

CRITICAL APPRAISAL OF MADHUMEHA (DIABETES MELLITUS)

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ABSTRACT

Prameha is a disease characterized by urinary disorder, but it may not be inferred that all the urinary disorders caused by urinary tract pathology may be included in prameha. Thus the manifestations of metabolic abnormality as well as urinary tract pathology are included in two symptoms: prabhuta mutrata (Excessive urination) and avila mutratu (Urine turbidity). Therefore a greater significance should be attached to the former i.e. prabhuta mutrata. The excessive urination is due to osmotic diuresis which in turn is due to hyperglycemia. Avila mutrata may be of significance at a late stage. This avila mutrata is turbidity in the urine, which occurs in various disorders of urinary tract and extra urinary tract. But the disorders vary from one another depending on colour (concentration), volume etc. of the urine, which occur due to body reaction with the doshas. Madhumeha is one of the types of vatika prameha and is the last in the list of twenty types of pramehas described by Charaka. Diabetes mellitus, often simply called as diabetes is a syndrome characterized by disordered metabolism and inappropriately high blood sugar (hyperglycemia) resulting from either low levels of the hormone insulin or from abnormal resistance to insulin's effects, coupled with inadequate levels of insulin secretion to compensate. The characteristic symptoms are excessive urine production (polyuria), excessive thirst and increased fluid intake (polydipsia), and blurred vision; these symptoms may be absent if the blood sugar is mildly elevated.

KEYWORDS: Madhumeha, Diabetes mellitus, prabhuta mutrata, avila mutrata, pramehaghna

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INTRODUCTION

Prameha comprises of a number of diseases with various physical and chemical changes in urine. It is also described that if not cured or treated properly, in due course of time, prameha changes into madhumeha (Diabetes mellitus)¹. Prameha is a disease characterized by urinary disorder but it may not be inferred that all the urinary disorders caused by urinary tract pathology may be included in prameha. Thus the manifestation of metabolic abnormality as well as urinary tract pathology are included in two symptoms: prabhuta mutrata (Excessive urination) and avila mutratu (Urine turbidity)². It may be also suggested that the former is more akin to metabolic changes and the latter to urinary tract pathology. Therefore a greater significance should be attached to the former i.e. prabhuta mutrata. The excessive urination is due to osmotic diuresis which in turn is due to hyperglycemia. Avila mutrata may be of

significance at a late stage. This avila mutrata is turbidity in the urine, which occurs in various disorders of urinary tract and extra urinary tract. But the disorders vary from one another depending on colour (concentration), volume etc. of the urine, which occurs due to body reaction with the doshas. Madhumeha is one of the types of vatika prameha and is the last in the list of twenty types pramehas described by Charaka. Astringency associated with sweetness distinguishes it from ikshumeha or ikshuvalikameha in which urine is extremely sweet without any trace of astringency. Because of profuse excretion, loss of ojas is an important feature in madhumeha. In fact, where there is loss of ojas due to negligence every type of prameha can be converted to madhumeha. It is to be noted that ojas has been mentioned as one of the pathogenic materials (dushya) in prameha generally and specially in madhumeha³. Here the term rasaojas is quite significant, which means the

essential nature of ojas. Explaining the pathogenesis of madhumeha, Charaka says that ojas is of sweet nature but vayu associated with astringency (kashayatva) carries it into urinary bladder and manifests as madhumeha. Thus the ojas plays an essential role in diabetes from beginning to the end. In prameha all aspects of ojas are affected. It checks the normal development, reduces immunity, which further causes appearance of pidakas and other complications, diminishes the sexual power, energy and finally leads to death. All these process are related to ojas. Hence the treatment of ojomeha (madhumeha) to promote the ojas and this is an important point which is to be kept in mind which can be achieved with drugs having rasayana and pramehaghna properties.

Diabetes mellitus is the most common endocrine disorder and is defined as a group of disorders that exhibit a defective or deficient insulin secretory process, glucose under utilization and hyperglycemia (Kahn, 1996). Diabetes mellitus, often simply diabetes is a syndrome characterized by disordered metabolism and inappropriately high blood sugar (hyperglycemia) resulting from either low levels of the hormone insulin or from abnormal resistance to insulin's effects coupled with inadequate levels of insulin secretion to compensate. The characteristic symptoms are excessive urine production (polyuria), excessive thirst and increased fluid intake (polydipsia), and blurred vision; these symptoms may be absent if the blood sugar is mildly elevated. Diabetes mellitus is a group of metabolic disorders with one common manifestation: hyperglycemia. Chronic hyperglycemia causes damage to the eyes, kidneys, nerves, heart and blood vessels. The etiology and pathophysiology leading to the hyperglycemia, however, are markedly different among patients with diabetes mellitus, dictating different prevention strategies, diagnostic screening methods and treatments. The adverse impact of hyperglycemia and the rationale for aggressive treatment have recently been reviewed⁴.

ETIOLOGY OF MADHUMEHA (DIABETES MELLITUS)

Diet and exercise

The apathya nimittaja prameha may be due to over eating, lack of exercise and other sedentary life styles and it may be compared to the non insulin dependent (Type-II) diabetes mellitus. Excessive sleep during day and night, lack of exercise, laziness and frequent and excessive use of new grains like hayanaka, yavaka, chinaka etc., use of new peas, black gram and other pulses along with ghi, tila, tilapisti etc. and the use of

sugar cane juice, milk and its products, fresh wine, dadhivikara, meat soups of different animals, residing in water or near water and all other materials vitiating kapha, results into prameha in susceptible individuals⁵. All the above etiological factors of prameha are similar to the modern concept of diabetes mellitus, which is a major health hazard affecting millions of people all over the world. Sushruta⁶ and Vagbhata⁷ have similar opinion regarding the etiological factors. In addition to the above mentioned factors, Charaka has emphasized that anxiety, anger, worry, grief and similar other stress producing factors lead to the development of prameha in susceptible individuals. Consuming foods that are low in fiber and high in glycemic loads is associated with increased risk of DM. There is now a considerable amount of evidence to suggest that rapid acculturation is associated with increased rates of type II diabetes mellitus. Present day lifestyle predispose to over nutrition and obesity, which intern increases the risk of developing insulin resistance and type II diabetes, particularly in individuals or populations with a genetic predisposition for diabetes. Physical inactivity and high intakes of energy dense foods lead to an energy intake in excess of requirements. The type of carbohydrate also seems to be important. Carbohydrates were formerly classified as simple and complex. The new classification is based on the glycemic index (GI), which ranks foods based on their ability to increase blood glucose. For example, glucose has a GI of 100; baked potatoes have a GI of 93, carrots 49, pasta (remarkably) 39, and peanuts 14. The relationship between dietary fat and the development of diabetes is likely through the influence of obesity. If the amount of carbohydrate consumed exceeds the ability to burn it as fuel, it will be converted to fat. Consumption of high levels of carbohydrate may lead to a decrease in LDL, but an increase in triglycerides and a decrease in HDL. Carbohydrates may also impair clearance of lipids from the circulation. It appears that dietary carbohydrate is a double-edged sword, with both advantageous and deleterious effects⁸. Lack of exercise is an independent factor from the body mass index. Reduced activities are associated with the development of type II DM.

Genes

The sahaja prameha may be due to some genetic defect and it may be inherited from parents. It is due to some abnormality in sperm or ovum (i.e. bija dosha) and it manifests early in life⁹. This sahaja type of prameha can be compared with type-I (Insulin dependent juvenile onset) Diabetes mellitus. It is important, therefore, to distinguish between diabetogenic genes and diabetes-

related genes (e.g., those regulating appetite, energy expenditure, and intra abdominal fat accumulation). The latter class of genes may be defined as not being specific (i.e. not being mainly limited to people with diabetes), as by themselves not being sufficient to cause diabetes and not necessarily being essential. These genes are best considered as genetically determined risk factors. An example might be a gene or group of genes causing obesity. These genes would not be limited to individuals destined to become diabetic (e.g., not specific), would not be sufficient since most obese individuals do not become diabetic, and would not be essential since, depending on the population, a considerable number of lean individuals develop Type II diabetes. A diabetogenic gene may be defined as being essential and relatively specific but, given the polygenic nature of Type II diabetes, may not be sufficient in itself to cause diabetes. For example, a mild alteration in the activity of glucokinase, such as is found in some MODY patients, which reduces insulin secretion, is relatively specific, being mainly limited to families with this type of diabetes; it may not be sufficient to cause diabetes in most individuals unless there are increased requirements for insulin such as that due to superimposition of acquired insulin resistance (e.g., obesity, physical inactivity, or pregnancy) but it may be considered to be essential since without this defect, diabetes would not otherwise occur¹⁰.

Mental Factors

DM is an established psychosomatic disorder. It is combined with anxiety, fears and fear of death, inappropriate assessment of their abilities, hypothermia, anxiousness, and vegetative dysfunctions. High risk of complications of DM was associated with influence of psycho stressors and depressive disorders.

So both sciences have accepted the role of diet, activities and mental factors in the development of diabetes Mellitus.

PATHOGENESIS OF MADHUMEHA (DIABETES MELLITUS)

Doshas like kapha, pitta and vata and dushyas like medas, rakta, shukra, ambu, vasa, lasika, majja, rasa, ojas & mamsa are responsible for the causation of prameha which is of twenty types¹¹. Prameha manifests due to complex interaction of bijadushti, doshas & dushyas which causes several distinct types of prameha.

According to Sushruta, due to prameha janaka ahara (diet) and Vihara (life style and behavior), aparipakva ama, vata, pitta and kapha become excited and vitiate mainly medo dhatu along with other dhatus. These excited doshas and vitiated dhatus reaches basti via

mutravaha srotas and remain there for some time and cause prameha of various types by excreting vitiated dhatus with urine¹².

Type II DM is characterized by impaired insulin secretion, insulin resistance, excessive hepatic glucose production, and abnormal fat metabolism. Obesity, particularly visceral or central (as evidenced by the hip-waist ratio), is very common in Type II DM. In the early stages of the disorder, glucose tolerance remains near-normal, despite insulin resistance, because the pancreatic beta cells compensate by increasing insulin output. As insulin resistance and compensatory hyper insulinemia progress, the pancreatic islets in certain individuals are unable to sustain the hyper insulinemic state. IGT (Impaired Glucose tolerance) is characterized by elevations in postprandial glucose. A further decline in insulin secretion and an increase in hepatic glucose production lead to overt diabetes with fasting hyperglycemia. Ultimately, beta cell failure may ensue.

METABOLIC CHANGES DURING THE DEVELOPMENT OF TYPE II DIABETES MELLITUS (DM)

Insulin secretion and insulin sensitivity are related, and as an individual becomes more insulin resistant (by moving from point A to point B), insulin secretion increases. A failure to compensate by increasing the insulin secretion results initially in impaired glucose tolerance (IGT) and ultimately in type II DM¹³.

Abnormal Muscle and Fat Metabolism

Type II DM is characterized by impaired insulin secretion, insulin resistance, excessive hepatic glucose production, and abnormal fat metabolism. Obesity, particularly visceral or central (as evidenced by the hip-waist ratio), is very common in type II DM. Due to inefficiency of the cell to metabolize glucose, reserve fat of body is metabolized to gain energy. When fat is broken down in the body, it uses more energy as compared to glucose.

Kapha dosha is the prime dosha which plays an important role in the manifestation of the disease, it is considered as madhumeharambhaka dosha. Its bhautika sanghathana is prithvi and ap mahabhutapradhana and it is having gunas like guru, shita, mridu, snigdha, madhura, sthira and picchila. In case of prameha due to the intake of etiological factors there will be vitiation of all these gunas but predominantly there will be vitiation of drava guna, it has been also mentioned that bahudrava shleshma is the dosha vishesha in case of prameha which in turn affects the sthira or baddha guna of vitiated kapha, this vitiated kapha tries to combine with the dhatu which are having similar quality as the kapha i.e. in

which it takes ashraya, like rasa, mamsa, meda, majja and shukra. This makes it easy for kapha to vitiate these dhatus by increasing kleda guna of these dhatus. These vitiated dushyas along with the kleda are excreted in the urine leading to bahumutrata. Medas vitiation is common and it is the dominant dushya in pathogenesis of prameha. Kapha & medas have close resemblance regarding functions as well as qualitative parameters. So both kapha and medas are vitiated more or less by same etiological factors. In prameha, medas is vitiated in two ways – abaddha & bahutva¹⁴. Concept of bahudrava kapha and abaddha medas may be correlated with abnormal fat metabolism. Insulin deficiency also reduces levels of the GLUT4 glucose transporter, which impairs glucose uptake into skeletal muscle and fat and reduces intracellular glucose metabolism. Ketosis results from a marked increase in free fatty acid release from adipocytes, with a resulting shift toward ketone body synthesis in the liver. Reduced insulin level, with elevation of catecholamines & growth hormone, increases lipolysis and the release of free fatty acids. Normally, these free fatty acids are converted to triglycerides or VLDL in the liver. However, in DKA, hyperglucagonemia alters hepatic metabolism to favor ketone body formation, through activation of the enzyme carnitine palmitoyltransferase I. This enzyme is crucial for regulating fatty acid transport into the mitochondria, where beta oxidation and conversion to ketone bodies occur.

Insulin resistance, the decreased ability of insulin to act effectively on target tissues (especially muscle, liver, and fat), is a prominent feature of Type II DM and results from a combination of genetic susceptibility and obesity. Insulin resistance is relative, however, since supernormal levels of circulating insulin will normalize the plasma glucose. Insulin dose-response curves exhibit a rightward shift, indicating reduced sensitivity, and a reduced maximal response, indicating an overall decrease in maximum glucose utilization (30–60% lower than in normal individuals). Insulin resistance impairs glucose utilization by insulin-sensitive tissues and increases hepatic glucose output; both effects contribute to the hyperglycemia. Increased hepatic glucose output predominantly accounts for increased FPG levels, whereas decreased peripheral glucose usage results in postprandial hyperglycemia. In skeletal muscle, there is a greater impairment in nonoxidative glucose usage (glycogen formation) than in oxidative glucose metabolism through glycolysis. Glucose metabolism in insulin-independent tissues is not altered in Type II DM. The obesity accompanying Type II DM, particularly in a

central or visceral location, is thought to be part of the pathogenic process. The increased adipocyte mass leads to increased levels of circulating free fatty acids and other fat cell products. For example, adipocytes secrete a number of biologic products (nonesterified free fatty acids, retinol-binding protein 4, leptin, TNF- α , resistin, and adiponectin). In addition to regulating body weight, appetite, and energy expenditure, adipokines also modulate insulin sensitivity. The increased production of free fatty acids and some adipokines may cause insulin resistance in skeletal muscle and liver. In Type II DM, insulin resistance in the liver reflects the failure of hyperinsulinemia to suppress gluconeogenesis, which results in fasting hyperglycemia and decreased glycogen storage by the liver in the postprandial state. Increased hepatic glucose production occurs early in the course of diabetes, though likely after the onset of insulin secretory abnormalities and insulin resistance in skeletal muscle. As a result of insulin resistance in adipose tissue and obesity, free fatty acid (FFA) flux from adipocytes is increased, leading to increased lipid [very low density lipoprotein (VLDL) and triglyceride] synthesis in hepatocytes. This lipid storage or steatosis in the liver may lead to nonalcoholic fatty liver disease and abnormal liver function tests. This is also responsible for the dyslipidemia found in Type II DM [elevated triglycerides, reduced high-density lipoprotein (HDL), and increased small dense low-density lipoprotein (LDL) particles¹⁵. Abnormal Muscle and Fat Metabolism, obesity concept was well established in both medical sciences. Impaired insulin secretion may be due to involvement of both jatharagni & dhatvagni along with pitta dosha. Insulin resistance is due to excessive accumulation of kapha inside the channels which circulates nutrients to the muscles. Excessive hepatic glucose production may be due to excess stimulation by vata (due to obstruction by kapha) to pitta dosha. Baddha medas may be compared to fat deposits & abaddha medas may be compared to free fatty acids (FFA). Abnormal muscle metabolism may be compared to mamsa dushti. The overall metabolic dysregulation associated with madhumeha(DM) causes secondary patho-physiologic changes in multiple organ system that impose a tremendous burden on the individual with DM & on the health care system. There is a complex interaction among doshas, dushyas & bija dushti brings disequilibrium state of humors, which inturn causes agnidushti resulting into abnormal digestion & metabolism. Proper functioning of agni & patency of srotas is vital for proper utilization of nutrients but in case of madhumeha both are decreased causing abnormal

secretion of insulin, excess hepatic glucose production & abnormal fat & muscle metabolism.

CLINICAL FEATURES OF MADHUMEHA (DIABETES MELLITUS)

Madhumeha is characterized by kesheshu jatilabhava, asya madhurya, karapada daha, karapada suptata, mukha talu kantha shosha, pipasa, alasya, kaye malam, kaya chhidreshu upadeha, paridaha angeshu, satapada pipilikabhi mutrabhisaranam, mutra cha mutra dosham, vishra sharira gandha, nidra sarva kalam, tandra sarva kalam, swedadhikya, sithilangata, shaiyya asana swapneshu sukhe ratishcha, hridaya-netra-jihva-sravana-upadeha, ghanangata, kesha nakha ativridhi, shita priyata, satapada pipilika sharirabhisaranam, snigdha gatrata, picchila gatrata, guru gatrata, madhura mutrata, shukla mutrata, sada, shwasa, deha chikkanata, dantadinam maladhyatvam, gala talu shosha, prabhuta mutrata, avila mutrata, sthauilya, bahuashi, snigdhangata, shayyasana swapnasila, krishta, alpashi, rukshata, paribramana shila, mutra madhurya, mutra kashaya varna, mutra pandu varna and tanu madhuryata^{16,17,18}.

Classical symptoms of DM are polyurea, polyphagia, polydipsia, weakness, cramps on walking, libido joint pain, weight loss, burning sensation in feet, glycosuria, dry mouth & tongue, deep sighing respiration (Kusmaul breathing), skin infections, banalities (devoid of freshness or originality), blurred vision, cardiac pain, neuropathy, nephropathy, ulceration, dementia, cognitive impairment, fatigue, pruritus vulvae, incontinence of urine and stool and weight loss. It shows that there is a similarity between madhumeha & DM in relation to clinical features.

DIAGNOSIS OF PRAMEHA

Kaphaja prameha are of ten types and they are curable because of the samakriyatvat, pittaja prameha are of six types and they are only palliable because of the vishamakriyatvat, vataja prameha are of four types and they are incurable because of the mahatyayatvat¹⁹. In kaphaja prameha, the dosha involved, viz. kapha and dushyas involved viz. medas etc., have similar attributes. Therefore bitter and pungent drugs prescribed for this condition alleviates both the dosha as well as dushyas. In pittaja prameha involved dosha is pitta and dushyas are same as that of kaphaja prameha i.e. meda, mamsa and shariraja kleda. These dushyas have opposite gunas of pitta which makes the chikitsa difficult i.e. if pitta is treated with shita and madhuradi dravyas, they are viruddha to pitta but are medo- mamsa and kledakara and if medadi dhatus are treated with tikshna ushnadi dravyas, they cause pitta vridhi, The dosha, pitta and the dhatus medas, mamsa and kleda have viruddhagunas,

which overpower the purpose of chikitsa. Therefore the six pittaja prameha are yapyas. In vatika pramehas the deeper dhatus like majja etc. are afflicted, because of which they are very serious in nature; they may be associated with serious complications that's why they are called as Mahatyayatvat.

OTHER CONDITIONS OF ASADHYA PRAMEHA

Jata pramehi is asadhya due to bija bhaga avayava dushti in medovaha srotomula as there is an irreversible madhumeharambhaka dosha dushti since the birth itself. Chakrapani opines that it can be caused by father, mother or grandfather which mean that the disease may get inherited from generation to generations²⁰. Madhumehi who has bala mamsa kshaya is considered asadhya according to ayurveda and thus can be left untreated. All Pramehas if left untreated terminate into madhumeha which is asadhya. Pramehas with arishta lakshanas is asadhya. A patient who hates hygienic habits like Snana, chankramana and one who has mandoshnata, who is atisthula, snigdha dies of prameha. Prameha associated with prameha pidakas is asadhya. Prameha associated with atiprasrita (atishayam dhatu mutra srava yuktam) is asadhya. If prameha is gadha (kala prakarsata) then it is asadhya.

UPADRAVA OF PRAMEHA (COMPLICATIONS OF MADHUMEHA)

1.General Complications

Trishna, Atisara, Daha, Daurbalya, Arochaka, Avipaka, Putimamsa pidaka, Alaji, Vidradhi²¹ etc.

2.Specific Complications²²

Kaphaja Prameha

Makshikopasarpanam, Alasya, Mamsopachaya, Pratishyaya, Shaithilya, Arochaka, Avipaka, Kapha praseka, Chardi, Nidra, Kasa and Shwasa.

Pittaja Prameha

Vrishanayoravadaranam, Basti-bheda, Medhra-toda, Hridaya shula, Amlika, Jvara, Atisara, Arochaka, Vamathu, Paridhumayana, Daha, Murccha, Pipasa, Nidranasa, Pandu, Pita-vinmutranetratvat.

Vataja Prameha

Hridgraha, Lauilya, Anidra, Stambha, Kampa, Shula, Baddha purishatva.

PRAMEHA PIDAKA

Brihatrayi have described prameha pidaka as a major complication of prameha, and these may develop without prameha in the individuals having primary medodushti. These pidaka require surgical intervention.

In relation to origin of prameha pidaka Sushruta says that due to atony of rasayanis in patients of prameha, doshas do not move upward and as such pidaka appear in lower parts of the body in case of madhumeha. According to

Sushruta madhumeha along with pidaka is asadhya. He narrated that these pidaka occur due to tridosha and vitiated meda & mamsa. These pidakas are mainly found in muscular regions, joints and vital points (marma)²³. Both sciences described exhaustive explanation about complications having certain similarities in both like Hridgraha, Laulya, Anidra, Stambha, Kampa, Shula, Baddha Purishata, Udavarta, Shosha, Kasa and Shwasa. The chronic complications of DM affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease. Chronic complications can be divided into vascular and nonvascular complication. The vascular complications of DM are further subdivided into microvascular (retinopathy, neuropathy, & nephropathy) and macrovascular complications [coronary artery disease (CAD), peripheral arterial disease (PAD), cerebrovascular disease]. Nonvascular complications include problems such as gastroparesis, infections, and skin changes. Long-standing diabetes may be associated with hearing loss. Whether type II DM in elderly individuals is associated with impaired mental function is not clear.

CONCLUSION

Prameha comprises of 20 sub varieties of diseases with various physical and chemical changes in mutra. Madhumeha is one of the variety included under vataja prameha and it is also mentioned that if prameha is not cured or treated in due course of time it gets converted to madhumeha. Madhumeha may be compared to diabetes mellitus because of the similarities in both diseases for example in respect to etiology, pathogenesis, clinical features & prognosis. Classical signs & symptoms of prameha are prabhuta mutrata & avila mutrata it signifies the metabolic abnormality as well as urinary tract pathology. Prameha can be diagnosed based on either of the following two important criteria i.e. slight increase in quality of urine associated with premonitory symptoms and complete appearance of premonitory symptoms or half of the premonitory symptoms associated with excessive urination. Disease madhumeha is considered as one of the incurable disease because of the vata predominancy, involvement of bijadushti, extension of disease pathogenesis up to deeper dhatus like majja etc, deficiency of ojas, and antagonicity on the lines of treatment of dosha & dushya involvement. It manifests symptoms & signs pertaining to vata, pitta and kapha quite often and this symptomatology may disappear at time and reappear at appropriate time. Negligence in management of this disease leads to development of seven types of severe pidakas over muscular areas, vital

parts & joints. So it can be concluded that description of etiology, pathogenesis, signs and symptoms, complications and prognosis appears to be similar in both Ayurveda and Modern medicine in respect to madhumeha (diabetes mellitus).

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