Aw open size A5 (21 X 14.8cm)

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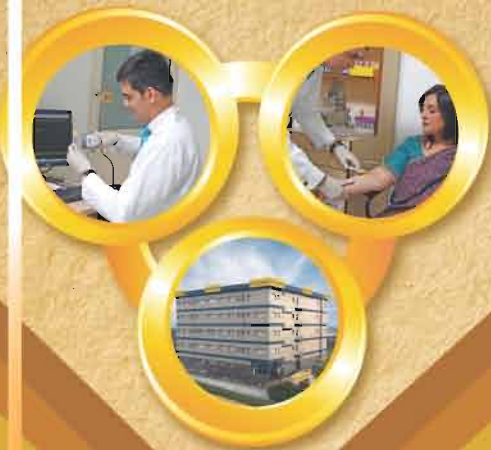

AN INSIGHT INTO DIABETES

Dr Lal PathLabs

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DIABETES

Diabetes is the most common set of disorders of carbohydrate metabolism, affecting a large population worldwide. The prevalence of Diabetes in Asian population has increased rapidly, reaching more than 110 million, leading to significant morbidity, mortality and cost. Diabetes is the leading cause of treated end stage renal disease, most common cause of non-traumatic amputations and foremost cause of blindness in adults. Diabetic Neuropathy affects 60%-70% of population. Diabetic patients are 2-4 times more likely to develop heart disease and cerebrovascular disease.

CLASSIFICATION OF DIABETES MELLITUS

Type 1 Diabetes
- Immune mediated
- Idiopathic

Type 2 Diabetes

Gestational Diabetes

Genetic defects of Beta cell function

Genetic defects in insulin action

Diseases of exocrine pancreas

Endocrinopathies
- Cushing's Syndrome
- Acromegaly
- Glucagonoma

Drugs or chemical induced infections

Syndromes associated with Diabetes
- Down Syndrome
- Turner Syndrome
- Klinefelter's Syndrome
- Prader Willi Syndrome

SPECTRUM OF GLUCOSE HOMEOSTATIS AND DIABETES MELLITUS

Type of Diabetes	Normal glucose tolerance	Hyperglycemia			
		Pre-Diabetes	Diabetes Mellitus		
		Impaired fasting glucose or Impaired glucose tolerance	Not insulin requiring	Insulin required for control	Insulin required for survival
Type 1 Type 2 Others GDM Time (years)					
Fasting blood glucose n mg/dL	70-100	100-125	>=126		
2 hour PP in mg/dL	70-140	140-199	>=200		
HbA1c %	<5.6	5.7-6.4	>=6.5		

Comments

- In most cases of Type 1 Diabetes, the individual traverses from normal glucose tolerance to impaired glucose tolerance to overt Diabetes.
- In Type 2 Diabetes, changes in glucose tolerance may be bidirectional depending on lifestyle modification.
- GDM may revert to impaired glucose tolerance or even normal glucose tolerance after delivery.

TYPES OF DIABETES

CHARACTERISTICS OF TYPE 1 & TYPE 2 DIABETES		
CHARACTERISTICS	TYPE 1 DIABETES	TYPE 2 DIABETES
Frequency	5%-10%	90%-95%
Age of onset	Any age, it is but more common in children and young adults	Later in age, but can occur in children and adolescence as well
Risk factors	Genetic, Autoimmune, Environmental	Genetic, Obesity, sedentary lifestyle, Race, Hypertension, Dyslipidemia. PCOD
Pathogenesis	Destruction of pancreatic beta cells, usually autoimmune	No autoimmunity, usually insulin resistance and progressive insulin deficiency
C-peptide levels	Very low or undetectable	Detectable
Pre-Diabetes	Auto-antibodies usually present	Auto-antibodies absent
Medication	Insulin	Oral agents or insulin
Therapy to prevent or delay onset	None	Lifestyle change, weight loss, increased physical therapy. Oral medications like Metformin
Associated Autoimmune conditions	Increased frequency of autoimmune diseases like Autoimmune Thyroiditis, Autoimmune gastritis and Celiac disease	-

A. GESTATIONAL DIABETES MELLITUS (GDM)

It is any degree of glucose intolerance with onset or first recognition during pregnancy. Usually the frequency is 1%-14% and these women are at significantly increased risk of development of Type 2 Diabetes. The risk is higher in women who have marked Hyperglycemia during or soon after pregnancy, obesity, and those diagnosed before 24 weeks gestation. All these patients should be evaluated for Diabetes 6-12 weeks after delivery and if Diabetes is not present should be re-evaluated every 3 years.

Screening and Diagnosis of GDM

One step strategy

Perform 75 g OGTT and measure glucose at fasting, 1 hour and 2 hour post load at 24 – 28 weeks of gestation for women not previously diagnosed with overt Diabetes (8 hour fasting is mandatory). Diagnosis of GDM is confirmed if any of the following conditions are met with:

- Fasting glucose > 92 mg/dL
- 1 hour post load >180 mg/dL
- 2 hour post load >153 mg/dL

Two step strategy

Step 1: Perform 50 g glucose load test and measure glucose level at 1 hour post load at 24 – 28 weeks of gestation for women not previously diagnosed with overt Diabetes. Patients need not be fasting.

Note: If blood glucose, 1 hour post load is >=140mg/dL proceed to the second step.

Step 2: Perform 100 g OGTT on a fasting patient. Diagnosis of GDM is confirmed if any two of the following conditions are met with.

- Fasting glucose > 95 mg/dL
- 1 hour post load >180 mg/dL
- 2 hour post load >155 mg/dL
- 3 hour post load >140 mg/dL

Note: If results are normal in a clinically suspicious patient, repeat the test during the third trimester.

B. PRE-DIABETES

Pre-Diabetes is the term used for individuals with impaired fasting glucose and/or impaired glucose tolerance. It indicates an increased risk for future development of Diabetes. These also increase the risk factors for cerebrovascular disease.

B.1 Impaired Glucose Tolerance

These individuals during an OGTT test show Post Prandial (PP) glucose between 140-199 mg/dL. Development of overt Diabetes occurs at a rate of 1%-5% per year. These patients do not develop renal or retinal complications but have increased prevalence of cardiovascular disease.

B.2 Impaired Fasting Glucose

These individuals have fasting blood glucose between 100-125 mg/dL. These individuals are also at increased risk of Diabetes and cardiovascular disease.

RISK FACTORS FOR DIABETES MELLITUS

Adults

- **Obesity:** Overweight adults with BMI >= 25 Kg/m2 for all races except Asian American where BMI >=23 /Kg/m2. Screening for these patients should start at age 45 years. If test is normal retest every 3 years
- Fasting blood glucose 100-125 mg/dL or 2 hour PP 140-199 mg/dL
- Hemoglobin A1c 5.7%-6.4%
- Physical inactivity
- First degree relatives with Diabetes
- High risk race/ethnicity
- Women who have delivered baby weighing >9 pounds or were diagnosed with Gestational diabetes

- Hypertension >140 / 90 mm Hg or on therapy for Hypertension
- HDL Cholesterol <35 mg/dL and or Triglyceride >250 mg/dL
- Polycystic Ovarian Disease (PCOD)
- History of Cardiovascular disease

Children

- **Overweight:** BMI > 85th percentile for age and sex, weight for height > 85th percentile or weight > 120% of ideal for height
- Family history of Type 2 Diabetes in first or second degree relatives
- Race / Ethnicity
- Signs of insulin resistance or conditions associated with insulin resistance like Acanthosis nigricans, Hypertension, Dyslipidemia, PCOD or small for gestational age birth weight
- Maternal history of Diabetes or Gestational Diabetes during the child's gestation
- **Note:** Initiate testing at the age of 10 years or at the onset of puberty, whichever is earlier. If test is normal, retest every 3 years.

IMPORTANCE OF SCREENING FOR DIABETES

A. TYPE 1 DIABETES

- Measurement of Islet cell antibodies in relatives with Type 1 Diabetes helps to identify individuals who are at risk
- Early diagnosis limits acute complications

ISLET CELL ANTIBODIES (GAD 65 ANTIBODY, IA-2 ANTIBODY & INSULIN ANTIBODY)	RISK OF TYPE 1 DIABETES AT 5 YEARS
Seropositive for 1 antibody	17%
Seropositive for 2 antibodies	39%
Seropositive for 3 antibodies	70%

B. TYPE 2 DIABETES

Widespread use of Fasting blood glucose or HbA1c screening is recommended because:

- Large number of individuals who meet the current criteria for Diabetes are asymptomatic and unaware that they have the disorder
- Epidemiologic studies suggest that Type 2 Diabetes mellitus may be present for up to a decade before diagnosis
- Some individuals with Type 2 Diabetes have one or more Diabetes specific complications at the time of diagnosis
- Treatment of Type 2 Diabetes may favourably alter the natural history of disease

CHRONIC COMPLICATIONS OF DIABETES MELLITUS

Microvascular

- Eye disease like Retinopathy and Macular edema
- Neuropathy – Sensory , Motor or Autonomic
- Nephropathy

Macrovascular

- Coronary heart disease
- Cerebrovascular disease
- Peripheral arterial disease

Others

- Gastrointestinal – Gastroparesis, Diarrhea
- Genitourinary
- Dermatologic
- Infectious
- Cataract
- Glaucoma
- Periodontal disease
- Hearing loss

CRITERIA FOR DIAGNOSIS OF DIABETES

- Fasting blood glucose >=126 mg/dL (minimum 8 hours fasting is mandatory)
- 2 hours PP glucose >=200 mg/dL using glucose load 75 g as per WHO criteria
- Random blood glucose >=200 mg/dL in a patient with classic symptoms of Hyperglycemia or Hyperglycemic crisis
- HbA1c >=6.5% using NGSP certified method

GLYCEMIC GOALS

A. **Non-pregnant adults with Diabetes**

HbA1c < 7%
Fasting blood glucose 80-130 mg/dL
PP glucose <180 mg/dL

B. **Children**

HbA1c < 7.5% across all pediatric age groups
Fasting blood glucose 90-130 mg/dL

C. **Pregnancy**

i. **Gestational Diabetes Mellitus (GDM)**

Fasting blood glucose <=95 mg/dL
1 hour post meal glucose <= 140 mg/dL
2 hour post meal glucose <= 120 mg/dL

ii. **Pre-existing Type 1 or Type 2 Diabetes**

Fasting blood glucose 60-99 mg/dL
PP glucose 100-129 mg/dL
HbA1c < 6%

PREVENTION / DELAY OF TYPE 1 DIABETES

- Number of interventions have successfully delayed or prevented Type 1 Diabetes in animal models by targeting immune system directly, preventing islet cell death by blocking cytotoxic Cytokines or increasing islet cell resistance to destructive process
- In humans with new onset, Type 1 Diabetes treatment with Anti CD3 monoclonal antibodies, Anti B lymphocyte monoclonal antibody and GAD vaccine have shown to slow down the decline in C-peptide levels

PREVENTION / DELAY OF TYPE 2 DIABETES

- Patients with impaired glucose tolerance or impaired fasting glucose should follow an intensive diet and physical activity for at least 150 minutes / week targeting loss of 7% of body weight
- Follow-up counseling
- Metformin therapy may be considered for Pre-Diabetic patients especially for those with BMI >35 Kg / m2 , age <60 years and females with prior history of GDM
- Annual monitoring of Pre-Diabetics
- Screening for and treatment of modifiable risk factors for cardiovascular disease
- Organizing Diabetes self management education & support programs for Pre-Diabetics

SELF MONITORING OF DIABETES

- Self monitoring of capillary plasma glucose by finger prick allows patients to evaluate their individual response to therapy and assess whether Glycemic targets are being achieved
- This helps in guiding medical nutrition therapy and physical activity, preventing Hypoglycemia and adjusting medication, especially insulin doses

ROLE OF LABORATORY IN DIAGNOSIS OF DIABETES MELLITUS

Preclinical	Markers
Immunologic	Islet cell antibody
	Insulin autoantibody
	GAD Antibody
	IA2 Antibody
Genetic	HLA association
Insulin secretion	Fasting
	Glucose challenge
	Hemoglobin A1c

Clinical	Markers
	Blood glucose
	Oral lucose tolerance test (OGTT)
	Hemoglobin A1c
	Ketones urine and blood
	Insulin
	C-peptide
	Stimulation tests

ROLE OF LABORATORY IN MANAGEMENT OF DIABETES MELLITUS

Acute	Markers
	Glucose blood and urine
	Ketones blood and urine
	Acid base balance
	Lactate
	Electrolyte
	Osmolality

Chronic	Markers
	Glucose blood and urine
	Hemoglobin A1c
	Fructosamine
	Microalbumin urine
	Urinary proteins
	Kidney and liver function tests
	Lipid profile
	C-peptide and insulin

Tests Available at Dr Lal PathLabs

CODE	TEST NAME	SPECIMEN
R055	C-Peptide, Fasting	2 mL serum in 1 SST
R157	C-Peptide, Post Prandial	2 mL serum in1 SST
Z276	C-Peptide Stimulation By Glucagon	2 mL serum in 1 SST each for Fasting, 5,10 & 15 min. post glucagon
Z037	C-Peptide response to glucose, 5 hours	2 mL plasma in 1 Grey Top & 2 mL serum in 1SST each for Fasting, 0.5,1, 1.5, 2, 2.5,3, 4 & 5 hrs post glucose
Z312	Diabetes Panel, Basic (*Glucose F/PP/R *HbA1c)	2 mL plasma in 1 Grey Top & 3 mL whole blood in in 1 EDTA
Z285	Diabetes Panel 1 (*Glucose F & PP *HbA1c*Cholesterol * Triglyceride*Urea* Creatinine)	2 mL plasma each in 2 Grey Top for Glucose F & PP; 3 mL whole blood in 1 EDTA & 3 mL serum in 1 SST
Z286	Diabetes Panel 2 (*Glucose F & PP *HbA1c*Cholesterol * Triglyceride**HDL*LDL Calculated *Urea* Creatinine *Uric acid *Microalbumin*Urine R/E)	2 mL plasma each in 2 Grey Top for Glucose F & PP; 3 mL whole blood in 1 EDTA ; 3 mL serum in 1 SST & 10 mL aliquot of urine
B071	Fructosamine	2 mL serum in 1 SST
B150	GAD-65 (Glutamic Acid Decarboxylase 65), IgG	2 mL serum in 1 SST
G004	Glucose challenge test (GCT); Glucose 1 hour Obstetrical	2 mL plasma in 1 Grey Top
G009	Glucose tolerance test, Pregnancy, 75 g Glucose	2 mL plasma each in 1 Grey Top (Fasting, 1&2 hrs)

CODE	TEST NAME	SPECIMEN
G010	Oral Glucose Tolerance Test (OGTT), Oral, 75 g Glucose	2 mL plasma each in 1 Grey Top (Fasting &2 hrs)
B001	Glucose, fasting (F)	2 mL plasma in 1 Grey Top
B002	Glucose, Post Prandial (PP), 2 hours	2 mL plasma in 1 Grey Top
B003	Glucose, Random(R)	2 mL plasma in 1 Grey Top
Z131	Glucose Fasting (F) & Post meal (PP), 2 hours	2 mL plasma each in 1 Grey Top
B080	HbA1c; Glycosylated hemoglobin	3 mL whole blood in 1 EDTA
L017	HLA DQB1*02,1*03	6 mL whole blood in 1 ACD
S241	IA-2 Antibody	2 mL serum in 1 SST
S133	Insulin antibody	2 mL serum in 1 SST
R039	Insulin fasting	2 mL serum in 1 SST
R042	Insulin PP	2 mL serum in 1 SST
Z385	Insulin Fasting & PP	2 mL serum each in 1 SST
S134	Islet cell antibody	2 mL serum in 1 SST
Z007	Kidney Panel: KFT *Urea *Creatinine *Uric Acid *Protein Total*Albumin *A:G Ratio *Alkaline Phosphatase *Calcium *Phosphorus *Electrolytes, serum	3 mL serum in 1 SST
B099	Lactate	2 mL plasma from 1 Grey Top . Separate plasma at source
B131	Lipid profile basic *Cholesterol *Triglycerides *HDL, Direct *LDL, Direct *VLDL, Calculated	2 mL serum in 1 SST

CODE	TEST NAME	SPECIMEN
Z025	Liver & Kidney Panel *LFT *KFT	3 mL serum in 1 SST
Z005	Liver Panel 1; LFT *SGOT *SGPT *GGTP *Bilirubin *Protein, Total *Alkaline Phosphatase	2 mL serum in 1 SST
B142	Microalbumin Creatinine Ratio, Urine	15 mL aliquot of random urine
U031	Microalbumin 24 hour urine	10 mL aliquot of 24 hour urine
B064	Osmolality serum	2 mL serum in 1 SST
U040	Osmolality urine	5 mL aliquot of random urine
U080	Protein creatinine ratio urine	20 mL aliquot of first morning /random urine
U020	Protein, Total, Random urine	15 mL aliquot of random urine
U004	Protein Total, 24 hour urine	20 mL aliquot of 24 hour urine
U001	Urine Routine examination	10 mL aliquot of first morning urine
U082	Urine, Glucose	10 mL aliquot of first morning urine
U080	Urine Reducing Substances	10 mL aliquot of first morning urine

About Diabetes Care Program (DCP) at Dr Lal PathLabs

A unique personalized Diabetes care and engagement program for Diabetics

Every diabetic has a unique set of needs based on years of suffering, managing glucose control variations, medications, diet control, need for associated tests and meeting various doctors. Hence, a personalized Diabetes care and engagement program to address diabetes needs can help every diabetic lead a care free life.

DCP is a highly personalized Diabetes care and engagement program, that helps answer many questions, which includes when to get tested and for what, what to eat, whether to travel alone overnight, how to handle symptoms of Hypoglycemia, how much to exercise, are children at risk and many more!

Why Dr Lal PathLabs personalized Diabetes care and engagement program

- India's first one-on-one program for diabetics - highly personalized care through regular engagement
- Introducing first time in India, availability of test results on mobile phone, color coded high or low value lab test depicted graphically, specialist advice, timely updates, tips on exercise and lifestyle all customized to individual needs
- Personalized engagement with our special consultant and counselor, facilitating appointments with specialized doctors, emergency advice in case of panic values and much more
- Yet, another first from India's oldest and most reputed laboratory, testing over 35,000 patients a day that understands Indians and their needs in a better way

For diabetes queries or to schedule a session
Call 8130-496-737 Email us : dcp@lalpathlabs.com
(Between 8AM- 5PM from Monday- Saturday)

* Conditions apply