziness, vertigo or vomiting. Testing is very crude and not worth a lot. When such problems are encountered or expected, bedside testing is a poor substitute for referral to an ENT surgeon or audiometrist for an audiogram and assessment. The following tests may, however, be applied as a rough guide.

***Testing***

- **Hearing:** Using a ticking watch or softly humming tuning fork, compare the hearing in one ear with that in the other. In most cases, the patient should be able to state which is hearing better. A refinement is to ask the patient to tell you when he can no longer hear the hum of the tuning fork in the worse ear, then transfer it to the other ear and see whether he can still hear it there.
- **Weber's and Rinne's tests**: Students of the history of medicine are invited to swot these up: the rest would be better off memorising the telephone number of the audiometry clinic.
- **Balance**: Many forms of vestibular disturbance are accompanied by *nystagmus*. Test for this. For the rest, tests for balance are the obvious ones of observing the patient sitting or standing erect.

## The glossopharyngeal nerve

This serves two functions of interest to the examiner: taste to the posterior third of the tongue, which is just about never tested, and somatic sensation to the back of the throat, which is much more easily tested.

***Testing***

- Have the patient open their mouth wide. Shine a light in so that you can clearly see their tonsils. If not, hold the tongue depressed with a spatula. Now ask them to say "Ah." The posterior oropharynx on each side should rise superiorly and laterally.
- **The gag reflex**. While holding the tongue depressed and a light shining into the mouth, lightly poke each side of the back of the throat with an orange stick - this is often easier if you ask an assistant to hold the torch for you. Both sides of the pharynx should move easily.

In patients who have had a stroke, the gag reflex is critically important. If absent, one may assume that the patient will be unable to swallow properly too. Attempts to feed the patient may then result in aspiration and pneumonia, which may be fatal.

## The Vagus nerve

For all practical purposes, the autonomic functions of this nerve (to stomach, etc.) are not examined by the neurologist. Of more interest to them are its motor fibres to the larynx. Dysfunction is therefore manifested as dysphonia (inability to make a voice, as opposed to a whisper) and hoarseness. Remember, however, that this may commonly be due to local laryngeal pathology, or to injury to the recurrent laryngeal nerves in the neck.

## The Accessory Nerve

This cranial nerve supplies motor fibres to two muscles: the sternomastoid and trapezius muscles.

***Testing***

- Have the patient turn their head to the side while you resist the movement by pressing the side of their jaw with your palm.
- Have them shrug their shoulders upwards while you resist the movement by pressing down on them.

### The Hypoglossal Nerve

This, the last cranial nerve, supplies motor fibres to all the tongue muscles. Dysfunction is manifested by dysarthria -slurred, indistinct speech.

***Testing***

- Listen for dysarthria
- Ask the patient to open their mouth and check that the tongue lies centrally. Ask them to stick it out; check that it does so in the midline. If still in doubt, test movement against resistance by getting them to press their tongue against the inside of their cheek while you apply pressure from the outside, or resist its movement with a spatula inside the mouth.

## THE CEREBELLA AND THE BRAINSTEM

The cerebella, which sit on either side of the brainstem, communicate with the rest of the body via the cerebellar peduncles. These link in with the pons in particular, but with the midbrain and medulla as well. Hence disease at any level of the brainstem may be accompanied by cerebellar signs.

Cerebellar disturbance manifests with disturbances of truncal positioning, limb positioning (both known as ataxia) and co-ordination of fine movement. This may also result in nystagmus and ataxic speech. Remember that not all are found in every case, as the brunt of the disease may well fall more on one part of the cerebellum than another.

### Recognising cerebellar disease

Signs of cerebellar dysfunction may commonly accompany disease of the cerebella themselves and brainstem disease interrupting the tracts.

It is of value to consider the cerebella in terms of the three evolutionary and functional components: the midline structures, which subserve balance and truncal stability; the paramidline structures which subserve gross limb movements, and the anterolateral parts of the cerebellar hemispheres which are responsible for co-ordination of fine movement. These are also known as the palaeocerebellum, archicerebellum and neocerebellum. It is stressed that this is on the whole irrelevant to your clinical practice; its importance lies in remembering to test all three areas of cerebellar function.

**Pathophysiology**: Relate different aspects of cerebellar function, the tests you perform to assess them and the area of cerebellum responsible.

***Is there disturbance of truncal stability?***

- Observe the patient sitting unsupported, and when you assess gait. Is there a gross tremor of the trunk or rhythmic nodding, called titubation?

***Is there disturbance of limb movement?***

- Carry out the following tests carefully.
    - The **finger-nose test**. Sit the patient up. Do not attempt the test while he lies flat. Hold your finger an arm's length in front of them. Ask them to move their index finger smoothly out and place it on your finger. then ask them to place that same finger on their nose. Repeat this two or three times with your finger in different positions, but always at arm's length.
    - The **heel-knee** test. Have the patient lift one foot at least 30 cm off the bed, smoothly place the heel on the knee of the opposite leg, and then slide that heel down the shin to the ankle. Look for the following: that there is no overshoot, i.e. that the foot stops accurately at a point in the air above the knee; that it is placed accurately on the knee, and that it slides down the shin smoothly, without shaking from side to side.
    - The **toe-to-finger** test. This is the counterpart of the finger nose test. Hold your finger out a fair height above their foot and have them touch your foot with their big toe.

***Difficulty with repetitive movements.***

- Place a book in front of the patient. Have them slap it with their hands rhythmically, one at a time. This should be done moderately rapidly, but not ridiculously so. Listen, rather than look for, regularity of rate and force.
- Devise a similar test for the legs, getting the patient to tap with their heel on their shin.

***Speech***

Articulation is no more than a specialised motor activity. Like all other motor activities, smoothness suffers in the presence of cerebellar disease. Listen to the patient's speech, listening for the counterparts of the disturbances above; that is irregularity of the force of speech and loss of fluency in getting the words out, as well as slurring. This is known as dysprosody, or scanning speech.

***Eye Movements***

- Look for nystagmus, especially on lateral gaze.

***Difficulty with fine movements***

- Observe for clumsiness in picking up small objects or undoing buttons. Remember that similar difficulty can stem from sensory disturbance.

## Interpretation of cerebellar signs

- Unilateral disease. This is likely to be a structural defect, i.e. a cerebellar or brainstem stroke.

- Bilateral disease. This is more likely to be a metabolic or diffuse disease than a structural one, e.g. alcoholic cerebellar disease, drug toxicity or hypoxic cerebellar damage. However, if it is principally characterised by midline involvement, i.e. truncal ataxia, then a midline structural lesion, such as a tumour, is possible.

## OPHTHALMOPLEGIA

Another important clue to brainstem dysfunction are the following disturbances of vision.

- *A lateral gaze palsy* - i.e. an inability to move both eyes in a particular direction. This follows damage to the paramedian pontine reticular formation (but can also be due to a hemispheral lesion involving the prefrontal cortex).
- *Internuclear ophthalmoplegia*. This is due to damage to the median longitudinal fasciculus which connects the third, fourth and sixth nerve nuclei so as to co-ordinate conjugate eye movement. The characteristic defect is inability to adduct the eye which must move medially, coupled with nystagmus of the abducting eye.

**Pathophysiology**: Draw a diagram to explain how an intranuclear ophthalmoplegia causes these disorders of eye movement.

## SUMMARY

Brainstem lesions are suggested by:

- Long tract signs
- LMN cranial nerve dysfunction
- Cerebellar signs
- Disturbances of consciousness or breathing
- Certain characteristic oculomotor disturbances.
- Disturbances of the vegetative functions of the medulla and certain deep-seated reflexes.

# DISTURBANCES OF THE CEREBRAL HEMISPHERES

## CONCEPTS

The cerebral hemispheres serve numerous functions. Of these, the most likely to assist in localisation of lesions are: speech, hearing, reading, intellect, interpretation of sensory phenomena and memory, as well as the initiation of movement and the reception of sensory data.

All these modalities need to be assessed in excluding or localising lesions of the hemispheres.

## SPEECH AND HEARING

### Concepts

Speech is a *specialised motor function*, and can be considered in an analogous manner to any other motor nerve:

- Speech is formatted and initiated in speech association areas.
- The impulses are transmitted via upper motor neurones to the cranial nerve nuclei of the ninth, tenth and twelfth nerves
- These cranial nerves function as lower motor neurones to innervate the responsible muscles.

Speech forms the efferent limb of a complex reflex arc of which hearing is the afferent limb. Where either limb is damaged, the other may be secondarily affected, and is also made more difficult to test.

Writing, and reading, are merely specialised means of speaking and hearing respectively, and disturbances of these are closely connected with the parent functions.

| | |
|---|---|
|  | **Warning**: Students frequently cannot explain the difference between dysarthria and dysphasia. FAIL! |
|  | **Pathophysiology**: Draw a diagram of the lateral surface of the brain. Indicate the position of the speech and hearing centres. Draw afferent and efferent arcs to/from the appropriate cranial nerve nuclei in the brainstem and the organs of speech and hearing. |

## MOTOR SPEECH DISTURBANCES

**At cortical level**. This is a true motor dysphasia. The power of speech may be lost entirely, with resultant mutism. A few words only may remain, and are used inappropriately, e.g. *hello, no.*

Words may be used incorrectly or understandable errors made consistently, e.g. using words which have a similar sound to the one intended (*pain* for *rain*) or context (*blue* for *yellow*). A hallmark of such a motor dysphasia is that hearing is normal - when the patient is asked to perform a task, they do it quickly and promptly. Similarly, they often show frustration at their inability to speak properly, as they are well aware of their disability.

**At UMN level.** The content of the speech is normal; it is just the motor apparatus that is at fault. This causes varying degrees of slurring—*dysarthria*. As cranial nerves are bilaterally innervated, the defect is usually not gross unless there is bilateral disease.

**At LMN level.** Again speech content is normal, but articulation is disturbed. It will be accompanied by LMN cranial nerve signs, e.g. a weak tongue which may fasciculate.

### Summary

- Dysphasia is a defect of the content of speech and suggests a cortical dysfunction.
- Dysarthria is a defect in articulation and points to UMN or LMN cranial nerve damage.

## HEARING DISTURBANCES

### Peripheral disturbances

Disease of the ear or brainstem may cause hearing loss and can be tested for in the normal way.

At cortical level, disease is manifested by an inability to understand the content of what is heard. This is best tested by asking the patient to repeat something which is said to them, and by asking them to carry out an action, e.g. pick up that book. Often their response will demonstrate that *he has heard that you have spoken to them, yet has not understood the message*. This is the hallmark of an auditory dysphasia.

Whereas writing is a specialised form of speech, reading is, if one likes, a specialised form of hearing (with the obvious proviso that intact visual pathways are required as well). Often deficits of cortical hearing and reading (auditory dysphasia and dyslexia) will coexist, but isolated defects are possible and are worth testing for.

## INTERPRETATION OF SENSORY INFORMATION

This is classically said to be a parietal lobe function. Defects are recognised as follows, but note the following warning. It is not possible to make correct interpretations of faulty sensory input - i.e. the sensory pathways to the cortex must be intact before one can reliably assess how the data is handled. For example, tests if parietal lobe function will be suspect if your patient has a hemianaesthesia.

### Sensory inattention

This is a body-space defect. The patient is noted to ignore one half of their body entirely - almost as though it does not exist.

### Sensory extinction

Given simultaneous, bilateral stimuli (either tactile or visual), he repeatedly suppresses one and claims only to see or feel one stimulus.

***Testing***

- Apply a touch stimulus to the left side, to the right side and then simultaneously to both sides of the body. The patient with sensory extinction will feel stimuli from either side independently, but when presented with both simultaneously, will claim to recognise one only.

### Astereognosis/tactile agnosia

They are unable to build up a picture of an object in the hand, despite normal sensory pathways, and are therefore unable to identify it by touch.

***Testing***

- Place simple objects such as a key or a pen in the hand without letting the patient see them. Ask them to name the object or describe its use.

## CORTICAL ASPECTS OF VISION

### Hemianopia

Posterior to the lateral geniculate bodies, the visual radiations sweep through the temporal and posterior lobes in a subcortical position to reach the occipital cortex. These radiations are commonly interrupted by a large cortical infarct or haemorrhage. This manifests as a homonymous hemianopia, which merely means that the patient is completely blind to all visual stimuli in that half of their visual field - everything to their left, or everything to their right. He is almost always totally unaware of their defect.

### Cortical blindness

True cortical blindness is rare. It is suspected where the patient is unable to see, yet their pupillary light reflexes are normal, indicating that the optic nerves are intact.

| | |
|---|---|
|  | **Warning**: Students are expected to be able to explain why patient with a cortical stroke frequently have a homonymous hemianopia. Make sure that you can explain what is meant by this term, that you can recognise it and that you can explain how it comes about. FAIL! |
|  | **Pathophysiology**: You must be able to draw a diagram indicating the path of the visual signal from the object to the retina, along the optic nerves and to the occipital cortex. This requires you to understand how the nasal fibres cross over in the optic chiasm. Indicate on this diagram the visual filed defect which arises with a lesion cutting one optic nerve, pressing on the nasal sides of the fibres just before the chiasm (as happens in a pituitary tumour), and interrupting the fibres in one cerebral hemisphere, as in a cortical stroke. |

## FRONTAL LOBE DISEASE

This may manifest with intellectual deterioration, loss of moral judgement and slipping of standards of behaviour, and certain neurological signs, including: a lateral gaze palsy (see below) and a positive grasp and pout reflex.

## SEIZURES

Epileptic phenomena usually indicate cortical or subcortical disease - especially when partial ("focal"). The latter in particular may have localising value.