The Great Revert of Uncontrolled Type 2 Diabetes Mellitus with Diabetic Neuropathy by Ayurvedic Intervention: A Case Study Relating ToPittaj Prameha-Subtype Haridra meha

by Jana Publication & Research

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The Great Revert of Uncontrolled Type 2 Diabetes Mellitus with Diabetic Neuropathy by *Ayurvedic* Intervention: A Case Study Relating To*Pittaj Prameha*- Subtype *Haridra meha*

ABSTRACT:

Diabetes mellitus (DM) is a multi-factorial disease of disturbed metabolism with hyperglycemic condition. Among 2 types of diabetes, type 2 DM also named asnon-insulin dependent diabetes is the most common typecauses due to sedentary lifestyle.In *ayurveda* DM can be correlate with *Prameha*. *Apathy-nimittajPrameha*is mentioned by *AcharyaSushruta* which occurs due to unhealthy lifestyle of patient. This presenting article is about a case of type 2 DM or *Apathy-nimittaj prameha*, diagnosed to a male patient of age 45 years.He had come to JEENA SIKHO LIFECARE LIMITED HOSPITAL, NAVI MUMBAI, MAHARASHTRA, on 12/09/2024 and showed symptoms like burning micturition, pain andnumbness of lower limb etc. He brought his HbA1c report investigated prior to visit hospital. His symptomatology and positive HbA1c had given a clue to diagnoseuncontrolled type 2 DM with diabetic neuropathy/*Pittaj prameha*. Laterhe starts to avail*ayurvedic* therapeutics. After 74 days of treatment his HbA1c values reducedto non-diabetic range and his symptoms also gotcompletely subsided. Treatment was included *ayurvedic* medicines along with diet and exercise recommendation which shown anexcellent result.

Key words: Type 2 Diabetes mellitus, *Apathy nimittaj prameha,* Diabetic neuropathy, *Pittaj prameha,*HbA1c, *Ayurvedic* therapeutics

INTRODUCTION:

As per the WHO, diabetes mellitus (DM) is defined as a heterogeneous metabolic disorder characterized by common feature of chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism. DM is a leading cause of morbidity and mortality world over. It is estimated that approximately 1% of population suffers from DM. The incidence is rising in the developed countries of the world at the rate of about 10% per year, especially of type 2 DM, due to rising incidence of obesity and reduced activity levels. Diabetes is expected to continue as a major health problem owing to its serious complications. [1]There are two general types of diabetes mellitus as follows: [2]

1. **Type I diabetes mellitus** [Insulin-dependent DM] – Is caused by lack of insulin secretion.
2. **Type II diabetes mellitus** [Non-insulin-dependent DM] –Is initially caused by decreased sensitivity of target tissues to the metabolic effect of insulin. This reduced sensitivity to insulin is often called insulinresistance.

Type II Diabetes: It is far more common than type I, accountingfor about 90 to 95 percent of all cases of diabetes mellitus. Inmost cases, the onset of type II diabetes occurs after age 30,often between the ages of 50 and 60 years, and the diseasedevelops gradually. Therefore, this syndrome is often referredto as adult-onset diabetes. In recent years, however, there hasbeen a steady increase in the number of younger individuals, including few younger than 20 years, with type II diabetes.Thistrend appears to be related mainly to the changing lifestyle from healthy to unhealthy. **Chronic hyperglycemia leads to diabetic complications**by causingtissueinjury.

When blood glucose is poorly controlled over longperiods in diabetes, blood vessels in multiple tissuesthroughout the body begin to function abnormally andundergo structural changes that result in inadequate bloodsupply to the tissues. This in turn leads to diabetic complications like heart disease, kidney disease, retinopathy, blindness, ischemia and gangrene of the limbs etc. Frequent complications of chronic, **uncontrolled diabetes** mellitus are **peripheral neuropathy**and autonomicnervous system dysfunction.These abnormalitiescan result in impaired cardiovascular reflexes, impairedbladder control, decreased sensation in the extremities, andother symptoms of peripheral nerve damage.[2]

According to *ayurvedaPrameha* is a *santarpanottha vyadhi*. It means that it occurs due to that factors which over nourishes the body.[3] So the *hetu* of *prameha* also included those things which cause impairment in the metabolism like *madya* (alcohol), *guda* (jaggery), *navanna* (new grains), *udaka mansa* (Sea food), *snigdha anna* (oily food) etc. *Hetu* of *prameha* are mentioned later in discussion to understand the etiological factors. All *aacharya's* mentioned the main symptom of *prameha* is *prabhuta mutrata*[4] or *prabhuta avila mutrata*[5] (excess and/ turbid urine). In *ayurveda*detailing of *pramehahetu* (etiological factors),*purvaroopa's* (pre-symptomatic phase), *roopa's* (symptomatic phase), *samprapti* (pathogenesis), *dosha-dushya sangraha* (pathogenic factors involved), *sadhya-asadhyatva* (prognosis) and *prameha upadrvas* (complications) are also mentioned.Management of *prameha* included detoxification, oral medicines together with diet and exercise recommendation. *Acharya Sushruta* classified *Prameha* in 2 types.[6]

1) *Sahaja Prameha* and 2) *Apatthya nimittaja prameha*

Among these types *sahaja prameha* is a genetic or hereditary type. *Apathy nimittaja prameha* has 3 types on the basis of predominance of *dosha*. These 3 types again sub-classified into 20 different sub-types on the basis of urine appearance. Types of *Doshaj Prameha's* are given as below:[4]

1) *Vataj prameha*
2) *Pittaj prameha*
3) *Kaphaj prameha*

This article is going to present a significant reversal in acase of uncontrolled type 2 diabetes mellitus with diabetic neuropathy in particular view of ***Pittaj prameha***and its subtype ***Haridra meha***. He was a male patient aging 45 years, who visited to Jeena Sikho Lifecare Limited Hospital, Navi Mumbai, Maharashtra, on 12/09/2024. By *ayurvedic* intervention his uncontrolled diabetes gets reverted to normal within 74 days. All symptoms got subsided along with normal shift in the HbA1c value. This treatment included, *panchakarma* therapies, oral medication, diet and exercise recommendations. All the belongings are mentioned from here onwards that how disease occurs, how it became uncontrolled and how ayurveda treated it accurately with *ayurvedic* conceptual study.

CASE REPORT:

This is a case of male patient was aging 45 years. He had come to JEENA SIKHO LIFECARE LIMITED HOSPITAL, NAVI MUMBAI, MAHARASHTRA, on 12/09/2024. On arrival, his chief complains were noted as given below followed by history taking and examinations as well.

1. **Chief complains:**

- Pain while walking
- Numbness and tingling to bilateral lower limb
- Anorexia
- Nausea and vomiting
- Burning micturition on & off/ persistent
- General weakness
- Burning sensation to both feet and sole
- Headache or dizziness
- Feeling of fear

2. **History taking:** He had no history of illness/ he was not taking any allopathic or other medicines/ no any family history of diabetes etc.

3. **Examinations:**

Table no. 1 General examination

Particulars	Remark
Blood Pressure	140/80 mm of Hg
Pulse	84/ min
Weight	69.2 kg
Nidra	*Prakrita*
Kshudha	*Prakrita*
Mutra	***Mutra daha* (burning micturation)**

Table no. 2 *Ashtavidh parikshan*

Particulars	Remark
Nadi (pulse)	*Vata pitta*
Mala (bowel)	*Asamyaka* (not clear)
***Mutra* (urine)**	***Mutra daha* (burning micturation)**
***Jivha* (tongue)**	***Alpa Sama* (mild coated)**
Shabd (pronounciation)	*Spashta* (clear)
Sparsh (touch)	*Anushna Sheeta*(normal)
Drik (eyes)	*Prakrita* (normal)
Aakriti (physique)	*Madhyam* (average)

Local examination: Bilateral pitting edema was found to lower limb.

4. **Investigation:**

He had already brought HbA1c report investigated on 15/08/2024 and showed elevated value of HbA1c, 10.4 % which countedunder poor control range and together with this he had also brought RFT, LFT, lipid profile reports.

Table no. 3 HbA1c report

Date	HbA1c	Eag
15/08/2024	10.4 %	251.78 mg/dL
03/10/2024	7.1 %	157 mg/Dl
05/11/2024	5.5 %	111.15 mg/dL
25/11/2024	4.9 %	94 mg/Dl

Table no. 4: Other investigations

Date	Tests	Result
15/08/2024	LFT (Liver function test)	Direct bilirubin - 0.43 mg/dl (mild high) Total Bilirubin, SGOT & SGPT normal
	Urine analysis	Specific gravity – 1.004 (Normal – 1.016 to 1.022)
	Lipid profile	Normal
13/09/2024	CBC (Complete blood count)	Normal
	LFT (Liver function test) Mild increase in bilirubin	Total Bilirubin - 1.79 mg/dl Direct Bilirubin - 0.69 mg/dl Indirect Bilirubin - 1.1 mg/dl
	RFT (Renal function test)	Normal

5. **Diagnosis:**On the basis of symptomatology, history, examination and blood report this case was diagnosed as **Uncontrolled Type 2 diabetes mellitus with Diabetic neuropathy.** According to ayurvedic perspective same case was diagnosed as ***Pittaj prameha* – subtype *Haridra meha.***

AYURVEDIC INTERVENTION:

After the diagnosis patient wanted to avail*ayurvedic* therapy for further treatment. Therefore, he wasadmitted to IPD for *ayurvedic* therapeutics which included oral medicines, *panchakarma* therapies (detoxification procedures), *pathy-apathy aahar vihar* (do's and don'ts of diet and activities).

1] *Panchakarma* Therapies (9 days of IPD):

Table no. 5: *Panchakarma* procedures

Therapy name	Medicine used for therapy	Quantity and time
1. Sarvang abhyang	*Ksheerbalataila*	30 min.
2. Avgaha swedana	*Ushna jala* (hot water)	20 min
3. Matra basti	*Punarnavataila*	90 ml for 10 min
4. Shirodhara	*Bramhitaila*	150 ml for 30 min.

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2] Medicines prescribed during IPD period:

Table no. 6: IPD prescription

Formulation	Dose and time
Divya Shakti powder	½ tsf HS (*Nishakala* with *Koshna jala* i.e. lukewarm water)
Prameharogahar powder	½ tsf TDS before meal (*Pragbhakta kala* with *Koshna jala)*
Syrup madhumehanashak	20 ml BD (*Adhobhakta kala* with *saman matra* of *Koshna jala* i.e. equal amount of lukewarm water)
Capsule DM	2 Capsule TDS (*Adhobhakta kala* with *Koshna jala)*
Yakritshothahar vati	1Tablet BD (*Pragbhakta kala* with *Koshna jala)*
Syrup Nervine tonic	10 ml BD (*Adhobhakta kala* with *Koshna jala)*

3] **Follow up during IPD:**

Table no. 7: IPD follow-up

Date	Follow-up of Symptoms	Treatment	Pain score 10
12/09/2024 (1st day of IPD)	• Chief complains as mentioned in Case report	Mentioned in table no. 5 & 6	4
13/09/2024	• No fresh complains • Recurrent vomiting^{++}	1. *Lepam* over bilateral feet *Nimba* + *karvellaka* powder 2. Syrup vomitab 10 ml BD 3. Arogya vati 4. Rest continued	4
14/09/2024	• Recurrent vomiting^{+}	Continue all	4
15/09/2024	• No fresh complains	Kansyathali – foot massage	
16/09/2024	• Morning 10.00 am: Per abdomen tenderness over whole abdomen • Evening 8.30 pm: Vomiting and edema reduced	Tab. vomitab 2 stat	5
17/09/2024	• Per abdomen: Normal/ non-tender	Continue all	4
18/09/2024	• Reduced burning sole, no vomiting	Continue all	3
19/09/2024	• Reduced burning sole,	Tab Dr. Sukoon 1BD	2

	• Diminish numbness and tingling of lower limb, • Pitting edema reduced • General weakness reduced, • Fear +	Rest continued	
20/09/2024 (7th day of IPD)	• No giddiness, • No burning sole, • General weakness+	Continued all	2

4] Daily diet during IPD:

Table no. 8 IPD diet

Early morning	Herbal tea + raw turmeric
Breakfast	Fruits, sprouts and red juice
Lunch and dinner	Salad and cooked food and raw turmeric
Afternoon	Green juice, *Makhana*, 4-5 almonds

5] Medicines prescribed to consume after discharge:

Table no. 9: Medicines to consume after discharge

Formulation	Dose and time
Divya shakti powder	½ tsf HS (*Nishakala* with *Koshna jala* i.e. lukewarm water)
Syrup Nervine tonic	20ml BD (*Adhobhakta kala* with *Koshna jala)*
Tablet JS Diab	2BD before food (*Pragbhakta kala* with *Koshna jala)*
Tablet Immune pathy	1 BD after food (*Adhobhakta kala* with *Koshna jala)*
Tablet Liv DS	2 BD (*Adhobhakta kala* with *Koshna jala)*
Syrup Liver tonic	20 ml BD after food (*Adhobhaktakala* with *saman matra* of *Koshna jala)*
Syrup Telome	10 ml BD after food (*Adhobhakta kala* with *saman matra* of *Koshna jala)*
Syrup Madhumeha nashak	10 ml BD after food (*Adhobhakta kala* with *saman matra* of *Koshna jala* i.e. equal amount of lukewarm water)
Tablet Dr. sukoon	1 BD before food (*Pragbhakta kala* with *Koshna jala)*

6] Diet suggested to follow after discharge:

Patient was advised to have DIP diet that was planned according to advanced method of diet plan named as **DIP (Discipline and Intelligent) diet.**Per day dietincluded **plate no. 1 of fruits,salad** and **plate no. 2 of millet diet** in lunch and dinner. Quantity of fruits and salad were calculated

according to DIP diet plan formula's and are given below.[7] He was advised to have that food which is *pathy* for *Prameha vyadhi*, will be discuss later.

Formula of fruits: Patient s weight × 10 = fruits in grams

Formula of salad: Patient s weight × 5 = salad in grams

In this case weight of patient was 69.2 kg. So by the above formula calculated quantity of fruits and salad advised is mentioned below in table no. 10. This table also noted thediscipline in having food as per time which was suggested to him:

Table no. 10: DIP diet at home

Diet	Quantity/type of food	Time
Fruits	• All type of fruits especially citric fruits • ~ 700 grams	Till 12.00 pm
Salad (Plate 1)	• All salads like cucumber, tomato, beetroot etc. • ~ 350 grams	Just before lunch and dinner
Lunch (Plate 2)	Millet diet, bitter and fruit vegetables, lentils etc.	Between 1.00 to 2.00 pm
Dinner (Plate 2)	Millet diet, bitter and fruit vegetables, lentils etc.	In the evening before 7.30 pm

7] Exercise: Regular exercise and meditation for 45 minutes was advised to him. He was told to practice Sun salutations (*Surya namaskara's*) along with *Kapalbhati pranayam*.

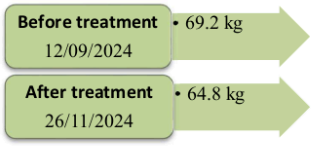
8] *Pathy-apathy* (Do's and don'ts):

Table no. 11: *Pathy-apathy*

***Pathy* (Do's)**	***Apathy* (Don'ts)**
Should have millet diet like barley, sorghum etc. Eat all vegetables especially bitter taste and fruit vegetables like *Karvellaka* (bitter guard), *Methika (Trigonella foenum-graecum),* Ivy guard etc.	Skip dairy products, jaggery and their products, oily, spicy food, packaged food, salty food. Don't eat non-veg.
Wake up early and sleep early	Day sleeping and night awakening
Do exercise regularly and always stay physically active.	Stale food, alcohol or any other addiction, avoid eating new grains.
Eat only in day time	Hold natural urge
Always eat homemade and fresh food.	Stress and anger

RESULTS:

Weight decline: By following DIP diet and exercise, his weight was reduced approximately by 5 kg within 2 and half months.



Reversal in altered HbA1C assessment:

After 21 days of ayurvedic treatment HbA1c value reduced by more than 3 % that is shifted to 7.1% from 10.4%. From here HbA1C was decreased to near about half of pre-treatment value and reached to 5.5% in the next 33 days. This is a border line reading of non-diabetic HbA1c value. After total 74 days of ayurvedic treatment it reduced to 4.9% successfully and it is within border line range of non-diabetic HbA1c. Tabular presentation of HbA1C outcome is given below in table no. 12.

Table no. 12: HbA1c outcome

Date	Before or after treatment	Result
15/08/2024	Before treatment, 28 days prior to start treatment	10.4%
03/10/2024	After 21 days of treatment	7.1%
05/11/2024	After 33 days from 1st follow up	5.5 %
25/11/2024	After 20 days from 2nd follow up (Within 74 days of treatment)	4.9 %

Symptomatic outcome:

Table no. 13: Symptomatic relief during IPD

Date	Day of IPD	Result
18/09/2024	7th day	• Mild reduction in burning sole, • No vomiting
19/09/2024	8th day	• Reduced burning sole, • Diminish numbness and tingling of lower limb, mild reduction in Pitting edema • General weakness reduced to some extent, • Complain of mild fear yet.
20/09/2024	9th day	• No giddiness, • No burning sole, • General weaknessmild

Outcome of pain score during admission was as like below:

Table no. 14: Progress in pain score

Day of treatment	Pain score
1st to 4th day	4
5th day	5
6th day	4
7th day	3
8th day	2
9th day (last day)	2

At the time of last follow up his all symptoms were subsided.

Table no. 15: Last follow-up

Symptoms	Result
Pain while walking	Diminishes
Numbness and tingling to bilateral lower limb	He was started to feel sensations to lower limb.
Anorexia	Normalized
Nausea and vomiting	Absent
Burning micturition on & off/ persistent	Reduced
General weakness	Recovered
Burning sensation to both feet and sole	Absent
Headache or dizziness	Absent
Feeling of fear	Went off

DISCUSSION:

As we studied earlier diabetes mellitus is a syndrome of disturbed carbohydrate, fat and protein metabolism caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin. In both types of diabetes mellitus which are mentioned in introduction, metabolism of all the main foodstuffs is altered. The basic effect of insulin lacks or insulin resistance on glucose metabolism is to prevent the efficient uptake and utilization of glucose by most of the cells of the body, except those of the brain. It leads to increase in blood glucose concentration along with cell utilization of glucose falls increasingly lower and utilization of fats and proteins increases.[8]According to*ayurveda*3 types of *DoshajPrameha*asstated in introduction are again re-divided into 20 sub-types by the appearance of urine. *Kaphaj prameha* have 10 subtypes, *pittaj* have 6 and *vataj* have 4 subtypes. This is a case of *pittaj prameha*, that's why subtypes of *Pittaj prameha* are mentioned here as follows:[9]

1. *Kshar meha*
2. *Kala meha*
3. *Neela meha*
4. *Lohita meha*
5. *Manjistha meha*

6. Haridra meha

This article is a case of uncontrolled type 2 diabetes with diabetic neuropathy or *Pittaj prameha*sub-type *Haridra meha*. A male patientof age 45 years had already investigated for HbA1c 28 days prior presented to JEENA SIKHO LIFECARE LIMITED HOSPITAL, NAVI MUMBAI, MAHARASHTRA, on 12/09/2024. His case report is already given. Now the detailed discussion on case study, diagnosis and patho-physiology of this case is as follows:

Etiological factors:

He was used to unhealthy lifestyle and not following the timings of eating and sleeping properly. He was not even exercising. Even after elevated HbA1c value he ignored it and this ignorance lead to again triggering in symptoms due to uncontrolled hyperglycemia. *Acharya Vagbhatt* mentioned following causative factors to generate *prameha* as givenin *shloka* no 1.

Food and activities which increases *meda* (Lipid or fat), *mutra* (urine) and *kapha dosha*, food of sweet, sour and salty taste, *snigdha* (Oily), *guru* (uneasy to digest), *pichchhila* (Sticky or fermented), *sheetal* (cold potency food), *nava dhanya* (new grains), *sura* (alcohol), *anoop mansa* (sea food, non-veg of buffalo, goat etc.), *ikshu* (sugarcane), *guda* (jaggery), *gorasam* (curd and milk), *ekasthanaaasanarati* (sitting continually at one place), *shayanamvidhivarjitam* (sleeping without following rules of sleep). [10]

श्लोक१:

"प्रमेहाविंशतिः तत्र……तेषांमेदोमूत्रकफावहम्॥१॥
अन्नपानक्रियाजातंयत्प्रायःतत्प्रवर्तकम्।
स्वादुअम्ललवणःस्निग्धगुरुपिच्छिलशीतलम्॥२॥
नवधान्यः सुराःअनूपमांसेक्षुगुडगोरसम्|
एकस्थानासनरतिः शयनम् विधि वर्जितम्॥३॥"

अष्टांगहृदयनिदानस्थान१०/०१

Symptomatology of case:

1. **Pain while walking, Numbness and tingling at bilateral lower limb, burningsensation at both feet and sole:**

It is a symptom of diabetic neuropathy. As with other complications of DM, the development of neuropathy correlates with the duration of diabetes and glycemic control.This case is ofa **Distal Symmetric Polyneuropathy (DSPN)**, the most common form of diabetic neuropathy, most frequently presents with distal sensory loss and pain. Symptoms may include a sensation of numbness, tingling, sharpness, or burning that begins in the feet and spreads proximally.[1] Pain typically involves the lower extremities. As per *ayurvedic* perspective, this symptom is mentioned in *poorvaroop*(Pre-symptomatic phase) of *pramehavyadhi* as below:

श्लोक१:

"स्वेदोअंगगन्धाःशिथिलांगताचशय्यासनस्वप्नसुखेरतिःच।
ह्लेत्रजिव्हाश्रवणउपदेहोघनांगताकेशनखातिवृधिः॥१३॥
शीतप्रियत्वंगलतालुशोषोमाधुर्यमास्ये**करपाददाहः।**
भविष्यतोमेहगदस्यरुपंमुत्रेअभिधावन्तिपिपीलिकाःच्॥१४॥

Table no. 16: *Poorvaroop*

Poorvaroop	**Elaboration**
Kara-pada daha [4]	Burning sensation to hands and legs
Hasta-pada-tala daha[5]	Burning sensation to upper and lower limb with palm & sole
Karapadayoh suptata dahou[8]	Numbness and burning to upper and lower limb

Modern science mentioned it as diabetic complication whereas *ayurveda* mentioned it as pre-symptomatic phase of diabetes. In treatment *Acharya* already said that if *prameha* is manifests with all its *poorvarup's* then it is not curable. And according modern science also diabetes with complications is the chronic stage of diabetes which is not curable.

2. Anorexia:
May be due to fear of gaining weight he was not eating enough food. Obese people are generally more prone to diabetes. So some people may have this symptom of anorexia nervosa usually called anorexia.

3. Nausea and vomiting:
This may be due to disturbed metabolism because liver plays a key role in digestion and metabolism. It also has a significant role in maintaining blood glucose level thereby causes homeostasis of blood. Nausea and vomiting are the symptoms of disturbed functions of liver.All *Acharya's*mentioned the different *Upadravas* of *Prameha*. *Upadravas* means complications which produced by the same *dosha* of previous disease or the main disease can become a causative factor of that *upadrava*.[11]In this case *kaphapraseka* (Nausea) and *chardi/vaman* (vomiting) were the symptoms present in the patient. *Kapha praseka,* and *chardi/vaman* are the *updrava's* of *prameha*. *Piitaj Prameha* also involves *rakta dhatu dushti*. And *rakta dushti* means *dushti* of *raktavaha srotas* and their *moolsthan*as well. So in this case it was found a border line alteration in LFT values but it was not a serious issue.

4. **Burning micturation on &off, Persistent** – It is due to high glucose level in the blood. It often causes infection in urinary tract. *Acharya Charaka*and *Sushruta*mentioned the *mutra daha* as a *roopa* (symptom) of *haridra meha* a subtype of *pittaj prameha*. *Shloka* by *aacharya* Charaka is given below:

"हारिद्रमेही कटुकम् हारिद्रासन्निभम् दाहात्॥१४॥"

5. **General weakness** –As body tissues cannot efficiently use the insulin they become unable to function properly. So body tissues cannot utilize glucose and it leads to weakness.*Acharya Charaka* in *prameha nidansthan* mentioned *Dourbalya* (weakness) as *updrava*of *prameha.*

6. **Headache/dizziness and Feeling of fear**

Due to weakness, he would bea feeling of fear. Because diabetes affects both physical and mental health. Nausea and vomiting may cause headache. In *prameha dosh dushya samurchana* there is *dushti* of *oja dhatu*. *Bhaya* i.e. fear and *dorubalya* (weakness) are the symptoms of *ojo dushti*.[12]

Local examination:
As he had complaining that tingling numbness, burning and pain in the lower limb, his lower limb was examined. There was pitting edema over both legs. On pricking there was a sensation of numbness. Hyperglycemia from uncontrolled diabetes can damage blood vessels in the legs. It leads to poor circulation and fluid accumulation thereby resulting in pitting edema.

Investigation: He was already investigated for HbA1c on 15/08/2024. It showed increase in reading and marked under poor control limit. So, he was not advised again for any blood glucose tests. After few days of treatment, he did HbA1c test to see the effect of treatment and it showed positive shift to normal by *ayurvedic* treatment. Findings are already noted in result. **Glycosylated hemoglobin (HbA1C)** Long-term objective assessment of degree of glycemic control is better monitored by measurement of glycosylated hemoglobin (HbA1C). This is because the non-enzymatic glycosylation of hemoglobin takes place over 90-120 days, lifespan of red blood cells. HbA1C assay, therefore, gives an estimate of diabetic control and compliance for the preceding 3-4 months. Since HbA1C assay has a direct relation between poor control and development of complications, it is also a good measure of prediction of microvascular complications.[1]

Pathogenesis of disease:
Samprapti of this case of *pittaj prameha*is like that,etiological factors cause increase in *pitta dosha* (*Kupita pitta*) which then vitiates to *bastigat medodhatu, mansadhatu* and *sharirgat kleda* and it leads to *pittaj prameha*.[13]But *prameha vyadhi*involves all 3 *dosha's* (*Vata, Pitta* and *Kapha*) with specific predominance of any *dosha*.

Flow chart of *Samprapti*

Diagnosis:
Though *Prameha* involved all 3 *dosha dushti* with predominance of *kapha dosha dushti*, however, on the basis of*dosha*which increased majorly than others due to their respective *hetu sevana* that type of *Prameha* is diagnosed. It should be decided by observing symptoms.

Table no. 17: Diagnosis of *Pittaja prameha- Haridra meha*

Symptoms	*Ayurvedic* terminology noted in *prameha vyadhi*	*Prameha vyadhi* correlation
Pain in legs while walking	Due to *dourbalya*	*Poorvaroop*
Numbness and tingling at	*Kara-padayo suptata*	*Poorvaroop*

bilateral lower limb		
Nausea and persistent vomiting	*Kapha praseka, vaman*	*Pittaj Prameha updrava*
Burning micturition on & off	***Mutradaha***	***Haridra meha lakshan***
General weakness	*Dourbalya*	*Poorvaroop*
Burning sensation to both feet and sole	*Karapada daha/hasta-pada tala daha*	*Poorvaroop*
Fear	*Bhaya*	*Ojo kshaya lakshana*

***Prameha upadravas* (Diabetic complications): [13]**

Kaphaj	***Pittaj***	***Vataj***
Avipaka	*Basti mehanyo todo*	*Udavarta*
Aruchi	*Mushka avadaranam*	*Kampa*
Chhardi	*Jwara*	*Hrudgraha*
Ati Nidra	***Daha***	*Lolata*
Kasa	*Trishna*	*Shoola*
Peenas	*Amlako udgar*	*Nidranasha*
	Murcha	*Shosha*
Kapha praseka [6]	*Vidbheda*	*Shwasa- Kasa*
	Vaman[6]	

Biological reference value for HbA1C test is as follows:

1. **Non-diabetic:** <5.7 %
2. **Pre-diabetic: between 5.7 to 6.5 %**
3. **Diabetic: > 6.5 %**

Hyperglycemia remains the fundamental basis for the diagnosis of diabetes mellitus. In symptomatic cases,the diagnosis is not a problem and can be confirmed by finding glucosuria.[1]HbA1c of the patient was elevated to **more than poor control**and it was **10.4%** on 15/08/2024. Patient reached to this value means he was suffering by diabetes from so many days but maybe hewas in asymptomatic phase or if any symptomwas there,hemight have ignored it. In between the time of investigation and initiation of treatment his symptoms got triggered and showed complications.

Hence on the basis of symptomatology and investigation report he was diagnosed as **uncontrolled type 2 diabetes mellitus with diabetic neuropathy**. According to *ayurvedic* criteria he was diagnosed as ***Pittaj Prameha***with subtype ***Haridra meha***.

Prognosis (*Sadhya-asadhyatva* of *Prameha*):

All *acharya's* said *PittajPrameha* is *yapya* means difficult to treat because of *vishamkriyatvat*. It mean that, to reduce *piita dosha* there is need of *sheeta veerya dravyas* (cool potency drugs) but it again increases *meda kaphadi dushy* (lipid/fat/*kapha* etc.). These *meda-kaphadi dushya* needs *ushna veerya dravyas* (hot potency drug) to diminish which again increases *pitta dosha*. But if there is fewer vitiation of *kapha dosha* and *medo dhatu* then *pittaja prameha* can be *Sadhya* (easy to treat). This *Medo dhatu dushti* can be identified by observing *poorvaroops* of *prameha.*

Purvaroop like *dantyadinam maladhyatvam*explained as *talugalajïvha dantyeshu malotpatti*by *acharya Sushruta*it means that accumulation of dirt in all parts of mouth like throat, tongue, teeth etc. This *poorvaroop* occurs by excessive vitiation of *medo dhatu.* In this patient *medo dhatu* is present but in less quantity so it showed symptom of mild coated tongue.This patient had investigated for lipid profile which showed normal results. His liver function test also showed a little bit changes. So this case of *PittajPrameha* became easy to treat. To reach this prognosis fine review of case with deep study is needed.

***Ayurvedic* intervention:**

Shodhan and *shaman* are the 2 *ayurvedic* treatments mentioned for the management of *prameha. Acharya Charaka* stated that *shodhan chikitsa* should be conducted in *sthula* (Obese) and *balvana pramehi* (strong immunity). So this patient had given shaman therapy along with *panchakarma* therapy which boostsimmunity of patient. *Panchakarma* treatment advised for patient during IPD period worked as like follows:

1. ***Abhyanga*:**He went through body massage by *Ksheerbala taila.* [14]*Ksheerbala taila* is mentioned by *acharya Vagbhatt,*is used here due to its *rasayan* property[immunity booster]. It is also useful in *Vataroga* to reduce pain.
2. ***Awgaha Swedan:***In this procedure patientwas asked to sit in a tub filled with hot water (42 degree temperature).It is one of the type of body steam.[15]It relieves *shoola* (pain) and pacifies the diseases caused by *vata* and *kapha dosha*.[16,17]
3. ***MatraBasti:***Small amount of *Punarnava taila basti*was administered to the patient through rectum during IPD period for 9 days. *Acharya vagbhatt* mentioned that matra basti is useful in *abalarugna* (whose immunity/strength is low) as it promotes strength.[18] It leads to easy elimination of *mala* (stool) and *mutra* (urine). *Punarnava* has *Shophanut* property (anti-inflammatory). [19] This patient had pitting edema at lower limb. So this therapy was given to boost immunity by reducing edema of lower limbs.
4. ***Shirodhara:****Shirodhara* is a form of independent *snehana* procedure, wherein involves gently pouring liquids over the forehead. In this patient *shirodhara* with *Bramhi* oil was performed. It performed to overcome his fear. *Bramhi* is said to be *medhya rasayan*. means it acts as immunity booster to brain. Thereby it helped to overcome his feeling of fear. [20]
5. ***Lepam:***Local application of *Dashmoola* powder paste over feet had been done during IPD period daily. Absorption of drugs is taking place through body surface and provides the effect of herbs directly on the site of action. *Dashmool*(group of 10 herbs) are named as *Shothahar Mahakashaya*by *acharya Charaka.* [21] *Shothhara* means it reduces swelling. So to reduce pitting edema of patient rapidly, *dashmoola* was applied directly to lower limb.
6. ***Kansyathali* foot massage:** It was given to increase circulation in the lower limb thereby reduce numbness and tingling sensation.
7. ***Neem-Karela* therapy:** In this therapy patient was told to soak his feet in the paste of *Nimba (Azadirachta indica)* and *Karvellaka (Momordica charantia).* This is also a local therapy. It was used to reduce burning sensation in feet. *Nimba* and *Karvellaka both* have *Sheeta virya* (cool potency) and both are *pittashamaka* herbs. [22,23]

***Shaman chikitsa* (Palliative drugs):**

It included Herbo-mineral formulations which act as *pramehahar* (Ant-diabetic) and *rasayan* (boost immunity). Formulations prescribed during IPD period and post-discharge along with ingredients and uses are given below. There significant role in this case is marked 20 red color.

1) **Divya shakti powder** –*Trikatu (Gingiber officinale, Piper nigrum, Piper longum), Triphala (Emblica officinalis, Terminalia chebula, Terminalia bellirica), Musta (Cyperus rotundus), Vidang (Embelia ribes), Laghu ela (Elettaria cardamomum), Tejpatr (Cinnamomum tamala), Lavang (Syzygium aromaticum), Trivrutta (Operculina turpethum), Saindhav (Rock salt), Dhanyak (Coriandrum sativum), Pippali mul (Piper longum root), Jeerak (Cuminum cyminum), Nagkeshar (Mesua ferrea), Dadim (Punica granatum), Brihat ela* (Black cardamom), *Hingu (Ferula asfoetida), Ajmoda (Apium graveolens), Sajjikshar (Sodium bicarbonate), Pushkarmool (Inula racemosa), Mishri (Rock sugar)*
   Use:Boosts immunity and aids to treat **indigestion**

2) **Capsule DM:**
   Ingredients:*Aamragandhi Haridra (Curcuma amada), Guduchi (Tinospora cordifolia), Methika (Trigonella foenum), Shweta musli (Chlorophytum borivilianum), Nimba (Azadirachta indica), Karvellak (Momordica charantia), Jambu (Syzygium cumini), Bilva patra (Aegle marmelos leaves), Gudmar (Gymnema sylvestre), Sheelajit (Asphaltum)*
   Indications:All types of diabetes and **all diabetic complications**.

3) **Madhumehanashaka syrup:**
   Ingredients: *Karvellak (Momordica charantia), Jambu, Nimba (Azadirachta indica), Kirattikta (Swertia chirayta), Gudmar (Gymnema sylvestri), Kutaj (Holarrhena antidysenterica)*
   Indications:Diabetes mellitus, Diabetes neuropathy, Retinopathy, Hyperglycemia

4) ***Prameha*roghar powder** –*Kutaki (Picrorhiza kurrooa), Kirattikta (Swertia chirayta), Nimba (Azadirachta indica), Karvellak (Momordica charantia), Rasanjan (Berberis aristat), Amlika beej (Tamarind seeds), Kala namak (Black salt), Guduchi (Tinospora cordifolia), Shunthi (Gingiber officinale), Babul tvak and phal (Acacia Arabica bark and fruit), Sarpagandha (Rauvolfia serpentine), Trivang bhasma, Yashad bhasma, Revandchini, Guggulu (Commiphora mukul), Methika (Trigonella foenum), Jambu (Syzygium cumini), Karanj (Pongamia pinnata), Shilajeet, Haridra (Curcumas longa), Haritaki (Terminalia chebula), Indrayava (Holarrhena antidysenterica seeds), Vanshlochan (Bambusa arundinacea), Bibhitak (Terminalia Bellerica),, Amalki (Emblica officinalis), Shweta musali (Chlorophytum borivilianum), Gudmar (Gymnema sylvestre)*
   Indications: All types of **diabetes**, controls blood sugar level, relieves urinary problems, improves **immunity**, useful in **diabetic neuropathy** and retinopathy

5) **Nervine tonic syrup:**
   Ingredients:*Ashwagandha (Withania somnifera), Mushali (Chlorophytum borivilianum), Manjishtha (Rubia cordifolia), Hatiraki (Terminalia chebula), Haridra (Curcuma longa), Rasna (Pluchea lanceolata), Vidari (Pueraria) , Arjun (Terminalia arjuna), Musta (Cyperus rotundus), Trivritta (Operculina turpethum), Shweta chandan (Santalum*

*album), Rakta chandana (Pterocarpus santalinus), Sariva (Hemidesmus indicus), Chitrak mula (*Root of *Plumbago zeylanica), Bramhi (Bacopa monnieri) , Shatavari (Asparagus racemosus), Ardraka (Zingiber officinale), Shatpushpa, Renuka (Calamus vattayila), Madhu* (Honey)

Indications:Nerve disorder, **numbness**, insomnia, memory loss, bone disease, **weakness**

6) **Tablet JS Diab:**

Ingredients: *Karvellak (Momordica charantia), Gudmar (Gymnema sylvestri), Paneer dodi (Withania coagulens), Jambu (Syzigiumcumini, Methika (Trigonella foenum-graceum), Nimba (Azadirachta indica), Kalmegha (Andrographis paniculata), Bilva (Aegle marmelos), Mamajjak (Enicostema littorale), Guduchi (tinospora cordifolia), Yashad bhasma, Vang bhasma*

Indications: Diabetes, diabetes neuropathy, retinopathy

7) **Tablet Immune pathy**

Ingredients: *Nmba (Azadirachta indica), Guduchi (tinospora cordifolia), Haridra (Curcuma longa), Maricha (Piper nigrum), Twak (Cinnamomum tamala), Shunthi (Zingiber officinalis), Ashwagandha (Withania somnifera)*

Indications:Immunity booster, **weakness**, liver disease, kidney disease, CA

8) **Capsule LIV DS:**

Ingredients: *Bhumyamalki (Phyllanthus niruri), Kasmard (Cassia oxidentalis), Hinsra (Capparis sepiaria), Punarnava (Boerhavia diffusa), Guduchi (Tinospora cordifolia), Kakmachi (Solanum nigrum), Arjun (Terminalia arjuna), Zabuk (Tamarix gallica), Vidang (Embelia ribes), Chitrak (Plumbago zeylanica), Kutaki (Picrorhiza kurrooa), Haritaki (Terminalia chebula), Bhringraj (Eclipta prostrate)*

Indications: Liver disease, GIT, GERD, loss of appetite

9) **Yakrit shothahar vati**

Ingredients:*Punarnava (Boerhavia diffusa), Marich (Piper nigrum) Pippali (Piper nigrum), Vidang (Embelia ribes), Devdaru (Cidrus deodara), Kushtha (Saussurea lappa), Haridra (Curcuma longa), Chitrak (Plmbago zeylanica), Haritaki (Terminalia chebula), Bibhitak (Terminalia bellirica), Aamalki (Emblica officinalis), Danti (Baliospermum montanum), Chavya (Piper retrofractum), Indrayava (*seeds of *Holarrhena antidysenterica), Pippali mula* (root of *Piper longum), Musta (Cyperus rotundus), Krishna jeerak (Carum carvi), Kayphal (Myrica esculenta), Kutaki (Picrorhiza kurrooa), Trivritta (Operculina turpethum), Shunthi (Zingiber officinale), Karkatshringi (Pistacia integerrima), Ajmoda (Apium graveolens), Mandoor bhasma*

Indications:*Deepan, Pachana, Rasayana*

10) **Syrup Telome:**

Indications: *Kumari (Aloe vera), Gduchi (Tinospora cordifolia), Bhringraj (Eclipta alba), Aamalki (Emblica officinalis), Kutaki (Picrorriza kurroa), Vidang (Embelia ribes), Chitrak (Plumbago zeylanica), Daruharidra (Berberis aristata), Kalmegha (Andrographis paniculata, Bhumyamalki (Phyllantyhes niruri), Pudina* (mint leaves), *Tulsi (Ocimum sanctum), Pippali (Piper longum), Jeerak (Cuminum syminum), Punarnava (Boerrhvia diffusa), Bilva (Aegle marmelos), Ela (Cinnamomum cardamom)*

Ingredients: Liver disease, GIT, metabolic disorder, cell rejuvenation

11) **Tablet Dr. Sukoon:**

Ingredients: *Apamarga (Acharanthes aspera), Shatavari (Asparagus racemosus), Ashwagandha (Withania somnifera), Bramhi (Bacopa monnieri), Vacha (Acorus calamus), Shankhapushpi (Convolvulus pluricalis)*

Indications: Sleeplessness, anxiety, headache, **restlessness**

12) **Arogya vati:**

Ingredients: *Loha bhasma, Abhraka bhasma, Tamra bhasma, Aamalki (emblica officinalis), Bibhitak (Terminalia bellerica), Haritaki (Terminalia chebula), Chitrak (Plumbago zeylanica), Kutaki (Picrorriza kurroa), Nimba (Azadirachta indica)*

Indications: *Deepan, Pachana, Rasayana*

Diet and Exercise:

DIP diet plan was advised to him. This diet plan is helpful in managing disorders which caused by unhealthy lifestyle. This diet gives discipline to the patient's diet timing and it planned intelligently with how much quantity should be advised for salad and fruit. Formulas for quantity of fruits and salad are mentioned previously in DIP diet plan according to patient's weight. It can be helpful in diseases like diabetes, hypertension, thyroid, liver diseases, etc.

Following *pathy-apathy aahar* (Healthy and unhealthy diet) was advised to patient which is explained by *acharya Bhavmishra.*

Pathy aahar:*Godhuma (*Wheat*), chanaka (*Chickpeas*), aadhaki (*Pigeonpea*), kulatth (*Horse gram*), purana anna (*Old grains/millets*), tikta shaka (*Bitter taste vegetables*), yavanna vikriti (*Barley recipes*), mudga (*Green gram*), shali (*Rice*)*

Varjayeta:*Madira*(Alcohol), *taila*(Oily food), *takra*(butter milk or curd), *ksheera*(milk), *ghrita*(ghee), *guda*(Jaggery), *amla*(sore taste food), *ikshurasa*(Sugarcane juice), *pishtanna*(Starch food), *anoop mans*(non-veg)

Exercise is more necessary in diabetic patient as *acharya Charaka* mentioned in the treatment of *prameha* that, "*vyayamyogai vividhai*"means different type of exercises should do.

FURTHER SCOPE OF ADVANCE RESEARCH:

This case study is of great value in its own as it gave a tremendous result in uncontrolled type 2 DM with its complication named diabetic neuropathy and this result is just within 74 days without any adverse effect by *ayurvedic* therapeutics. But this is a single case study with diabetic complication. There is a need to collect data on large scale to analyze the average result of *ayurvedic* therapeutics in type 2 DM along with its all type of complications and not only the diabetic neuropathy. This collective data will be a proof and be useful to treat the patients of DM successfully with *ayurvedic* therapeutics.

CONCLUSION:

This case is of uncontrolled type 2 diabetes mellitus and diagnosed as *pittaj prameha-Haridra meha* according to *ayurveda.* Overview of the case concludes that though the case is of uncontrolled diabetes came with diabetic complication also, he/she can be cured and get reversed to normal within short period. This treatment does not show any adverse effects.

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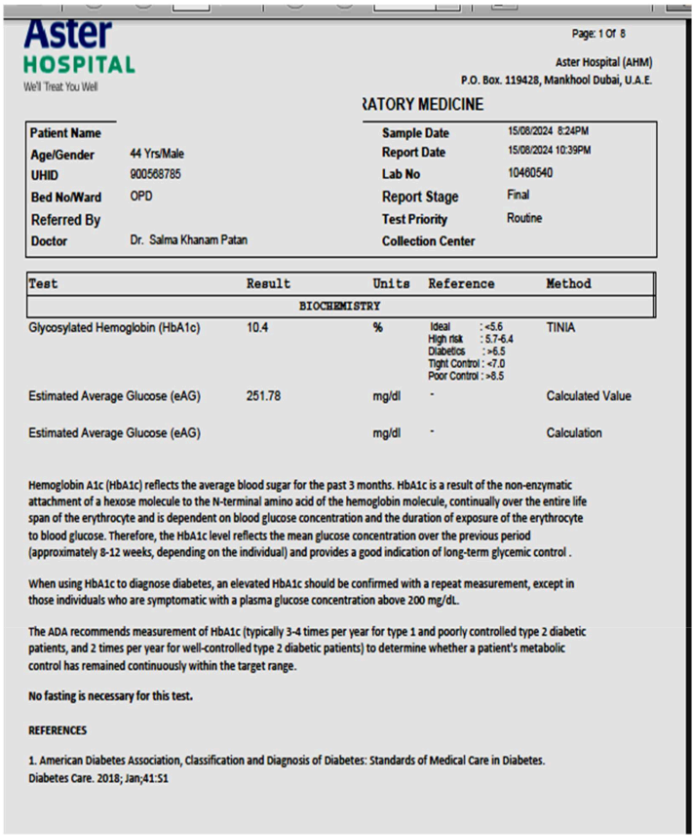
BEFORE AND AFTER TREATMENT REPORTS:

Before treatment



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RATORY MEDICINE

Patient Name		**Sample Date**	15/08/2024 8:24PM
Age/Gender	44 Yrs/Male	**Report Date**	15/08/2024 10:39PM
UHID	900568785	**Lab No**	10460540
Bed No/Ward	OPD	**Report Stage**	Final
Referred By		**Test Priority**	Routine
Doctor	Dr. Salma Khanam Patan	**Collection Center**	

Test	Result	Units	Reference	Method
	BIOCHEMISTRY			
Glycosylated Hemoglobin (HbA1c)	10.4	%	Ideal : <5.6 High risk : 5.7-6.4 Diabetics : >6.5 Tight Control : <7.0 Poor Control : >8.5	TINIA
Estimated Average Glucose (eAG)	251.78	mg/dl	-	Calculated Value
Estimated Average Glucose (eAG)		mg/dl	-	Calculation

Hemoglobin A1c (HbA1c) reflects the average blood sugar for the past 3 months. HbA1c is a result of the non-enzymatic attachment of a hexose molecule to the N-terminal amino acid of the hemoglobin molecule, continually over the entire life span of the erythrocyte and is dependent on blood glucose concentration and the duration of exposure of the erythrocyte to blood glucose. Therefore, the HbA1c level reflects the mean glucose concentration over the previous period (approximately 8-12 weeks, depending on the individual) and provides a good indication of long-term glycemic control .

When using HbA1c to diagnose diabetes, an elevated HbA1c should be confirmed with a repeat measurement, except in those individuals who are symptomatic with a plasma glucose concentration above 200 mg/dL.

The ADA recommends measurement of HbA1c (typically 3-4 times per year for type 1 and poorly controlled type 2 diabetic patients, and 2 times per year for well-controlled type 2 diabetic patients) to determine whether a patient's metabolic control has remained continuously within the target range.

No fasting is necessary for this test.

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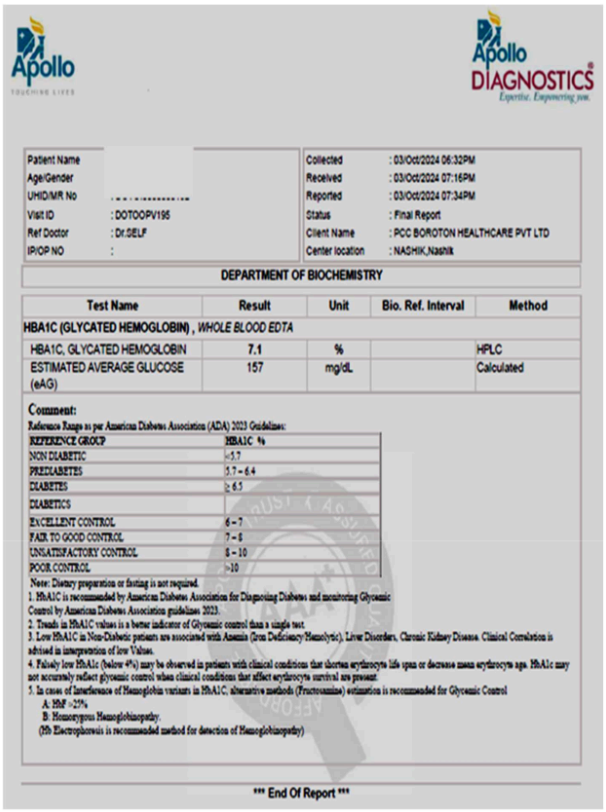
After 21st day of treatment



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Patient Name		Collected	: 03/Oct/2024 06:32PM
Age/Gender		Received	: 03/Oct/2024 07:16PM
UHID/MR No		Reported	: 03/Oct/2024 07:34PM
Visit ID	: DOTOOPV195	Status	: Final Report
Ref Doctor	: Dr.SELF	Client Name	: PCC BOROTON HEALTHCARE PVT LTD
IP/OP NO	:	Center location	: NASHIK,Nashik

DEPARTMENT OF BIOCHEMISTRY

Test Name	Result	Unit	Bio. Ref. Interval	Method
HBA1C (GLYCATED HEMOGLOBIN) , *WHOLE BLOOD EDTA*				
HBA1C, GLYCATED HEMOGLOBIN	7.1	%		HPLC
ESTIMATED AVERAGE GLUCOSE (eAG)	157	mg/dL		Calculated

Comment:

Reference Range as per American Diabetes Association (ADA) 2023 Guidelines:

REFERENCE GROUP	HBA1C %
NON DIABETIC	<5.7
PREDIABETES	5.7 – 6.4
DIABETES	≥ 6.5
DIABETICS	
EXCELLENT CONTROL	6 – 7
FAIR TO GOOD CONTROL	7 – 8
UNSATISFACTORY CONTROL	8 – 10
POOR CONTROL	>10

Note: Dietary preparation or fasting is not required.

1. HbA1C is recommended by American Diabetes Association for Diagnosing Diabetes and monitoring Glycemic Control by American Diabetes Association guidelines 2023.
2. Trends in HbA1C values is a better indicator of Glycemic control than a single test.
3. Low HbA1C in Non-Diabetic patients are associated with Anemia (Iron Deficiency Hemolytic), Liver Disorders, Chronic Kidney Disease. Clinical Correlation is advised in interpretation of low Values.
4. Falsely low HbA1c (below 4%) may be observed in patients with clinical conditions that shorten erythrocyte life span or decrease mean erythrocyte age. HbA1c may not accurately reflect glycemic control when clinical conditions that affect erythrocyte survival are present.
5. In cases of Interference of Hemoglobin variants in HbA1C, alternative methods (Fructosamine) estimation is recommended for Glycemic Control
   A: HbF >25%
   B: Homozygous Hemoglobinopathy.
   (Hb Electrophoresis is recommended method for detection of Hemoglobinopathy)

*** End Of Report ***

After 74 days of treatment

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Patient Name		Collected	: 25/Nov/2024 05:59PM
Age/Gender		Received	: 25/Nov/2024 07:36PM
UHID/MR No	: DOTO.0000000247	Reported	: 25/Nov/2024 08:23PM
Visit ID	: DOTOOPV254	Status	: Final Report
Ref Doctor	: Dr.SELF	Client Name	: PCC BOROTON HEALTHCARE PVT LTD
IP/OP NO	:	Center location	: NASHIK,Nashik

DEPARTMENT OF BIOCHEMISTRY

Test Name	Result	Unit	Bio. Ref. Interval	Method
HBA1C (GLYCATED HEMOGLOBIN) , *WHOLE BLOOD EDTA*				
HBA1C, GLYCATED HEMOGLOBIN	4.9	%		HPLC
ESTIMATED AVERAGE GLUCOSE (eAG)	94	mg/dL		Calculated

Comment:

Reference Range as per American Diabetes Association (ADA) 2023 Guidelines:

REFERENCE GROUP	HBA1C %
NON DIABETIC	<5.7
PREDIABETES	5.7 – 6.4
DIABETES	≥ 6.5
DIABETICS	
EXCELLENT CONTROL	6 – 7
FAIR TO GOOD CONTROL	7 – 8
UNSATISFACTORY CONTROL	8 – 10
POOR CONTROL	>10

Note: Dietary preparation or fasting is not required.

1. HbA1C is recommended by American Diabetes Association for Diagnosing Diabetes and monitoring Glycemic Control by American Diabetes Association guidelines 2023.
2. Trends in HbA1C values is a better indicator of Glycemic control than a single test.
3. Low HbA1C in Non-Diabetic persons are associated with Anemia (Iron Deficiency/Hemolytic), Liver Disorders, Chronic Kidney Disease. Clinical Correlation is advised in interpretation of low Values.
4. Falsely low HbA1c (below 4%) may be observed in persons with clinical conditions that shorten erythrocyte life span or decrease mean erythrocyte age. HbA1c may not accurately reflect glycemic control when clinical conditions that affect erythrocyte survival are present.
5. In cases of Interference of Hemoglobin variants in HbA1C, alternative methods (Fructosamine) estimation is recommended for Glycemic Control
   A: HbF >25%
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