
UNIT 2 INVESTIGATING THE ELDERLY

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2.0 OBJECTIVES

After reading this unit, you should be able to:

- discuss rationale of doing investigations in elderly;
- decide how much investigation is justified and their importance;
- enumerate the problems faced while investigating;
- interpret the results;
- describe methods of collection of specimen in day to day practice; and
- list the newer investigations and elaborate their usefulness in elderly.

2.1 INTRODUCTION

From a physiological point of view, human aging is characterized by progressive constriction of homeostatic reserve of every organ system. This decline is often referred to as homeostasis and is evident by the third decade and is gradual and progressive, although the rate and extent of decline varies. The decline of each organ system appears to occur independent of changes in other organ system. You have already read about this in details in Block 2 of this course. This decline is influenced by diet, environment and personal habits as well as by genetic factors. As investigations are for assessment of various organ systems, naturally their values and their usefulness in determining a disease also alters with aging. In this unit you will learn about why, when and how to investigate an elderly, how to interpret the results carefully and about various modalities of investigations. This unit also deals with practical difficulties

encountered in day to day practice and how to tackle them. This unit intends to teach you how investigations are helpful in diagnosing, early detection and primary prevention of diseases.

2.2 RATIONALE IN INVESTIGATING THE ELDERLY

Atypical presentations and multiple problems are very common in elderly. You have already learnt this in the previous unit.

In elderly, clinical judgement alone can contribute to only about 50 per cent of diagnosis. Of course, only sound clinical knowledge can lead on to possibilities of differential diagnosis based on which investigation should be ordered. You must have an idea how much investigation are justifiable and how valuable they are.

2.2.1 Indications of Investigation

The objective of any investigation is to aid the long and short term management plan of the patient. It should also be recognized that extensive investigation of multiple pathology is likely to cause considerable distress, discomfort and inconvenience.

The reason for initiating any investigation must be clear. No routine investigation should ever be performed unless it can be justified in terms of benefit to the patient.

Age *per se* only rarely should be a bar to investigation. It may be better to obtain a specialist opinion before resorting to a battery of uncomfortable and potentially hazardous tests.

Non-invasive procedures are preferred over invasive procedure. It is most important that the patient gives 'informed consent' to the procedure.

The following examples will give you an idea about what we are learning:

Example 1: An eighty year old lady who is demented for nearly past 20 years, with score for ADL in the lower range is found to have an abdominal mass suspected to be an ovarian mass is not going to benefit by doing laporotomy (diagnostic) and preoperative battery of investigations for her anaesthetic fitness.

Example 2: An eighty year old man, independent for ADL should be investigated for new onset cough, anorexia and dyspnoea.

Similarly investigation of a relatively younger elderly who lives alone and who by virtue of his acute confusional state cannot give you reliable history, should be vigorously investigated as we know it can be completely reversed if we know the cause.

2.2.2 Valuability of the Tests

A valuable test is one which will give a high return in terms of treatable disease or indicates the need for further, more extensive investigations. From the patient's point of view a 'valuable' test is one which causes him the least possible inconvenience and disruption to his life.

A 'valuable' test is also one that gives an unequivocal result that enables firm decision to be taken. It is almost universal that variation in physiological and other individual parameters increases with increasing age. Whether this is due to the aging process or latent disease is often not known. Consequently what is normal for one person may not be so for another. In this content the value of record keeping comes. Comparison of patient's old report of the same test may give a clue.

X-ray chest in a lady who underwent surgery for cancer breast (x-ray chest showing loss of breast shadow) now showing vague mass lesion should not be taken lightly. It should be compared with previous one. If the previous x-ray is normal, all the more importance should be given to the present one and the search for secondaries lung to be undertaken.

2.2.3 Social Problems Faced while Investigating

Social factors play a major role, particularly while doing an invasive procedure.

Often Doctors frequently face the problem of patient himself or herself refusing investigation which are so valuable for the diagnosis, even if they are non-invasive.

Socially unstable elderly face this problem of resistance to investigations from his/her care giver. The relatives would their elders to have only symptomatic treatment rather than curative treatment based on investigation report, because they feel it is a waste to spend money for investigations.

Check Your Progress 1

1) Choose the most appropriate answer/answers:

What is a valuable test?

- a) Gives unequivocal results.
- b) Done for untreatable conditions.
- c) Less costly.
- d) Done of academic interest.

2) Investigation should be given a second priority in a comatosed elderly who is brought to the hospital from roadside.

(True/False)

2.3 INTERPRETATION OF RESULTS

Biochemical test results are collected from reference populations under controlled preanalytic and analytic variables. Similarly, specimen from patient population must be obtained and processed under controlled circumstances. Selected preanalytic variables. Some of which are more characteristic in geriatric population are given in Table 2.1.

Table 2.1: Selected Preanalytic Variables

Subject Preparation	Prior diet, fasting or non-fasting, drug regimen, biologic rhythm, physical activity stress
Specimen Collection	Environmental condition, time body posture, specimen type, collection site, technique
Specimen Handling	Clotting, transport, centrifugation storage, pre-paration for analysis

The most commonly ignored preanalytic variable is the fact that elderly subjects are often on a drug regimen. Drugs may have invivo/invitro effects on biochemical tests. Likewise dehydration is a frequent condition in the elderly, with concurrent effect on renal function and homeostasis, and on the other hand, oedematous states falsely lower serum protein and albumin concentrations and correspondingly reduction of protein bound constituents.

Reference Values/Analytic Variables

Biochemical tests are performed on various body fluids for several purposes. A measure or observed value is compared with a reference value. Gradual physiologic changes that occur over time as part of aging process affect several analytes. With the introduction of clinical laboratory automation and large scale multiphasic screening programme during the 1960s, it became possible to collect a sufficient database to document age and sex dependent changes and reference intervals for most biochemical diagnostic tests. There is some laboratory data that remains unchanged in old age (Table 2.2).

Table 2.2: Laboratory Data Unchanged in Old Age

Serum sodium
Serum bicarbonate
Serum chloride
Serum magnesium
Serum aspartate transaminase
Serum lactate dehydrogenase
Serum alanine transferase
Serum amylase
Serum 5 - nucleotidase
Serum creatinine kinase
Serum bilirubin
Haemoglobin and red-cell indices
Coagulation tests
Thyroid hormones

Some parameters are on the other hand altered with age (Table 2.3).

Table 2.3: Laboratory Data Altered in Older Persons

Test	Reference range in old age	Change in old age
Serum albumin	3.3-4.9 g/dl	Lowered
Serum globulin	2.0-4.1 g/dl	Raised
Serum potassium	3.6-5.2 meq/l	Raised
Blood urea	20-40 mg/dl	Raised
Serum creatinine	0.6-1.07 mg %	Raised
Serum uric acid	2.6-6.0 mg %	Raised
Serum calcium (women)	8.6-11.0 mg %	Raised
Serum calcium (men)	9-11mg %	Unchanged
Serum phosphate (women)	3.5-5.0 mg %	Raised
Serum phosphate (men)	4-5.0 mg %	Lowered
Serum alkaline phosphatase	3-13 K.A. Unit	Raised
Random blood glucose	65.0-115 mg %	Raised
Leucocyte count	3100-8900 mm ³	Lowered

Let us have some more details about few important parameters useful in day to day practice.

Haematological Tests

Most of the standard haematological indices are unaffected by age, so that the same values can be placed on these tests as in younger people.

The white blood cell counts tends to fall with age due to lower production of lymphocytes. Levels in the upper normal range or just above should be viewed with suspicion for they may indicate a granulocytic response to infection. Lymphocyte numbers in peripheral blood decline with age, but this may represent a redistribution of cells into lymphoid follicles, since immunoglobulin and IgG subclasses rise with age in the absence of malignancy.

ESR

Tends to rise with age, being slightly higher in women than in men. The value of the test as discriminator between health and disease is less in the older subject. Nevertheless, very high levels of around 100 mm/hr should not be disregarded and levels over 30 mm/hr should be viewed with suspicion and the subject examined carefully. If the test is performed in isolation, it has limited specificity but it is a useful test, if taken in conjunction with the clinical condition of the patient and other laboratory and radiological tests. Serial values may also be of value in monitoring the progression or treatment of an infection.

Creactive Proteins

Only 1-2 per cent of old people with a clinically significant infection have normal values. So it is an extremely sensitive test. But it is not specific for any particular infection. It may be useful for monitoring treatment. Persistent elevation should make one scrutinize for unsuspected condition.

Blood Urea

The ability of the kidney to excrete nitrogenous waste products may be impaired in some elderly, so that their blood urea may be slightly elevated, a level of up to 10 mmol (150 mg%) being accepted as normal compared with a range from 2.5-6.6 mmol/l (20-40 mg%) in younger individuals. This is due to a reduced GFR. If the renal reserve is reduced the blood urea is likely to rise to even higher levels in situations of stress. Hence patients with acute infection such as pneumonia might have blood urea levels of 15-20 mmol/l (50-100 mg%).

Serum Creatinine

Serum creatinine has a higher upper limit in old age. Serum creatinine may be normal even when the creatinine clearance is reduced. This is due to loss of kidney tissue which coincides with the decrease in lean body mass and hence creatinine generation.

Both blood urea and serum creatinine levels provide only a limited amount of information about renal function in the elderly. Factors such as fluid intake, diuretics, protein intake, body weight and muscle mass also have a major effect on them.

The standard test for renal function is the creatinine clearance test. There are problems, in obtaining 24 hours collection of urine from frail elderly patients. Radioisotope test is a valuable test which does not require a timed sample of urine. Radio active chromium labelled EDTA can be injected I/v and its clearance estimated from blood samples taken at 2, 3 and 4 hours.

The ability of the kidney to concentrate urine may also be impaired in old age. This is tested by injecting 5 units of pitressin. In healthy young adults, the osmolality of urine should exceed 750 mosmol/kg and elderly are likely to produce less concentrated specimen.

Serum Calcium

High serum calcium is often found in old people. Some common causes are primary hyperthyroidism, skeletal metastases, multiple myeloma and vitamin D intoxication.

Calcium balance is dependent upon a complex interaction between the parathyroid glands, the kidneys, the small bowel and bone. Since aging affects all four organ sites, it is often difficult to determine the primary site of age related changes in calcium metabolism.

Low serum calcium may be found in osteomalacia. Since a low calcium level may also be due to low levels of albumin, most laboratories use a single formula which 'corrects' the serum calcium concentration for albumin levels.

Test for Gonadal Function

Women

After menopause there is dramatic fall in both oestrone and oestradiol. Thereafter there is a further progressive decline in oestrone levels where as oestradiol levels remain unchanged or even rise marginally.

After menopause, there is a three fold rise in plasma LH concentrations and ten fold increase in those of FSH. Following an initial post-menopausal rise, there is a progressive fall.

Men

Both serum free and total testosterone concentration are consistently reduced in the old. Conversely there is no change in dihydrotestosterone concentration.

The testis also secretes oestradiol and plasma levels of this have been reported as being either normal or increased in old age.

Plasma levels of LH and FSH are increased in elderly men.

Radiological Investigation

No x-ray should be ordered as a routine procedure, since this wastes valuable time and money. Chest x-ray and x-ray of abdomen are the most useful and simple tests.

The chest x-ray gives information on the state of lungs and heart size, and also gives information on the state of the skeleton, and helpful in assessing the degree of osteoporosis or osteomalacia. An abdominal x-ray should be taken to include both hip joints. It will then not only show the faecal content of the bowel but also possible skeletal and joint disease. Other changes, including aortic and vascular calcification may be seen as well as gallstones, renal stones and soft tissue shadow of kidneys and bladder.

Check Your Progress 2

- 1) During interpretation of results following should be considered except:
 - a) Patient's drug regimen.
 - b) Specimen handling.
 - c) Level of consciousness.
 - d) Patient's ambulatory status.
- 2) The following lab data is not altered in elderly:
 - a) Leukocyte count.
 - b) Serum sodium.
 - c) Serum calcium.
 - d) Haemoglobin and red cell indices.

2.4 COLLECTION OF MATERIALS

As we learnt earlier it is a preanalytic variable and wrongly collected or transported material which may give false positive or false negative result and in turn interfere with proper diagnosis and treatment.

Frail elderly cannot by himself/herself meet the specification mentioned by doctor or lab technician in collecting samples. Collection of specimen like getting sputum from confused elderly patient and collection of clean catch from frail, bedridden lady in the case of urinary infection are few examples.

Methods of Collection of Specimens

Urine

A key to make an accurate diagnosis is to obtain an uncontaminated specimen of urine. It is relatively easy in men to collect a midstream specimen. This technique is most difficult in immobile elderly women. It is essential that the vulva should be cleaned thoroughly with soap and water. Antiseptic solution should not be used since this may contaminate the sample and inhibit the growth of organism. Best way of getting uncontaminated urine is to perform a suprapubic stab, but old people have difficulty in filling their bladder fully, therefore the stab is frequently unsuccessful. An alternate is to pass a short narrow bore catheter and collect the urine.

Once a specimen has been collected it is either cultured immediately or placed in a refrigerator at 4°C. If it is at room temperature for more than 2-3 hours, even a small number of bacteria can multiply to give a false positive result.

Urine analysis still has a part to play in the assessment of the elderly patient, although it is not as important as in a younger patient. Haematuria, even if only microscopic, warrants investigation. Chemical analysis is less valuable. Glycosuria may be absent even when the patient has diabetes.

It may difficult to obtain adequate samples in a confused elderly patient with a suppressed cough reflex and reduced respiratory excursions. Sustained efforts of a physiotherapist and a nurse, perhaps with inhalation of nebulized saline may be required. This is called sputum induction. A more common approach is to perform broncho alveolar lavage (BAL) using a flexible bronchoscope and take serial samples. The recovery rate of organism from BAL is around 80 per cent. This technique requires specialized skills.

Yet another way of collecting sputum in an elderly is to aspirate gastric content through Ryles tube insertion in the early morning.

Motion

It is always better to collect stool sample in a clean container. Culture is indicated when there is not a clear non-infective cause found or if empirical treatment fails.

Ulcers

Routine wound swabs for bacterial culture are unhelpful. They usually yield a mixed growth of contaminants. A recently adopted approach is to send a punch biopsy for bacterial examination. Attempts at aspiration of the leading edge of the lesion are rarely successful.

Blood Culture

Blood culture plays an invaluable role in aiding diagnosis of certain life threatening situations like septicaemia, infective endocarditis, pneumonia, typhoid etc. The normal immune response may be compromised by disease and poor nutrition so that pyrexia and other signs of infection may be absent in the early stage of septicaemia and doing an early blood culture may be the only chance of saving patient's life. (Please note that the importance of recognition of atypical

presentation of disease in elderly is stressed in many places in this block as well as in any clinical topic in geriatrics.)

Check Your Progress 3

- 1) Best way of collecting uncontaminated urine in elderly is by suprapubic tab. (True/False)
- 2) Choose the correct answer:
Early morning collection is best for:
 - a) Urine
 - b) Sputum
 - c) Both
 - d) None

2.5 DISEASES AND INVESTIGATIONS

Let us now discuss some common investigations done in commonly encountered problems and disorders in the elderly.

2.5.1 Metabolic and Endocrinal Disorders

The commonly encountered metabolic and endocrinal disorders include diabetes mellitus, hyperlipidaemia and thyroid disorders.

Diabetes Mellitus

Both mean fasting and post prandial blood glucose levels rise with increasing age. This may be considered as being normal. The alternate view is that no matter what the age of the patient, persistent elevation of blood sugar above the normal for young adults is potentially harmful.

A patient having random plasma glucose (blood glucose level will be less than plasma glucose level) of $> 200 \text{ mg\%/l}$ or a fasting one of $> 140 \text{ mg\%}$ ($> 7.8 \text{ mmol/l}$) should be considered to have diabetes. When the glucose levels lies between the two sets of value a GTT test should be performed. In asymptomatic patients the diagnosis should only be made if glucose levels at both 1 and 2 hours values are $> 200 \text{ mg\%}$ (11.1 mmol/l). Patients with a fasting glucose $< 140 \text{ mg\%}$ (7.8 mmol/l) and 2 hours values between (140 mg\% 200 mg\%) ($7.8\text{--}11.1 \text{ mmol/l}$) are considered to have impaired glucose tolerance (IGT) or hyperglycemia of aging. Approximately 2 per cent per annum of individual with IGT will go on to develop diabetes mellitus, while a proportion revert to having normal glucose tolerance. You will learn more about this in Unit 2, Block 5 of this course.

Glycosylated Haemoglobin Assay

In an IDDM a glycosylated haemoglobin (HbA1) assay is performed every 4-6 months to assess diabetic control. It remains a useful test in the elderly patient with NIDDM, in whom unexpectedly low values may point to periods of unsuspected mild hypoglycemia.

In older patients suffering from NIDDM, the fasting blood sugar is an excellent guide to glycaemic control. Normal level ($4.8\text{--}8.00 \text{ mmol/l}$ or $90\text{--}145\%$).

Preanalytic variable is to be considered while interpreting the blood glucose levels other than routine variables like fasting/non-fasting states. Stress can produce transient hyperglycemia in an acutely ill patient. Even though patients may need blood sugar control while in hospital, they may not require treatment after discharge. The other important variable is drug, as hyperglycaemia is a complication of medication used to treat hypertension, heart failure,

hypercholesterolemia, seizures, bipolar disorder and asthma. Over the counter medication with a sugar content such as cough syrups can raise plasma glucose levels too.

As in younger diabetics, geriatric diabetics also should have their urine tested for microalbuminuria yearly to detect early nephropathy.

Hyperlipidaemia

Rise in cholesterol and triglyceride concentration with increase of age is not uncommon. Despite the increased prevalence of both hyperlipidaemia and atherosclerosis in old age, the importance of hyperlipidaemia as a risk factor in conditions such as coronary artery disease decline with age (total cholesterol).

In both men and women TC (total cholesterol) levels increase from adolescence and achieve the plateau in middle age, then decline slightly after 70 years of age.

One study indicates that the cholesterol/HDL-C (coronary heart disease) ratio relate significantly to CHD in people above 50 years. HDL-C appears more important in predicting CHD in older persons than LDL-C which is a vital factor in estimating CHD risks in middle age persons. Elevated total cholesterol is not associated with CHD mortality in older men, but may be a risk factor in older women. Generally speaking, a patient with TC/HDL-C ratio 5 may be at an increased risk of CHD.

Lipids in Older Persons, By Age

(Mg/dl)	up to 50 years	50-60 years	70 years
TC	200	214	207
TGL	130	141	130
HDL-C	45	48	51
LDL-C	130	146	143
TC/HDL-C	4.00	4.46	4.06

The preanalytic variables to be considered are diet, physical activity, drug regimens and time of collection (Lipid values in a serum collected after 12 hours fast is reliable).

Because, none of the trials on lipid lowering treatment by drug/diet involved persons over 70 years we have to rely on these variables and the presence or absence of renal/hepatic/coronary artery disease in a given patient with high cholesterol values. In an healthy elderly, with high cholesterol, altering the diet and weight and level of physical activity itself may make drug treatment an unnecessary one.

Thyroid Disorders

You will also learn about tests of thyroid disorders in Course-2, Block-5, Unit-5. Screening of the secretory status of the thyroid gland can be accomplished by measurement in the blood of TSH, total circulating T₄ and T₃ concentration and FT₄ and FT₃ (Free T₄ and Free T₃) concentration through the use of RIA or immunometric assays. The development of supersensitive immunoassays for TSH have allowed differentiation of normal from suppressed levels of the hormone, so that this single measurement can provide evidence supporting a diagnosis of primary hypothyroidism, secondary hypothyroidism and hyperthyroidism. This is the best initial test. Generally accepted value of 5 MIU/L as the upper limit in the adult may actually be as high as 10 MIU/L in individuals who have reached eighth decade.

Total and free concentration of T_4 and T_3 are unaffected by aging and deviation from normal must be considered as evidence for thyroid disease or for other illness or states that affect hormone measurement.

Low T_4 and T_3 concentration in the presence of normal TSH is called euthyroid sick syndrome. This occurs in severe illness and the prognosis is poor. In recovery phase of severe illness, TSH also can rise up to 20 MIU/L. In that case it will be difficult to differentiate primary from secondary hypothyroidism.

The response to injection of TRH helps to differentiate primary from secondary hypothyroidism.

Antithyroid antibodies are commonly raised in old people particularly in women. High titres may be associated with thyroid disease.

Isotope scan will give a characteristic appearance of multinodular goitre or non-functioning area e.g. Carcinoma.

Thoracic inlet x-ray may show calcification in long standing case of multinodular goitre. Evidence of tracheal compression may also be seen.

Ultrasound can be used to establish whether a lesion is cystic or not. Cyst aspiration is also useful for cytological examination.

A further diagnostic approach in solid non-functioning or non-hyper functioning lesion is to perform a needle biopsy using either fine needle aspiration cytology or a cutting needle biopsy. The value of needle biopsy is dependent on local expertise in cytology and histopathology.

Lastly a mention about sub-clinical hyperthyroidism—the finding of suppressed or absent serum TSH along with serum T_4 or T_3 in the upper end of the normal range. Generally these individuals will not have clinical features of hyperthyroidism but present as atrial fibrillation.

2.5.2 Tuberculosis

Isolation of mycobacterium tuberculosis is the only absolute confirmation of active infection. Sputum should be collected as discussed earlier in persons who are not able to bring out sputum. It is the golden practice to send at least three good sputum samples for smear tests before starting antituberculous treatment.

Chest x-ray usually shows greater prevalence of mid and lower zone shadowing. In x-ray showing apical cavitory lesion, it is better to take CT scan to rule out malignancy. Normal chest x-ray almost excludes tuberculosis with a rare exception of endobronchial post-primary disease.

Tuberculin Test

The prevalence of cutaneous allergy to tuberculosis increases with age in those with active diseases. A negative tuberculin test therefore does not exclude the diagnosis of tuberculosis. Also false negative tests can occur in other infections, corticosteroids, sarcoidosis, lymphoma, mal-nutrition or even massive overwhelming tuberculosis infection. In clinical practice the tuberculin test should be performed at a 5 unit strength and repeated at 250 units if this is negative. If either of the test is positive there is evidence that the patient has had previous exposure to tuberculosis and that it may have become reactivated. A negative test is of less value, since it may indicate either lack of exposure or immunological incompetence.

Other useful screening tests include reactive protein or ESR estimation. Normochromic normocytic anaemia and mildly raised peripheral white cell count may be present.

In addition elderly are more likely to have hypoalbuminaemia, abnormal liver function test, hypocalcaemia and hyponatremia.

Renal and genitourinary tuberculosis though less common, could be silent and confirmation needs three early morning urine specimens for microscopy and culture.

Bone marrow aspiration, liver biopsy, synovial aspiration or lymphnode biopsy may be helpful in disseminated disease.

The value of anti-TB immunoglobulin are doubtful. PCR (Polymerase Chain Reaction) is a new additional test which helps in detecting T.B.

2.5.3 Haematological Disorders

A full blood count is a valuable routine investigation in all elderly patients. If anaemia is found it must be investigated before any treatment is started, as empiric treatment may alter the findings and accurate diagnosis may be extremely difficult. The next step is examination of peripheral blood smear to categorize the morphological type of anaemia based on morphology. Further biochemical tests e.g. estimation of iron status, B₁₂ levels etc. should be also carried out. Anaemia accompanied by abnormalities of white blood cells or low platelet count suggests a primary marrow production problem.

Bone marrow examination is rarely necessary in the initial evaluation of anaemia in older patients. However we should know the aging changes. Studies have shown there might be decline in marrow cellularities from 70 per cent in childhood to 30 per cent in the eighth decade of life. The basal function of pleuri-potential and committed stem cells are little altered, but the response of such stem cells to stimuli such as anaemia or infection is deficient.

Some of the indications for bone marrow aspiration/biopsy are multiple myeloma, myelofibrosis, aplastic anaemia and myelodysplastic syndrome and rarely in diagnosing disseminated infection like tuberculosis.

2.5.4 Neoplasms

As far as the investigations in neoplasms are concerned the focus should be mainly on primary prevention and early detection or secondary prevention thereby decreasing morbidity and mortality increasing the chance of cure and prolonging disease free interval following therapy.

Primary prevention which involves changing the life style e.g. diet is less applicable to elderly.

The secondary prevention for individual cancer involves early diagnosis and management. The basic principles of these have been covered in Block 7 of this course. You will also be introduced briefly to the various methodologies in theory and practicals.

- 1) Testing for indirect evidence e.g. Faecal occult blood testing in detection of colonic cancer.
- 2) Cytology e.g. PAP smear for cervical cancer, bronchial washing, sputum cytology for bronchogenic carcinoma.
- 3) Fine needle aspiration cytology e.g. for detection of thyroid solitary nodules, breast cancer and lymph node aspiration.
- 4) Blood investigations-Biochemical

Tumour Markers

A special mention should be made on tumour markers. Tumour markers have little place in diagnosis except in detection of choriocarcinoma and Bence Jones Protein (BJP) in the detection of multiple myeloma.

Measurements are useful in monitoring disease progress and in the diagnosis of recurrence.

Healthy aged people appear to have an increased prevalence of elevated levels of serum

tumour markers. Apart from PSA (prostatic specific antigen) elevated antigen levels in elderly are related to the aging process itself rather than to occult pathology. Elevated PSA in elderly men generally reflects pathological condition of the prostate, malignant or not.

2.5.5 Cardiovascular Disorders

ECG

Tracings are frequently abnormal and community surveys have shown that about half the elderly have some alteration of wave form. Many of these are insignificant and at least require no therapeutic action. The ECG is most useful in the diagnosis of arrhythmia and in determining digitalis toxicity. Other usefulness are in the diagnosis of ischaemic heart disease and chamber hypertrophy.

Stress Electrocardiogram

Asymptomatic or minimally symptomatic elderly can still have severe coronary artery disease. Stress electrocardiogram either exercise ECG or phar-mo-cologically induced stress ECG is helpful in diagnosing those category of patients. The limitations of exercise ECG is the inability to do the test due to arthritis/pulmonary insufficiency. Negative test in an elderly with other risk factors and some symptoms may still be associated with 50 per cent chance of having significant CAD and its inaccuracy in patients with baseline negative ECG. Pharmacological testing may be helpful in these settings. Positive test for severe disease include, an early positive test, one that remains positive for more than 8 minutes after the termination of exercise, more than 2 mm of ST segment shift, changes in the anterior and inferior leads with stress, a systolic fall in pressure of more than 10 to 20 mm Hg and exercise induced malignant ventricular arrhythmias.

Echocardiography

Recently developed M-mode, cross sectional and doppler echocardiography allow non-invasive, assessment of cardiac function and consequently the diagnosis of cardiac disease. This is essential for the assessment of cardiac failure, the severity of valvular disease and the diagnosis of bacterial endocarditis. Also helpful in the selection of suitable patient for surgery e.g. $Ef < 40\%$ increases the cardiac risk and the patient is temporarily unfit for surgery.

2.5.6 Gastrointestinal Disorders

Investigation should be directed on symptoms. Two widely used tools are ultrasonogram and endoscopy in addition to various biochemical tests.

Ultrasonography

It is being used increasingly for the investigation of intra abdominal condition. It is of value in the assessment of renal masses, liver secondaries and gallstones, prostate diseases and other pelvic disease (particularly as an aid to accurate biopsy). Being relatively non-invasive it is acceptable to elderly patients although explanation of the procedure is still essential to allay anxiety.

Endoscopy

Endoscopy as a special investigation now presents a major advance in the management of the elderly patient. The elderly seem to tolerate endoscopy extremely well. In many the procedure is preferred to a barium examination. Although, endoscopy is relatively non-invasive, it should not be undertaken lightly and only then after full explanation.

2.5.7 Neurological Disorders

The localization of lesion in neurology of course is dependent on detailed clinical examination. But the pathology underlying needs investigations.

Acute confusional state in elderly is one of the commonest condition seen in geriatric practice. It's evaluation involves various biochemical and non-biochemical tests. These include biochemical tests for various metabolic parameters. Haematological tests, imaging of brain and other organs as required in appropriate situations.

Imaging studies have now become important modality of investigations. To differentiate disease from normality, the effects of normal aging upon them should be known.

Computed Tomography Scan

CT scan brain of healthy elderly person show that the volume of cerebrospinal fluid within and surrounding the brain increases with age. The ventricles enlarge and the gaps (sulci) between certain major gyri widen. The dementia of Alzheimer's type also show similar changes of brain shrinkage. Visual ratings to differentiate these two conditions have low discriminatory power whereas computer assisted assessment are superior. CT will also show treatable causes of dementia e.g. hydrocephalus, chronic subdural haematoma, infarctions etc.

Magnetic Resonance Imaging

This is superior to CT scan in that no radiation is involved, resolution is superior to CT and there is no bony artifact. In Alzheimer's and vascular dementia, there will be prolongation of T1 relaxations and it will be normal in health brain.

PET (positron emission tomography) and SPECT (single photon emission tomography) are newer techniques. SPECT shows cerebral blood flow distribution. PET shows regional cerebral metabolism measurements.

EEG

This has been used to differentiate dementia from normal aging. However the slow activity may be seen also in dizziness and vertigo. EEG is still an investigation of choice to diagnose epilepsy.

Besides these non-invasive tests, an age old invasive test is cerebro spinal fluid analysis through lumbar puncture. Because of kyphosis and lumbo sacral spondylosis, there will be a practical difficulty in performing this test. It is useful only in suspected infection of nervous system and is dangerous in the presence of space occupying lesion.

2.6 INTERVENTIONAL RADIOLOGY

Before concluding this Unit let us learn few points about interventional radiology.

Radiologist venturing into what was once considered tiger territory, biopsying masses in the thorax, abdomen, pelvis and the skeleton, guided by fluoroscopy, ultrasound, computed tomography or MRI, making exploratory laporatomy and thoracotomy a thing of the past.

Radiologist drain cysts, abscesses, effusions, emphysemas, obstructed biliary trees, obstructed kidney etc. and are venturing into per cutaneous gastrostomy and cholecystostomy.

Most of these procedures are carried out under the influence of local anaesthetic, light sedation and analgesia if required. The therapy is minimally invasive, needs little preoperative and post operative preparation and care. In fact, interventional radiology represents, "key hole" surgery per excellence.

Interventional radiology procedures are especially suited to the elderly because they are minimally invasive and do not involve general anaesthesia.

Recent advances are:

- Biopsy technique
- Abscess and cyst drainage technique
- Revascularization technique—dilating vascular stenosis percutaneously
- Transcatheter vessel occlusion—vascular malformation in most body parts are amenable to embolotherapy using various embolic material, absolute alcohol or plastic polymers.
- Endoscopic retrograde cholangio pancreatography (ERCP)—diagnostic and therapeutic.
- Non vascular intervention in urology e.g. as in percutaneous nephrostomy (PCN).
- Radiological intervention in the esophagus—dilatation of tight strictures.

Check Your Progress 4

1) Choose the correct answer:

Impaired glucose tolerance is:

- i) same as hyperglycemia of aging.
- ii) needs vigorous treatment.
- iii) measured 3 hrs after oral glucose in GTT test.

2) The critical factor determining coronary artery disease risk in geriatric population is:

- i) LDL - C
- ii) TC/HDL - C ratio
- iii) TC/LDL - C ratio
- iv) Total cholesterol level

3) Subclinical hyperthyroidism should be suspected in patients with

2.7 LET US SUM UP

Investigations are an essential tool in the diagnosis of elderly patients. Age *per se* should be a bar only rarely. Though they are valuable in the diagnosis, results vary from person to person and so clinical findings and preanalytic variables should be considered while interpretation of the investigation results. Under and over investigating should be avoided and non-invasive rather than invasive tests should be preferred. Utmost care should be given while collecting the specimens like urine and sputum and methods of collection in elderly should be learnt by a geriatric practitioner.

Criteria for diagnosis of diseases based on investigations are slightly to be different as allowances are given for changes due to normal aging and there are certain investigations which do not change with age also. Serial investigations are necessary sometimes in these situations.

The possibility of multiple pathology and atypical presentation of diseases should always be kept in mind while dealing with a geriatric patient so that one will be careful in initiating treatment of one system disease which could possibly affect the already changed other systems.

The newer investigation modalities would help in delivering better care for elderly in many areas.

2.8 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) a, c
- 2) False

Check Your Progress 2

- 1) c
- 2) b

Check Your Progress 3

- 1) True
- 2) c

Check Your Progress 4

- 1) i)
- 2) ii)
- 3) Atrial Fibrillation

2.9 FURTHER READINGS

Khan, A.N. (1996), "The Role of Interventional Radiology", *A Guide to Care of the Elderly*, R.B. Shukla and D. Brooks, (eds.) HMSO, Copy right Unit, Norwish, NR - 3, IPO - U.K.

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