Material & Methods
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The present study was conducted on subjects attending the diabetes clinic as well as the general Out Patient Department of Medicine at M.L.B. Medical College, Jhansi.

CRITERIA FOR SELECTION

Any individual who is diagnosed to be Diabetes Mellitus Type 2 first time, included in the study. Their criteria for diagnosing diabetes will be the same as laid down by the WHO.

A complete medical history should be obtained with special emphasis on diabetes relevant aspects such as weight loss, family history of diabetes and its complication, risk factors for cardiovascular disease, prior medical conditions, exercise, smoking, and ethanol use.

GENERAL EXAMINATION

(Built, nutrition, Pallor, clubbing, cyanosis, Jaundice, edema, lymphadenopathy, organomegaly).

In addition to complete physical examination, special attention should be given to

BMI

\[
BMI = \frac{Wt. (Kg)}{Ht. (m)^2}
\]
The range for acceptable normal or optimal BMI for Asian population should be narrowed to 18.5 – 23 Kg/m². According to WHO expert consultation on appropriate BMI for these population that took place on July –8-02’ in Singapore.

In Asian population morbidity and mortality is occurring in people with lower BMI and small waist circumference. Thus, they tend to accumulate intra abdominal fat without developing generalized obesity.

<table>
<thead>
<tr>
<th>BMI</th>
<th>WHO</th>
<th>Asian Pacific Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal</td>
<td>18.5 – 24.9</td>
<td>18.5 – 22.9</td>
</tr>
<tr>
<td>- Overweight</td>
<td>25 – 29.9</td>
<td>≥ 23</td>
</tr>
<tr>
<td>- At risk</td>
<td></td>
<td>23 – 24.9</td>
</tr>
<tr>
<td>Obesity class I</td>
<td>30 – 34.9</td>
<td>25 – 29.9</td>
</tr>
<tr>
<td>Class II obesity</td>
<td>35 – 39.9</td>
<td>≥ 30</td>
</tr>
<tr>
<td>Extreme obesity</td>
<td>&gt; 40</td>
<td></td>
</tr>
</tbody>
</table>

WAIST CIRCUMFERENCE AND WAIST HIP RATIO

The simple clinical measure is waist measurement.

The metabolic complication is more if waist circumference >102 cm in men and >88 cm in women.

The WHO recommendations for measurement of waist circumference, the standard anatomical locations are used. The WHO (1995) recommended method is as follows:
"The subject should stand with feet 25 – 30 cm apart, weight evenly distributed. Measurement is taken mid way between the inferior margin of the last rib and the crest of the ileum in a horizontal plane, the measurer should stand by the side of the subject and fit the tape snugly but not compressing soft tissue. Circumference is measured to nearest 0.1 cm".

For hip circumference the measurement is taken around the pelvis at the point of maximal protrusion of the buttock.

In Caucasian a WHR > 1 for men and WHR > 0.85 for women are used to identify those with abdominal fat accumulation.

However, waist circumference is the preferred measure of abdominal obesity compared to the WHR (WHO 1998).

Apple shaped (with more weight around the waist) faces more health risk than those with pear shaped bodies that carry more weight around hip.

**HYPERTENSION**

*JNC VII guidelines*

<table>
<thead>
<tr>
<th></th>
<th>Systolic BP</th>
<th>Diastolic BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120</td>
<td>&lt; 80</td>
</tr>
<tr>
<td>Pre-hypertension</td>
<td>120 – 139</td>
<td>80 – 89</td>
</tr>
<tr>
<td>Stage I Hypertension</td>
<td>140 – 159</td>
<td>90 – 99</td>
</tr>
<tr>
<td>Stage II Hypertension</td>
<td>&gt; 160</td>
<td>&gt; 100</td>
</tr>
</tbody>
</table>
SINGLE SPEED AND DOUBLE SPEED: - In ECG LAD16%, LAHB 5.5%, RBBB with or without LAHB4.2%. The LAD is the most common finding seen in NIDDM patients either symptomatic or asymptomatic.

The grade of involvement may vary from individual to individual. Routine annual ECG monitoring should be a standard investigation procedure for the patients with NIDDM.

DYSLIPIDEMIA

ATP III Classification

<table>
<thead>
<tr>
<th>LDL – Cholesterol (mg / dl)</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 100</td>
<td>Near or above optimal</td>
</tr>
<tr>
<td>100 – 129</td>
<td>Borderline</td>
</tr>
<tr>
<td>130 – 159</td>
<td>High</td>
</tr>
<tr>
<td>&gt; 190</td>
<td>Very High</td>
</tr>
<tr>
<td>Total Cholesterol (mg / dl)</td>
<td></td>
</tr>
<tr>
<td>&lt; 200</td>
<td>Desirable</td>
</tr>
<tr>
<td>200 – 239</td>
<td>Borderline High</td>
</tr>
<tr>
<td>&gt; 240</td>
<td>High</td>
</tr>
<tr>
<td>HDL – Cholesterol (mg / dl)</td>
<td></td>
</tr>
<tr>
<td>&lt; 40</td>
<td>Low</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>High</td>
</tr>
<tr>
<td>Triglyceride (mg / dl)</td>
<td></td>
</tr>
<tr>
<td>&lt; 150</td>
<td>Normal</td>
</tr>
<tr>
<td>150 – 199</td>
<td>Borderline High</td>
</tr>
<tr>
<td>240 – 499</td>
<td>High</td>
</tr>
<tr>
<td>&gt; 500</td>
<td>Very Low</td>
</tr>
</tbody>
</table>
RETINOPATHY

A thorough fundus examination of all patients included in the study was done. Fluorescence angiography was done in selective patients after taking proper consent.

Fluorescence Angiography

Fluorescence angiography reveals to a certain extent the anatomical integrity of the retina, the choroids, and most importantly the blood retinal barrier.

An informed consent is obtained following this. The patient’s pupils are dilated with a short acting mydriatic-cycloplegic combination.

Angiography done by injecting 3 ml, 20% Fluorescene dye in anticubital vein. Prior to this we take a red free photograph and control photograph (with green and blue filter). After injecting dye in 15 – 20 seconds, dye appears into the retinal circulation and we take the photograph at every 2 seconds for initially 30 seconds, then after 1 minute and 5 minutes.

Alteration in fluorescent angiography is of two kinds Hyper and Hypofluorescence. Hyperfluorescence may be produced by the abnormal presence of the dye into a location where it is not usually seen, for example retinal neovascularization or retinal-pigmented epithelium detachment, or to a greater concentration in normal places.
Hypofluorescence may be produced by the absence of fluorescence in normally filled area for example retinal capillary ischemia, or by the transmission blockage secondary to an overlying condition for example retinal hemorrhage.

Fluorescent angiography of the macula in the presence of clinically significant macular edema is fundamental for the detection of treatable lesion.

Hypofluorescent areas may be overlapping by exudates or hemorrhages and hyperfluorescent may be due to window effect and retinal pigment epithelium or leakage from vessels, we can also delineate microaneurysm and neovascularization very correctly.

The only absolute contraindication for fluorescein angiography is a past history of allergy to compounds containing iodine and past history of severe adverse effect following injection of fluorescein.

**NEPHROPATHY**

Urine examination including routine, microscopic, and for microalbuminuria.

Microalbuminuria is the stage where the patient excretes small amount (μgm) of albumin in the urine, before the usual routine urine protein estimation become positive. Thus, it helps in predicting the onset of overt proteinuria and renal failure. Normal
adult excrete a very small quantity of albumin around 10μg/min, assuming an average daily urine output of 1 – 1.5 L., this gives a concentration of < 200 mg/L, note this is the rate / minute and this is concentration / liter.

Microalbuminuria or overt nephropathy with proteinuria where usual lab estimation of urinary protein become positive, urine albumin excretion rate will be > 200 gm/minute and concentration will be > 100 mg/l.

"The intermediate value in between normal and overt proteinuria indicates microalbuminuria".

Microalbuminuria is defined as urinary albumin excretion rate 20 – 200 g/minute with a concentration of 20 – 300 mg/L, this will amount to 30 – 300 μg/day. Importance of microalbuminuria lies in that improving blood glucose control and the use of ACE inhibitors such as Captopril might reverse or even arrest the progression to overt renal failure at this stage.

Diagnosis of microalbuminuria requires excretory rate of albumin 20 – 200 μg / minute in 2 or 3 samples collected in 6 months period. Other transitory cause of albuminuria like poor metabolic control, hypertension, infection and excretion are to be excluded before diagnosing microalbuminuria. Special commercial test strips, able to detect proteinuria in the microalbuminuria range are now available. (Micral strips – test done by micral strips)
NEUROPATHY

A complete motor and sensory examination will be carried out to detect any polyneuropathy, radiculopathy, mononeuropathy (examination done by monofilament).

CARDIOVASCULAR DISEASE: - For assessment

Single and Double speed ECG.

Echo.

TMT (if required).

Cerebro vascular disease: A detailed history to rule out episodes of stroke or conversely to detect diabetes in patient presenting with stroke.

PERIPHERAL VASCULAR DISEASE: -

Ankle: Brachial BP Index is ratio of systolic pressure at the ankle to that in the arm.

The resting ABPI is normally about 1. Value below 0.9 indicates some degree of arterial obstruction, a value less than 0.3 suggest eminent necrosis.

ABPI = Normal 1.

ABPI < 0.9 – Arterial obstruction

ABPI < 0.3 – Eminent necrosis

A femoral or popliteal and color Doppler, if required and other physical signs according to the clinical condition of the patient.
Instead of other routine investigations like Hb, TLC, DLC, ESR, urine, B.urea, S.Bilirubin, S.Creatinine.

Glycated HbA1C – HbA1C reflects average glycemic control over the period of 2 – 3 months.

HbA1C assay by HPLC (High Performance Liquid Chromatography) method is standard reference method. Hemoglobinopathies, hemolytic anemia and uremia may interfere with HbA1C results.

When measured by HPLC the HbA1C approximates the following mean plasma glucose value

An HbA1C of 6% is 6.6% mmol/L (120 mg/dl)
An HbA1C of 7% is 8.3% mmol/L (150 mg/dl)
An HbA1C of 8% is 10.0% mmol/L (180 mg/dl)

A 1% rise in HbA1C translates into 1.7 mmol i.e. 30 mg/dl.
Working Proforma

Name
Address
Occupation
Age/Sex

Chief complaints
Family history
Gen Examination

Weight
Height
BMI
Waist Circumference

Heart Rate (Resting)
Blood Pressure (Resting)
Ankle BP
ECG (Single speed)
(Double speed)

X-ray chest (PA view)
Lipid profile-
Cholesterol
Tri-glycerides
VLDL
HDL
LDL
Nephropathy
  Microalbuminuria
  Serum Creatinine
  Urine (RM)

Neuropathy CNS Examination
Ankle jerk
Touch sensation by fiber
Retinopathy Fundus examination

Fluorescine Angiography

Peripheral Vascular Disease (All pulse to be palpated)
(Carotid Doppler if patient is willing)