Diabetes mellitus

By

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A first thesis

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Diabetes Mellitus

Its Characteristics. Physiology. Pathology & Treatment

With Three Cases

Definition. So far as our present knowledge of this disease informs us, we may define it as a disease of the nervous system, characterized by the secretion of an abnormally large quantity of urine containing sugar in large proportion.

Like all other diseases no two cases are alike and no character which is absent in any one case can be included in the definition.

Only those characters that are present in all cases can be considered essential and some even of these may be no part of the disease but only accompaniments of it, as cause or effect or effects of a common cause.

We have to consider then what are the invariable characters.
Character of a typical case of Diabetic Mellitus and how far these are connected together and on what causes they depend.

Description of a typical case—

The patient usually is most likely to be a male of middle age complains of excessive thirst and at the same time excessive urination.

It is unsteadied though his appetite is good or even voracious. The urine passed in twenty-four hours is several pints in quantity of a pale chlor of high specific gravity and contains a notable quantity of sugar (one per cent or more).

The skin is parched and dry there being little or no perspiration.

Thirst must be considered as an effect rather than a cause of the excessive urination. It is caused by excessive elimination by other channels as in Diarrhoea vomiting fever perspiration &c.

Whenever water is withdrawn from the tissues there is an increased demand for fatty material from the blood and the main source of it to the blood is the Alimentary Canal. Have a desire for fluid to supply this deficiency.

II. Polyuria. On the other hand may be said to be the effect of the large amount of fluid drunk and—
And this at one time was considered to be the case but the polyuria does not abate proportionately as the fluids ingested are restricted. Restriction of drink does produce decrease in the quantity of urine but not to a proportionate extent.

It has been stated that in some cases the amount of urine may exceed all the fluids taken but Wuermer disputes this. However this may be there is something in the Diabetic patient. More than the excessive drinking that causes the polyuria. We find that when a Diabetic patient and a healthy person take a large amount of fluid (each the same quantity) the Diabetic will pass more urine than the healthy person though both pass more than when the water is restricted to a small quantity.

We must therefore consider the polyuria in part at least an effect of something else than the excessive thirst.

111. Inanition and increased appetite
This inanition may depend to some extent on the polyuria for it is found that the amount of urea in the urine of Diabetic patients is increased. Most of the nitrogenous matters are excreted in the form of urea so that when this is increased the tissues of the body suffer a proportionate loss.
as it requires nitrogenuous material to make them up. In like manner the increased loss of nitrogenuous matter in the form of urine occasions a drain on the tissues and an increased demand for more material analogous to the increased demand for water occasioned by its increased loss in perspiration. The voracious appetite then is occasioned by the loss of nutriment and tissue forming material the latter as Causing the resentment.

IV. The urine. He said that the quantity varies from the normal up to thirty pints. The colour is pale clear or slightly yellow coloured and the specific gravity is high usually from 1040 to 1050. This being due to the large quantity of saccharine material held in solution in the urine.

Pavy found that sugar is a natural constituent of normal urine and that in Diabetic there is a larger amount present than normal. The blood also of Diabetic patients has been found to be highly charged with sugar. This substance sugar has a strong affinity for water and will attract it from the tissues instead of allowing it with the nutritious particles in solution to pass out of the circulation and nourish the body.
This withdrawal of water from the tissues into the circulating blood increases its volume; consequently increased the blood pressure.

Increase of blood pressure allows the urine to pass more rapidly through the glomeruli in the kidneys & to produce an increased secretion of urine.

The nitrogenous elements instead of being allowed to transude through the capillaries to fill the urine, the body is carried with the circulation to the kidneys & thus passes out in the form of urine & produces evacuation and thirst. Appetite merely expresses a want of nourishment, as thirst similarly expresses a want of fluid. Here a difficulty arises which may be made clearer farther on. Why is it that through the kidneys only there is an increased transudation?

One would think that the blood pressure generally would be raised & that consequently there would be an increased secretion of sweat, saliva & other fluids besides urine. It thus appears that the elimination of sugar in excess is the essential characteristic of diabetes; and we have to consider its mode of production both physiologically & pathologically.
Physiology. At one time it was considered that sugar was properly a vegetable product and did not exist in the animal organism except as a result of disease. It is now well known that it can be obtained from many tissues of the body and that it exists in considerable quantity in milk.

Claude Bernard, in the year 1848, exhibited before the Academy of Sciences some alcohol made from sugar extracted from the liver and they inferred that sugar was formed in this organ by the action of having flowed in the liver of animals fed solely on animal diet. From more extensive experiments made by Bernard, his theory of animal glycogenesis became developed. He found sugar in considerable amount in the portal vein hepatitis, but failed to detect any in the portal vein. The sugar thus found had passed through an amylace stage.

Glycogen or animal starch was produced in the liver both during life and after death by virtue of a kind of fermentation process set up by the blood blood. Obliga or almost any animal fluid being sufficient to effect the transformation. As a proof of such a process a rabbit was killed and the liver quickly taken and a cannula introduced into the portal vein. A stream of pure water passed through the circulation of the organ.
The fluid passing from the hepatic vein was collected in three different vessels. The first vessel almost pure blood gave evidence of an abundant quantity of sugar. The second, largely diluted showed less sugar, and the third none. When a portion of the same liver was divided into small pieces mixed with saliva and heat applied it gave a decided saccharine reaction. It was also found that when the liver was washed quite free from blood and other substances and put aside for a time it gave proof of the existence of sugar due to a fermentive action in the liver peculiar to itself. Bernard supposed that while glycogen needed in some hepatic cells, the ferment had its seat in others. Dr. Parry is of opinion that the transformation of the starch into sugar was due to a post mortem change and shows that blood removed from the right ventricle of heart during life by means of a catheter introduced by one of the veins contains a very small proportion of sugar although not absolutely free of that substance. It shows that the blood in every part of the vascular system presents very nearly the same behavior if a small piece of the liver be immediately taken from an animal recently killed and be either frozen or subjected to the action of boiling water so as to prevent or arrest fermentive changes.
Changes it gives evidence only of a trace of sugar. Dr. Perry's experiments have been repeated and varied by Dr. McConnel, who adopts his views as to the formation of sugar being a post mortem change. The existence of a special ferment has been inferred although it has not been isolated. According to Schäffer the formation of sugar is due to the excretory production of it, not by glycogen, but by the ferment influence of food on the production of glycogen. Dr. Perry found that dogs fed wholly on animal diet the proportion of glycogen in the liver was 7.19 per cent; on vegetable food—potatoes with barley meal or bread—the average percentage of glycogen in the liver was 1.72. Not only was the proportion of glycogen in the liver increased, but the liver was nearly double its weight relatively to that of the animal. The quantity of glycogen which the dog forms after meat is more than quadrupled by a diet of potatoes and grain. With sugar was mixed with animal food similar results were obtainable. With four dogs the glycogen gave an average of 14.5 per cent of the liver were increased in size as in omnivorous diet the same generally saccharine. In the case of rabbit the same results were obtained, when two of these animals were killed fasting the livers respectively yielded 1.3 and
1/4 per cent of glycogen. The liver of the fed on sugar + starch afforded 15.4 per cent. That of another
on cane sugar + starch gave 16.9 per cent.
Further experiments made with these animals showed
that the large formation of glycogen under a diet
of starch & sugar was not diminished by the admixture
of their food with phosphoric acid, leguminous, potassium acetate
or citrate of potash. On a diet of gum arabic the
glycogen was likewise and with olive oil, gelatine or
albumen the product was absent or only a trace noted.
It may be asked what becomes of the sugar
derived from the transformation of glycogen and
was changed during life into the blood. At one time
Bernard was of opinion that it was consumed in
the lungs but afterwards with other physiologists
believed it to be used up in the nutrition of the tissues
more particularly of the muscles. He found that by
increasing the secretions of the stomachs increasing its
muscular activity, the sugar in the blood of the limb
underwent active destruction. Thus it is clearly
proved that sugar in the blood plays an important
part in nutrition.

On what part of the nervous system does the
production of glycocera depend?
So the genius of Bernard we are indebted for the
answer to this question. He found that by puncturing
the floor of the fourth ventricle above the origin of the
pneumogastric nerves the urine became saccharine.
Some further experiments showed that the effect was
not produced as at first imagined by direct
innervation of the pneumogastrics, as puncture of the
medulla caused the urine to be saccharine
although these nerves were divided. It was found
that galvanizing the peripheral segments of the
divided pneumogastrics no sugar appeared in
the urine, but when the poles were applied to the
crural segments sugar quickly followed in
the urine. It is thus evident that the
pneumogastric nerves take no share in conveying
the glycosura influence from the brain to the
viscera, though capable of conveying it in the
contrary direction. Bernard inferred that
the white lay along the spinal cord v. subliminal
nerves in the vaso motor nerves of the liver, the
effect being to cause relaxation of the bloodvessels
and prital increase of function.
According to Schiff more marked lesions of the
pneumoartic was followed by excessive retention
of sugar in the urine. Section of the posterior
peduncles of the cerebellum also gave rise to
glycosura.
glycosuria. Pruritus of the meatus gave rise to glycosuria in its greatest intensity, as produced by D'Ornars. Decapitation or transverse section of the meatus produced a similar effect.

Dr. Pavy cut the cord between the second and third vertebra, life being retained for some time artificial respiration without giving rise to any symptom of diabetes. Schaff produced prolonged diabetes by breaking up the cord opposite the second dorsal vertebra and the urine was rendered sugarine by various injures about the roots of the brachial plexus, while some experiments testified that this result followed section of the posterior column that of followed section of the anterior and lateral columns of the cord.

It appears that the region most sensitive to the diabetic influence is limited in front by a line connecting the origins of the auditory nerves and behind by one joining the origins of the pneumoglossus.

It is said that wounds of the medulla oblongata to produce diabetes must involve the auditory fasciculi, it is now an established fact that lesions of the hollow bodies is almost invariably present in those who have died from diabetes.

The part of the central spinals axis in which... experimental.
experimental injuries, have been found to under
the urine becomes reabsorbed from the caudal
thalamus to the ureter end of the cervical enlargement
of the cord. By tracing the glycogon influenced
to the viscera the results of experiments plan to indicate
that it leaves the cord in the cervical region by
filaments in connection with the sympathetic and
descends along the vertebral artery to the third
cervical ganglion, the veins which accompany
the subclavian artery it reaches the first dorsal
ganglion or from thence is conveyed by the prevertebral
cord the splanchnic nerves to the splanchnic plexus to
the liver. Glycogon has not been found to follow
the cutting of the dorsal prevertebral cord or of the
splanchnic nerves or of all the nerves entering the
liver in the lesser splanchnic comprising the entire
nervous supply of the organ.
It has been found that after section of the
splanchnic nerves or of the branches leading from
thence to the liver, plane of the medulla no longer
causes the urine to be glycogonized though when
the urine is made glycogonized by puncture of
the medulla the glycogoninity does not cease
upon section of the splanchnics.
Abolition of the liver by the section of medulla or
passage
Anesthesia cause glycosuria
Bernard also demonstrated that the injection of
Morphine or Opium caused an increase gasolubility
of both blood and urine and that these results
afford evidence that the poison causes paralysis
of the base motor nerves of the liver, thus rendering
the vessels larger and its circulation more active just
as by fracture of the fourth ventricle
Glycosuria has also been observed after poisoning
by strychnia or morphine and according to Bernard this
result is brought about in the same way as in the case
of Opium. The glycosuria effect of phosphoric
acid was first pointed out by P. Party who found
it to result whether the solution is introduced into
the alimentary canal or directly into the blood.
It has been supposed that sugar becomes converted
in the tissues more particularly in the muscles into
lactic acid by the aid of a ferment which theoretically
possible that the want of this ferment may allow the
sugar to remain in its unchanged state and escape
by the kidney. This theory is not in accordance
with the fact that animals may be frozen to death in
process which must prevent all fermentive action
without being rendered glycosuria, nor is it consistent
with the clinical history of Diabetes which gives us
No reason to connect it with any attendant failure in the general nutrition of the body. We conclude that the superabundance of sugar circulating in the body essential to diabetes is in matter of increased supply not of diminished consumption and so the problem limits itself to the intrusion of excess of sugar into the blood. The excess of sugar may be derived from glycogen resulting either from its increased production or from its increased saccharine transformation or it may as experiment with curara suggest rather made instead of glycogen out of its materials. The view most consistent with our present knowledge is that with the diabetes in which sugar is made in the body out of the protein substances the leading view is a perversion of hepatic action which while it does not hinder it possibly exaggerates the disruption of the protein bodies putrefies in the urine except for glycogen. Thus the material which ought to be retained as glycogen to form sugar is replaced by sugar of which the greater part is expelled. As Almond first though every gland has two kinds of nerves which have antagonistic functions on stimulating or the other repressing secretion.
Pathology and Morbid Anatomy —

Of the very little is known except some valuable observations which Dr. Dickinson has described and theories founded thereon. Most authorities are agreed that it is to the nervous system that we are to look for the lesion giving rise to Diabetis. The vasomotor or vasoconstrictory nerves or their centres are so affected by paralyses or irritation, that the small arteries and capillaries are dilated and consequently the blood rushing through the system in a comparatively arterialized condition, thus giving rise to the state which Poisy found to produce glycosuria.

Brain. On making a rough naked eye examination of the brain it appears firm in texture and natural in colour. On looking more minutely we may detect a fine orbiform appearance in limited patches, like pinholes, each puncture containing a bloodvessel much smaller than itself. Sometimes though rarely cavities about the size of peas are seen in connection with processes of the pia mater in the pons. The fluid in and around the brain is slightly less clear or colourless. Some small — slightly injected patches may be seen on the cord of that central canal may be detached.
Commisura Bovini. The small cavities in the brain are sometimes globular, and at other times elongated or narrow. They are probably caused by the destruction and absorption of nervous matter around the bloodvessels and sometimes the contents of the vessels escape into the surrounding tissues leading to degeneration and softening. The walls of these vessels may be seen to be remarkably fringed along its borders by defined lines of cellular blood corpuscles.

These small cavities increase in size as the disease progresses, and sometimes contain crystals of haematin suggesting their haemorrhagic origin. Their most common seats are the olie telencephalica, medulla oblongata, as well as the centre of the prosencephalum. Numerous erasures may also be seen by the naked eye in patches of the white matter of the convolutions. Each contains an artery, around which is an irregular space which contains haematine crystals, nerve cells & degenerated nervous matter. Pus may also be seen along the arteries of the cord or especially in the transverse commissure.

Liver. Dr. Poul observed a gorged condition of the veins of the Portal system, as well as chronic inflammation with constricted enlargement of the liver.
liver in conjunction with jaundice, Autralia confirms this. Dr. Wilks has noted that the diabetic liver is dark, tough, and homogeneous.

The bile according to Dr. Panw is red or browned-red with a deposit after standing of epithelium and granular matter, but it is sometimes yellow or yellowish tinctured.

Microscopically examined, the diabetic liver shows an overgrowth and crowding of epithelium cells along with hardening of hyperaemia. The hepatic changes may be summed up to be hyperaemia and its consequences—enlargement hardness and overgrowth of epithelium + fibrous tissue giving the organ the appearance of cirrhosis to a slight extent.

Lungs. For a long time pulmonary changes following on Diabetics were regarded as Pithiacal. Nephritis and ascites were common and these changes though resembling Pithia are not really tubercular: in fact Diabetic patients are seldom the subjects of true tuberculosis.

The process appears to be a form of pneumonia—chronic circumference and calcification which rapidly lead to the formation of cavities. Inflammatory affections of the lung in the lungs occur in the course of Diabetes.
The cheesy-like nodules occurring in the lungs of diabetic patients present no tubercular character. The air cells which are the seats of the exudation are occupied by a Corpuscular Fluid like in ordinary chronic pneumonia. The walls of the air cells break down and thus cavities are formed. The seat of the exudation is in the lower part of the upper lobe, whereas in true tuberculosis it is the apex which is affected.

Dr. Pearsall of opinion that these changes are due to the haemorrhage. Exudation of the blood is suppressed and the lung of the blood is reduced by treatment. The susceptibility to pulmonary complications is correspondingly decreased.

According to others these changes are due to the action of the nervous system and adduce instances in which pneumonia or pleurisy result from injuries to the nervous structures. Dr. John Reid found that in sections of the pneumogastric nerve pneumonia was of frequent occurrence. Dr. Seguier found that in injuries of the brain pneumonia bronchial effusion & extravasation of blood into the pulmonary tissues was common especially when the injury was situated at the foramen magnum. Dr. Pery found pleurisy to be a constant result of section of the sympathetic cord.
Immediately above the superior thoracic ganglia this is of especial interest since we may suppose that with the lungs as with the liver the motor influence is conveyed in the later part of its course led by the sympathetic nerves.

Looking at the altered function of the liver in diabetes as due to aetiological hyperaemia originating in cerebral irritation directed to the gland ultimately by the sympathetic nerve we may with much probability assign the state of the lungs to a similar result of the same central influence.

Kidneys. The kidneys are usually found to be enlarged and congested perhaps due to increase of function. From noticed in connection with diabetes an enlarged gland occasionally congested state of the kidneys a portion of the organ made from the recently dead body has assumed on exposure to the air a peculiar deep orange-reddish tint. The tissue is often seen from fatty degeneration within the tubes, overgrowth of fatty infiltration of the epithelium.

The other organs of the body are generally atrophied, the heart being below its natural size, weight and its muscular substance stiff, fatty and flecked with a yellowish colour.
The urine. The quantity of urine increases with the severity of the disease and may amount to thirty pints daily. It soon loses any habitual turbidity or exudative deposition, becomes bright and clear with a peculiar odor which is not as well marked as that of the breath, has been likened to that produced during lactic fermentation, which is similar to that of acetone.

The urine attracts flies during warm weather, shows ammoniacal decomposition, acquires occasionally a viscous odor, depositing a bulky white sediment of yeast. The specific gravity ranges from 1.025 to 1.050. The quantity of sugar in the urine passed during twenty-four hours varies from two or three ounces to three or four pounds. The average quantity of urea is often increased five or six times above the natural amount (30 x 10).

The quantity of uric acid is according to some observers greatly reduced, according to others remains about normal. There is a considerable increase of chloride of sodium + in some cases of the faeces of lime + magnesia. The remaining constituents of the urine are about their natural proportion.

Tests for sugar. Fermentation test: Add a little yeast to the urine in a suitable vessel and expose the mixture.
Mixture to a temperature of seventy or eighty degrees Fahrenheit. If sugar be present an effervescence will speedily begin, carbonic acid will escape, the liquid will acquire a vinous colour. This test is very delicate as the part of sugar may be detected at the thousand parts of wine. By collecting the carbonic acid over mercury and measuring it we may ascertain with tolerable accuracy the amount of sugar present, allowing for each cubic inch of gas the grain of sugar.

Sulphuric acid test——Dry a few drops of the urine on a porcelain plate & let fuel on the spot a drop of sulphuric acid diluted in the proportion of one of acid to five or eight of water & if sugar be present it gives a blackish colour.

Tannin test——Add enough of solution of sulphate of copper to the urine to give it a blue colour, then add liquor potassaee in great excess until the oxide of copper precipitated at first is redissolved producing the peculiar blue of ammoniated copper faintly that the mixture if sugar be present the red suboxide of copper will be precipitated.

Moore's test——Depends upon the property of sugar forming a brown substance (mellasse acid) under the action of an alkali. To two fluid ounces of urine
in a test tube nearly a dram of liquor potassae is added & the mixture boiled for a minute or two. If sugar be present an orange brown tint will be produced which becomes darker as the boiling is continued. Mr. Maunten of Rhemns proposes the following test which he finds extremely delicate. A strip of white merino or other tissue not affected by chloride of tin is dipped in a strong solution of that salt and dried. A few drops of the suspected urine are placed upon the strip thus prepared & exposed to a heat of 260° to 300° F. A black or dark brown stain is immediately produced if sugar be present.

Another convenient test is by adding the urine with an equal quantity of the solution of Carbonate of Soda one to three and a little perihlorate of bismuth is added. After boiling for some time the bismuth will be reduced & deposited as a black powder if sugar be present. Dr. Levy uses the following known as Levy's Solution: Bicarbonate of Copper 320 grains Neutral tartarate of potash 670 grains Carbonic potash 1200 grains distilled water 20 fluid ounces the tartarate of potash & the Carbonic potash are to be dissolved together in one portion of the water and the bicarbonate of copper alone in the other. The two solutions then mixed. Boil a small quantity of the
Mixtures in a test tube and add to it a little of the suspected urine drop by drop until you have used less than the equal quantity of solution.

If sugar be present an intense opaque yellow-brown is produced if no such precipitate has taken place when the liquor has become cold the urine is not pure charcoal.

It has been stated above that Pavy found sugar in normal urine. He was able to detect an amount as small as 0.0% per thousand where Salmond found no reaction with his method of testing by copper. Pavy's plan of testing he describes in "Oxford Medical Lectures on certain points connected with Diabetes" p. 5–6: 10. He first separates the sugar as recommended by Brinck in the following manner: A saturated solution of the neutral acetate of lead is added to the urine in great excess to separate the uric and phosphoric acids by precipitation. This precipitate is washed and separated often when the sugar which remains in solution is precipitated by addition of ammonia. The precipitate is washed very carefully till all the ammonia is removed. It is then treated with a stream of hydrogen sulphide to liberate the sugar and form the insoluble sulphide of lead, which is separated by filtration and
And the excess of sulphuric hydrogen is driven off by heat. The sugar now is left in solution which may be concentrated in any convenient bulk & it may then be tested by the ordinary methods.

Davy found that he could detect tartrin in a weak solution when he could not detect the same quantity in urine & thus explains why Bernard failed to find it in normal urine.

Knapp's method of testing for sugar by cyanide of mercury is very delicate. On boiling a little of this substance with saccharine urine metallic mercury is precipitated. This depends on the reducing power of the sugar similar to its action on sulphate of copper but other substances have the power & the question comes to be how far the sugar is concerned in the reduction. Hagan & Muller who have recently made some observations on this subject, reported in The Lancet 6 April 26th 1879, consider that from 0.07 to 0.37 per cent of reducing power was shown in the method of testing by cyanide of mercury when no sugar existed.
Causes. The immediate cause of Diabetes is probably the passage through the liver of imperfectly dearterialized blood. Caused in turn by dilatation of the small vessels, this dilatation, probably being due to stimulation of the vaso-inhibitory or paralytic of the vaso-motor nerves from some unknown lesion affecting them or their centres. As to the nature of these lesions very little is known except the post mortem appearances observed by Dr. Dickinson. He states however that in many cases no lesion has been found in the brain, but whether this be that the lesion has been there though not recognized or that it is in some other part of the body, has not yet been made out. Hereditary influence is one of the most frequent causes. As an instance of such I know a family here, of whom three of its members died from Diabetes & two of these I personally attended.

It is often found to affect two consecutive generations or passing to the nephew or niece of the person originally affected. Sir Henry Martyn mentions the case in which the disease was transmitted from parent to child into the fourth generation.

Dr. Robson mentions a family of eight children, all of whom became Diabetic though the parents were healthy. Dr. Payre refers to a family of seven of which
which four members—two brothers and two sisters—became subjects of the disease, and to another in which three brothers were affected.

Great grief, protracted intellectual toil, wild anger, or mental shock might all be shown to be directly productive of this disease. Injuries of the head are also a frequent cause and may be for practical purposes divided into two classes, the first comprising cases in which some mechanical hurt or easily recognizable morbid change has been followed by a temporary paciﬁcation of the urine which subsides should the patient survive. The second including those in which the lesion causing glycosuria proves permanent or at least persists long after the other effects of the injury have subsided.

A large number of cases of diabetes following injuries of the head are similar in their symptoms to the idiopathic disease, comparable to the effects of cold and damp.

The disease is found to be more common in cold damp climates or where agricultural pursuits involve exposure to weather.

Foul supposed Malaria to be a predisposing cause of the disease. Alcohol is also considered a cause. According to Willis the daily or inmoderate use
Use of Ale, cider & acid wines was productive of diabetes. It has been thought to arise from diet containing sugar and starch in excess. There is no doubt when sugar is taken in excess some will pass off by the urine and instances are put forward of the disease attacking sugar refined, but the negro on sugar plantations who partake largely of sugar are not specially liable to diabetes. Excessive sexual indulgence is also given as a cause.

Symptoms and Cause

Diabetes generally comes on gradually. The person affected feels thirst or passes a larger quantity of urine than usual. The urine being persistently clear. He loses flesh, but on account of his appetite being increased, he supposes himself in good health. To medicines or delusive is the departure from health. The urine is sweet to the taste. Contains sugar which may be seen sometimes as white manifestations in the patient's linen. The appetite, thirst with loss of flesh continue to increase with the disease. The surface of the body generally becomes dry. Throat may be covered with a fine like dust.
As Dr. Parry observes the hands when rubbed together produce a dry sound, and the lines of flexure become opaque or mealy.

The breath has a peculiar odour, described like ether, or the atmosphere in which the patient sleeps has been lit up by Sir Thomas Watson to a room in which apples are kept, and this is most characteristic when the hands are contracted. It increases as the disease progresses. The tongue is often red, but sometimes coated with a thick white fur, towards the termination of the disease it gets dry, shrivelled, and stained with brown.

In advanced cases the mouth has a sweetish taste; the gums which may in some cases be sore, tender, the teeth become loosened and fall out. The dryness of the tongue and mouth is most felt when the diet is without restriction. In the female the contact of the urine with the vulva may cause an annoying leucorrhea. In men the orifice of the urethra and glands penis gets inflamed and irritable. In severe cases the power of erection is lost with it sexual desire. But should the symptoms mitigate he may recover too.

The mind deteriorates both morally and intellectually. He who was formerly of an equable temper, becomes irritable.
irritable & subject to fits of passion. He of a strong & restless character, becomes restful & quiescent. Probsly is not an uncommon occurrence in the lower strata of society. There is no venous obstruction to the head. Well The edema of Diabetes is probably the result of anaemia in the same way as in cases of starvation. When in connection with Diabetes large doses of the tincture of the perchloride of iron quickly remove. Poils & Carbuncles often occur either spontaneously or as the result of some irritation of the skin. Lichen & some other cutaneous affections often appear in cases of Diabetes. Towards the later stages of the disease the sugar may to a considerable extent disappear from the urine & albumin in large quantity take its place. The tubules of the kidneys stimulated by the diabetic action of the sugar, after a time become congested & inflamed, thus producing albuminuria. The kidneys give evidences of this after death by thermometer in blood & greater vascularity. Gastricine is among the later complications though a rare one very similar to the pimple gastricine of old age, it may be due to degenerative change in the walls of the arteries.

Pulmonary
Pulmonary affections are common in the later stage. In many cases the symptoms simulate tubercular phthisis, though no true tubercle is deposited. The microscope shows the tubercle little nodules of Diabetes to be due to a form of anaerobic bacteria.

The younger the subject of the disease the more urgent and the more rapidly fatal it is. In advanced life the affection is often mild, intermittent and almost harmless. If the patient be careful as regards diet, the temperature in Diabetes remains usually under the normal generally from 94° to 98° F. In about one in thirty, Cataract is developed as a complication.

Modes of Death. The patient may die from exhaustion or perhaps through the effect of some slight or fatiguing injury or slight cold, or he may die comatose. He falls into a drowsy, lethargic condition which advances into unconsciousness gradually from deeper until death takes place.

Dr. Balthazar Hosier of Birmingham published an article in the British Medical Journal in January 1873 on Diabetic Coma. He supposed it to be due to the development of Acetone in the system through the decomposition of Sugar.
He sums up his conclusions thus:

1. That acetone has been found in the breath, urine, blood, &c., of patients who have died of diabetic coma.
2. That grape sugar may be converted in the stomach by alcoholic & acetic fermentations into acetone.
3. That the changes in the blood after death from diabetic coma can be artificially produced by the addition of acetone.
4. That the administration of acetone in large quantities to animals produces similar symptoms to those observed in diabetic coma.

In a case which was under the charge of Professor Saunders in the Edinburgh Royal Infirmary in 1879, the patient died of diabetic coma and the blood presented the same characters as those described by Dr. Foster, viz.: a peculiar pale, creamy appearance, under the microscope the blood corpuscles seemed to break down into granular debris which looked like fat but did not dissolve in ether.

Pettit was the first to show in 1857 that acetone was developed in the system of diabetics, and Kaulich three years afterwards confirmed this.
Diagnosis. Glycosuria is found in many cases not truly diabetic. One of the main features of which is its persistence accompanied with general wasting.

The points to be looked at are the family or social history, duration of the disease, presence of sugar in the urine, thirst, polyuria, wasting state of the appetite etc.

The diseases most likely to be mistaken for it are: Diuresis, Temporary Glycosuria, Syphilitic Renal Disease, and Hysteria.

Prognosis. Is more favourable the sooner the case is seen & the older the patient. When there has been no family history of syphilitis, consumption, or diabetes, and the constitution generally good, the prognosis is favorable. But while the contrary is the case & the disease has advanced for a considerable time, there is very little hope of saving the patient. The disease may become arrested for a time by judicious treatment, but only to break out again & become more intractable than ever.
Treatment: The chief indications are first to prevent the formation of sugar which appears to lie at the very bottom of the disease, secondly to diminish the amount of wine which independently of its peculiar character tends to improve the blood, and thirdly to alter the condition of the blood itself.

Our first object is to remove from the food those substances which contain sugar. The patient must be denied from such food as bread, potatoes and all substances containing starch. From such luxuries as sugar fruit and beer he must abstain. He may take fresh fish, foul and anything of a fatty nature since it appears that this hypoglycaemia is not amenable to lactic acid persuasion. Eggs, unsweetened jelly and soups which do not contain those vegetables which have been prohibited. In slight or early cases milk may be given in moderate quantity, but on account of the large quantity of sugar it contains it is to be avoided in severe cases.

All substances derived from milk with the exception of those such as butter, cheese, cream cheese and cream may be used without any injurious effect. Gluten bread or gluten flour, from which by washing...
with hot water most of the starch has been removed, may be taken. Fresh meat, green vegetables & a proportion of bran biscuit make up the deficiency caused by extracting from the wheat bread, those nutritious substances besides starch, such as the phosphates, the alkaline & earthy calcium &c. Cakes or biscuits made from bran come next to gluten bread. The bran should be freed by careful washing from any starch or flour, then dried & ground into flour & made into cakes. Malt means almost biscuits afford a good change but are too expensive to be used as a daily bread. The almond & all fruits of a similar composition as the walnut, hazel nut & cocoa nata are objectionable. A bread containing no starch has been made from potatoes & used with asserted advantage. The following is the recipe—Take fifteen pounds of potatoes, previously rasped & washed free from starch, three quarts of a pound of winter flesh, half a pound of sweet butter, twelve eggs, half an ounce of carbonate of soda, two drachms of citrated eruvite acid. Mix the ingredients, divide the mass into twelve cakes & bake quickly until browned. To offer & tea without sugar or honey have been recommended from their highly agotised composition.
but their tendency to cause dyspepsia under their use questionable.

The skim milk treatment has of late years been counted as something like a panacea since its virtues embrace not only Diabetics but granular kidney and Addison's disease. In mild cases in which the patient is corpulent or plethoric suggesting hepatic rather than nervous glycosuria--a diet of skim milk might effect a cure, but whereas the disease occurs in a fever form or as a wasting disease restriction to the skim milk diet has been followed by good health.

Drinks may be considered injurious in proportion to the sugar they contain. Care must be taken to avoid effervescent wines which from imperfect fermentation and arsenic additions are objectionable.

Port, Sherry, Madeira, cider, and malt liquors except the pale bitter ale made by Alleppey or Bass are to be avoided.
Medicinal Treatment. Diabetes in its early stage may be controlled or cured by the judicious administration of drugs along with careful attention to the rules of dietetics. When the disease has advanced beyond a certain stage our efforts can only be palliative. Of the remedies most efficacious in diminishing the discharge of urine none can exceed Opium. It not only diminishes the flow of urine but allays the nervous irritation of the patient, makes him feel more comfortable. It should be given so as to keep the system moderately under its influence. Care of course being taken to prevent a too rapid increase of the dose, or the establishment of a bad habit on the part of the patient. One of the best forms to give it in is Dover's powder in doses of ten or fifteen grains at bedtime.

Hydrochloria is of all medicines the most constantly useful, it reduces & preserves the general health in a way equally welcome to the patient & evident to the physician. So far as our experience goes this article cannot be said to diminish the urine, but it has the effect of antagonizing in a manner not to be mistaken its lowering effect. The best form to administer it in is the liquor in doses of five minims gradually increased to ten three daily. 

Iron
Now is of great service as a means of counteracting poverty of the blood. It is the one remedy for diabetes oedema. The preparation most suitable is the mixture of the perchloride in doses of fifteen to thirty minims three daily.

Cod-liver oil: This oil like all other oils resists peroxidation so valuable as a food as much as a medicine. It has the effect of retarding emaciation and maintaining strength.

Chemical Food or Parrish's Syrup, or Syrup of the Phosphate, may be given with advantage.

Mineral Acids. The best and most suitable of the class is the Muriatic. It has the property of alleviating thirst & acts slightly as a laxative which is a great disadvantages which will also tend to assist in supplying the deficiency in the gluten bread. The dose the metallic acid may range from ten to thirty drops or six times daily.

Alkalies. Dr. Parr found that the injection of a solution of Carbonate of Soda into the jugular vein produced the appearance of sugar in the urine when subsequently the upper cervical ganglion was removed & inferred that the alkali inhibited the glyceremia by a change of products in the blood. This supports the old view according to which Alkalies

wine
were remedial as promoting oxidation, the deficiency of which was the cause of the disease. They have been given by the mouth injected into the bowels. The alkaline baths of Vicki Vals, Carlsbad, or Manninbad have been used as habitual drinks, but we have no proof of their special curative effect in Diabetes.

Peroxide of Hydrogen has on the same oxidation theory been advanced as an antitoxin for Diabetes, with but little effect.

Allopathy has been frequently given even in very large doses, but without any very marked effect in lessening the quantity of urine and sugar.

Lactis of Potassium has been found beneficial in lessening the quantity of sugar.

Dr. James Gray of Glasgow found Renne's diet of great service with restriction of diet, but it has been found of very little benefit in the hands of others. The objective of the diet was to convert the sugar into Lactic acid an effect which it has the property of doing outside the body. Lactic Acid itself has also been administered, with in many cases marked benefit, but has not been found to prove of any permanent benefit.

Argot has been given with the view of causing contraction of the small arteries; this contracting what appears to be at the foundation of the disease.

[Signature]
Laburnum, and its active principle pilocarpine have been administered with the view of promoting the vascorous action of the skin and other secreting organs, and diminishing the quantity of urine.

A great many other remedies might here be referred to, but none of them afford us much evidence of their utility as to enable them to much consideration.
Case 1.

James Mcleod, forty-two years of age. Coal miner, born in the village of Newcasle. I heard there consulted me in September 1869. Complaining of weakness, great thirst, pains in the back, symptoms which had troubled him for about two months—previous.

On inquiry I found that his parents were both healthy as well as his other near relatives, except a sister who had died of consumption.

He was married, had five children all healthy. He was temperate—lived comfortably. Was not overburdened but complained of bad ventilation in the pits.

His previous health was good, except on one occasion when he complained a fracture of the tibia from which he recovered perfectly. Was a man of middle height—pale thin. Had a sunburned expression. The tongue was covered with a pale yellow film. Was dry and parched as was the mucous membrane of mouth and throat. The breath was somewhat putrid. The appetite had always been good, but for some time had been excessive. As was also the craving for liquids.

He complained of a sensation of sinking in the region of the epigastrium, about an hour after meals. Bowels constipated. He had been in the habit of taking laudanum medicine to relieve them.
I found on examination that the liver was slightly enlarged & showed on percussion an increased area of dullness, which extended downwards in the Mammary line, about an inch & a half beyond the level of the ribs.

He complained of slight expectoration & breathlessness on exertion, but on examination I found quite healthy

The pulse was somewhat over a hundred quite regular & good volume. The arteries did not appear atheromatous. Respiration about twenty for
in the minute—somewhat harsh with prolonged
expiration & a few mucous rales. As occasional cough especially in the mornings after getting out of bed was accompanied by dark tough expectoration

The percussion note slightly muffled over the whole chest. Skin dry &苍白. Mucous membrane ground were of the consistence of raw garlic. The urine was pale of high specific gravity, slightly acid with no albumene or bile. On applying Tannin test I

I made him aware of the nature of the disease & ordered the diet to be restricted as follows—Flesh & fish as much as he chose & wrote him out
A recipe for making bread from potatoes you as mentioned in page 35 which was at the time highly recommended by the late Dr. Warburton Neglie. He was to avoid all starchy & saccharine food (the articles of food to be avoided being specified by me) of drink he might take either milk or he hotels daily & about the same quantity of water containing one or two teaspoonfuls of dilute phosphoric acid. A small amount of tea or coffee with as little sugar as he could. Avoid all alcoholic stimulants were to be avoided. Avoid warm clothing night & day was to be worn & exposure to cold & wet carefully avoided. By my advice he gave up Coal Mining & began travelling the neighbourhood selling tea & &c. Of medicine I ordered one grain of powdered Opium with a quarter of a grain of extract of Belladonna made into a pill to be taken daily. To improve the state of the blood which I believed was deficient in red corpuscles I ordered some of the powder of the peroxide of iron & for the constipation occasional doses of Cauter. He.

For fully six months under this treatment which was persevered in with little variation, he decidedly improved, his urine considerably diminished in quantity as well as the amount of sugar in it, the patient also expressed himself as feeling stronger & more comfortable.
About seven months after first consulting me he had been from home. (His urine up to this time having steadily decreased in quantity to four or five pints daily, and the amount of sugar proportionately diminished.) Returning then to ordinary diet, he became much worse, but on resuming his former treatment, after coming home, he soon again improved. I continued for fully a year in moderate health. Towards the end of April 1871, he was seized with an acute attack of bronchitis, from which he very slowly recovered, but not perfectly. He continued to strictly adhere to the form of diet & medicines prescribed, with the exception that the dose of Opium was gradually increased up to the prime daily, with a slight increase in the dose of Belladonna. The exhaustion & emaciation gradually increased & he was obliged to wholly confine himself to bed in January 1873 and died in March following. of exhaustion, having lived nearly four years from the time the first symptoms appeared.
Case II

Robert Stoddart, a baker twenty six years of age a very intelligent young man, left Kanguhar in 1872 where he banded up till then and went to Glasgow to work as a baker Confectioner. He continued there at that occupation for about two years. In July 1874 he returned from Glasgow on a visit to people here & not feeling himself, very well he consulted me. From the symptoms complained of I had reason to suspect Diabetes & on examining his urine I found such to be the case.

Family history. His brother Peter and Aunt had previously died of Diabetes. His father of Consumption. The other members of the family are not of robust constitution.

The patient had a comfortable home & was a total abstainer, but was a good deal exposed to variations of temperature due to the nature of his occupation. He always enjoyed good health up to about a month previous to his consulting me. He was a man of medium height and weight a fair complexion, light coloured hair and sandy whiskers.

The tongue was red & dry & he complained of dryness and tenderness about the throat. Poore's Constitution, & declined with acids which troubled him a good deal. There was no alteration in the liver, abdominal distension. Had no food symptoms. Stool slightly dry and the body fairly nourished.

The urine passed daily amounted to about five or six pints.
And contained as shown by Tremes test a considerable quantity of sugar. He complained of a feeling of colicness all over the body & a sense of weakness in the lower extremities. Otherwise the symptoms were somewhat similar to those in Case 1.

The treatment also was similar except that the Syrup of the Phosphates was substituted for the dilute phosphoric Acid & the gluten bread was taken as well as the bread made from potatoes. He gave up his occupation except some little work of the same nature as his father's. This treatment was persevered with—the only exception being that he took in his drinks the dilute phosphoric Acid or dilute sulphuric Acid as a change from the Syrup of the Phosphates—for about a year. He gradually increased in strength & weight & expressed himself as feeling much better.

I had last visited him for fully a month when about the end of July 1875. I was requested to put see him. I found him considerably worse—he was very considerably reduced in body, felt much weaker, was passing a very large quantity of urine (fifteen to twenty pint daily) and his thirst & appetite more inordinate then at any time. On enquiry I found these symptoms had become developed within ten days previous to my visit & were daily getting worse. At this time he had done
Slight cough with a few streams of blood in his expectoration. He complained to me that he had been acting contrary to my instructions regarding his diet and had been taking large quantities of potatoes, ordinary bread, and other food containing starchy saccharine principles. On examination of his chest by percussion and auscultation, I could detect no lesion to account for the bloody expectoration.

I strongly urged on him the necessity of adhering to the diet formerly prescribed. I ordered the use of cod liver oil, a mixture of perchloride of iron, the opium and belladonna to be taken at bedtime, the dose of the opium now about two grains was ultimately increased to three grains. He again showed decided signs of improvement for about three months, but then had another severe relapse due to his again breaking through the digestive rules laid down to him. From this date forward the disease gradually progressed, with no treatment. Digestive or otherwise seemed to arrest its progress until his death which took place about end of December 1875, having lived about twenty months from first appearance of the symptoms.

A few days before death his breath, body, & the apartment emitted a smell answerable to the disposition of acetone. He was comatose for fully twenty-four hours before death.
Case III

I was sent for in March 1876 to visit John Glendinning aged forty-six years a ploughman residing in the parish of Sanghar who had been complaining for nearly six months of thirst, hunger and debility which had gradually increased up till the time I was sent for when he was obliged to give up work.

He was married & the father of a large family all healthy. His mother had died of cancer & a brother & sister of consumption. I found him in a very weak & prostrate condition. His tongue was red & tender. The pulse was about Ninety irregular, The arteries seemed Atheromatous the temporal & radial felt like whipcord under the finger. The craving for food was not so excessive as that for drink.

The wine amounted to fourteen or fifteen pints daily & his calls to urinate were very frequent. The presence of sugar was well marked & there was slight albumenuria.

He complained of pain in the region of the heart.

I adopted the same dietetic treatment as in the two previous cases I ordered sixty to eighty minims of the tincture of ferrochloride of iron to be taken along with the two or three pints of water to which he was restricted during the twenty four hours. He took three or four pints of skim milk daily. I ordered dream in the form of Dover's powder two grains twice daily.

About
About a month afterwards I substituted the dilute nitrohydrochloric acid for the solution of perchloride of iron, when the amount of urine had decreased and the albumenuria had entirely disappeared. He showed symptoms of improvement for five or six months and continued to go about and take his air exercise, but began from this time to lose ground notwithstanding his adherence to the treatment prescribed.

A month before his death there was a return of the albumenuria, the ankles became edematosus, fluid collected in the chest, he felt breathless on making the least exertion, on examining his heart I satisfied myself that it was somewhat hypertrophied.

We sank somewhat suddenly about the end of October to symptoms of Apoplexy.

One point in common note the whole three cases is that there is a history of consumption in the families.

In the second case has been a strong hereditary tendency to both Diabetic and Consumption.

In the third case the patient's strength had become greatly exhausted from the effects of the disease and the complications which he suffered under no doubt hastened his death. I may remark that albumen was present in the urine in all the three cases during the later stages of the disease.