

**A note upon the relation of traumatic diabetes insipidus to glycosuria / by
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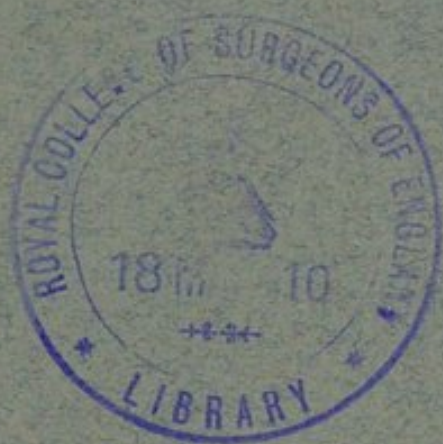
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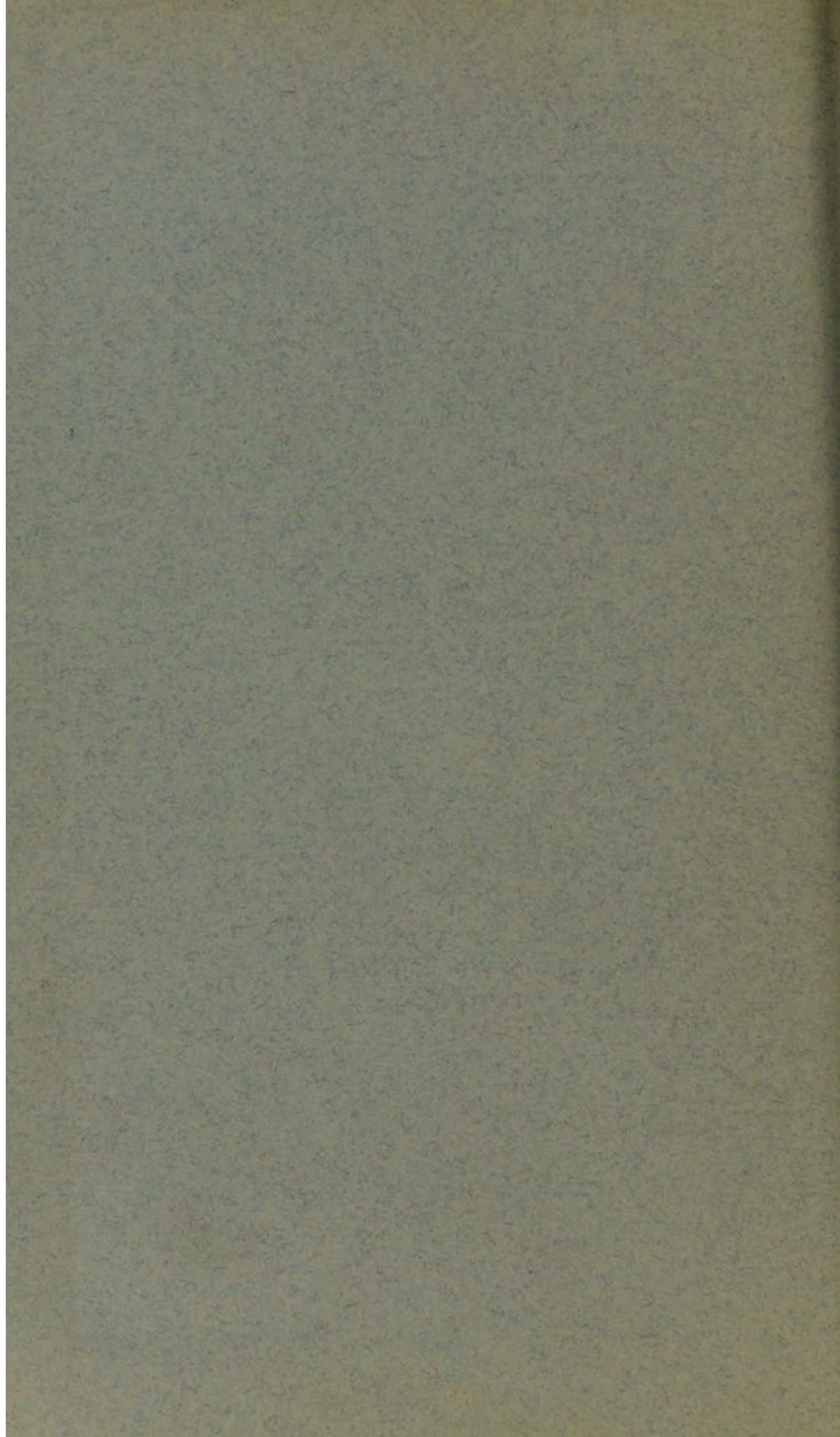
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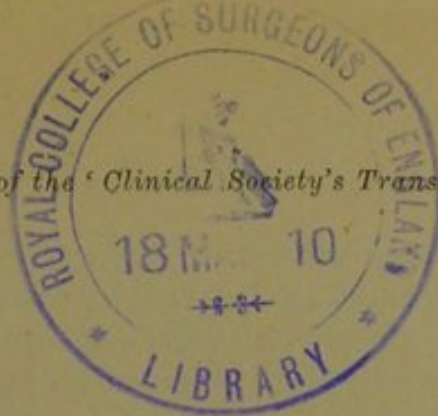


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A Note upon the Relation of Traumatic Diabetes Insipidus to Glycosuria. By HERBERT FRENCH, M.D., and C. B. TICEHURST, B.A. Read March 9, 1906.

THE following is an addition to the history of that case which was published in Vol. LVII of the *Guy's Hospital Reports*, under the title "A Research upon the Metabolism of a Patient suffering from Diabetes Insipidus, following upon Fracture of the Skull."

The notes of the case at the time of the last publication are briefly as follows: William T., æt. 44, was in perfect health up to June, 1901. He then met with a bicycle accident, fracturing his basisphenoid. He was unconscious for fourteen days, cerebro-spinal fluid dripping from his nose. He recovered and became active and able to resume work, but suffered from bilateral temporal hemianopia, slight strabismus, polydipsia, and polyuria, all attributable to his head injury.

His condition was typical of diabetes insipidus. He was under close observation from September 12 to October 15, 1901, during which time all his food and drink were strictly measured and analysed, as were also his urine and fæces. He passed, upon the average, 7500 c.c. of urine daily, of specific gravity 1004. He drank fluid proportionately. The urine was daily examined for sugar, but on no occasion could any be found.

Not only did the man not pass sugar in his urine when he was taking ordinary diet, but he could not be made to pass sugar when his carbohydrate diet was abnormally increased. Upon different occasions he was given excess of lactose, of grape-sugar, of cane-sugar, and of starch. His daily consumption was pushed until he was taking over 700 grams of dry carbohydrate in addition to the ordinary amount of proteid and of fat, yet no sugar appeared in his urine at that time. His diabetes insipidus seemed then to be quite free from any tendency to glycosuria.

The history of the case subsequent to the metabolic research carried out in 1901 is interesting in that the patient has now spontaneously developed a glycosuria which at that

time could not be dietetically produced. During 1902 and 1903 the man remained actively at work as an insurance agent, suffering from no inconvenience except his impairment of sight and his continued polydipsia and polyuria. He ate well, and maintained his vigour and weight. In September, 1904, his medical attendant detected a small amount of sugar in his urine for the first time—three years and four months after his fractured base and the onset of diabetes insipidus. Notwithstanding treatment the glycosuria persisted. The man did not suffer any change of symptoms, and did not lose weight, nor relinquish his work. In February, 1905, he came into Guy's Hospital again, under the care of Dr. Beddard (Medical Report, No. 124). In his general condition he was much the same as upon his discharge in 1901. His weight had not altered, he had the same slight strabismus, the same bilateral hemianopia, the same polydipsia. His heart, lungs, abdominal organs, and general nervous system seemed perfectly healthy.

The condition of his urine is the main point of interest. Whilst upon ordinary diet analyses showed :

Date.	No. of oz. of urine passed in each 24 hours.	Specific gravity.	Reaction.	Percentage of sugar.	Total sugar in grains per 24 hours.	Diacetic acid (ferric chloride test).	Acetone (sodium nitro-prusside test).
Feb. 21	100	1016	Neutral	4.76	2080	Not found	Not found
„ 27	106	1016	„	2.63	1220	„	„
„ 28	172	1016	„	3.57	2687	„	„
March 1	243	1016	„	2.84	3020	„	„
Average	155	1016	Neutral	3.45	2252	Not found	Not found

The sugar was estimated by Pavy's method, and was shown to be glucose both by the fermentation test and by the formation of phenylglucosazone crystals.

The patient was then put upon the strictest diabetic diet, and the urine analyses for a week upwards were as follows :

Date.	No. of oz. of urine passed in each 24 hours.	Specific gravity.	Reaction.	Percentage of sugar.	Total sugar in grains per 24 hours.	Diacetic acid (ferric chloride test).	Acetone (sodium nitro-prusside test).
March 2	179	1016	Neutral	2.02	1580	Not found	Not found
" 3	222	1014	"	0.83	809	"	"
" 5	186	1010	"	0.87	706	"	Slight
" 6	206	1010	"	0.54	483	"	"
" 7	188	1010	"	0.27	219	"	Not found
" 8	193	1010	"	0.25	209	"	Slight
" 9	196	1010	"	0.35	270	"	"
" 10	202	1010	"	0.48	489	"	"
Average	200	1011	Neutral	0.70	596	Not found	Slight

Thus the sugar fell to one quarter of what it was upon ordinary diet; but the man who in 1901 could not be made to pass sugar in his urine when he had carbohydrate pushed to nearly double what an ordinary man takes in 1905 failed to assimilate properly the minimal amount that a strict diabetic diet contains. The restricted diet was carefully continued for a much longer period, but sugar was persistently present in the urine.

It is not within the province of the present note to discuss whether or not there be a fundamental distinction between "alimentary glycosuria" and "true diabetes mellitus." The difference may be one of degree only. It is, however, recognised that some cases of glycosuria are simpler than others, and that in the simpler cases there is usually no diacetic acid or acetone in the urine, whilst the glycosuria disappears when the carbohydrate food is strictly limited. It was thought that the present case was possibly a simple alimentary glycosuria, and that strict dieting would cause a disappearance of the sugar from the urine. We were a little surprised that this did not turn out to be the case. We lay no stress upon the occurrence of acetonuria, because it has been found that a perfectly sound man will pass acetone in his urine if all the carbohydrate be eliminated from his food. Our patient's urine was by no means typical of diabetes mellitus; diacetic acid was never found; the specific gravity was low. Nevertheless the fact that the sugar did not disappear entirely upon careful dieting would seem to show that the condition was not "simple" nor purely "alimen-

tary," though the patient maintained his weight and felt quite fit for work.

Brouardel and Richardi re (1) have written an exhaustive paper upon the relation of injury to diabetes mellitus, from a medico-legal point of view. They could find only thirty-three cases in which injury could be put down as a factor in the causation of glycosuria. The injuries in their cases were by no means always to the head. Of their 33 collected cases :

17 were secondary to head injuries.

5 " " injury to the spine.

11 " " injury to various parts of the body.

In regard to the time after the injury at which glycosuria was discovered :

In 8 cases there was glycosuria within 2 days of the injury.

" 4	"	"	"	"	7	"	"	"
" 5	"	"	"	"	3 to 6 weeks	of injury.		
" 3	"	"	"	"	2 months	"		
" 2	"	"	"	"	3	"	"	
" 1	"	"	"	"	4 to 5 months	"		

" 9 the intervals were longer still up to 4 years of injury.

They give examples of every degree of glycosuria secondary to injury. In some the condition was temporary, rapidly getting well by itself; in others careful treatment was required, but cure resulted; in others, again, the glycosuria persisted in spite of treatment but the condition seemed to be stationary, and did not seriously affect the patient; finally, there were those bad cases which ran the ordinary course of rapid diabetes mellitus with a fatal ending. Nevertheless they lay stress upon the rarity with which diabetes can be attributed to injury. Griesinger (4) holds the same view after analysing 225 cases, amongst whom he found only 20 in which trauma could by any possibility be put down as a cause. Senator (6), having collected 1090 cases of diabetes mellitus, could find but 11 cases, or 1 per cent., in which he could definitely attribute the condition to any injury.

The question of the relation of head injury to diabetes mellitus has been discussed in a previous paper (2) in which, and in a paper by Fletcher (3) references to the literature are given. The conclusions drawn are, that head injury rarely causes either form of diabetes, but that diabetes insipidus is attributable to injury rather less infrequently than is diabetes mellitus.

The majority of cases of diabetes insipidus are not

associated with glycosuria. Some Guy's Hospital cases have had diabetes insipidus for many years without becoming seriously ill, and without developing glycosuria. When, however, it is so well established that Claud Bernard's puncture of the fourth ventricle leads to glycosuria, and when it is recognised that injuries and tumours of the base of the brain certainly may be a cause of polyuria, it is contrary to expectation that a head injury which is followed by persistent diabetes insipidus should not also lead to glycosuria. Nevertheless, we have been able to find only one case in the literature which exactly resembled our own. This is recorded by Brouardel (1). A man, æt. 45, met with a railway accident on July 18, 1884. He was generally concussed, but did not lose consciousness. Twelve days later, on July 30, 1884, it was noticed that his urine was "very much increased" in quantity, and that no sugar was present. He recovered, but continued to suffer from polyuria and excessive thirst. He was again examined on December 24, 1884, when the polyuria with absence of sugar was confirmed. The same condition persisted through the greater part of the next year, but on November 30, 1885, sixteen and a half months after the accident, he was found to be passing sugar to the extent of 47 grams per litre. The specific gravity of his urine was 1032, and the daily quantity "large." There is no mention of diacetic acid or of acetone having been tested for. The man's general health was good, and his condition appears to have been very similar to that of the present patient. In both cases polyuria immediately followed a severe accident affecting the brain; in both the polyuria persisted; in both there was absence of sugar for a long while after the accident; in both sugar ultimately appeared in the urine, in Brouardel's case $1\frac{1}{2}$ years, in our case $3\frac{1}{2}$ years, after the injury. In both cases the general health was excellent, notwithstanding accident, polyuria, and glycosuria.

In our search for other similar cases we have come across one which is almost the converse. Käemnitz (5) records it. A woman, æt. 17, met with an accident in which her head became severely compressed among the wheels of some machinery. She was comatose, and the same day passed 500 c.c. of clear, non-albuminous urine, free from sugar. Six days later, being then conscious again, she complained of great thirst, and passed much pale urine, of specific gravity 1023, and containing 1 per 100 of sugar. Two weeks later the urine had a specific gravity of 1029, and there were 2.3 parts of sugar

per 100. For one month the urine continued much the same, then the sugar began slowly to diminish. At the fourth month from the injury there was no sugar in the urine, but the patient passed from 4000 c.c. to 6000 c.c. daily, of specific gravity 1005. The polyuria persisted. Sugar did not recur. The condition seems to have been one of traumatic polyuria and glycosuria, which passed on to one of simple diabetes insipidus.

In our previous paper we drew the conclusion that the head injury which had caused diabetes insipidus in our patient had in no way diminished his power of metabolising carbohydrate. It is true that this was the case at that time, but it seems important to record the fact that in the course of a few years a complete change occurred in this respect. The patient in the early stage of his traumatic diabetes insipidus had been able to assimilate enormous amounts of starch, glucose, lactose, and cane-sugar, but after three and a third years ceased to be able to metabolise properly even quite small quantities.

A year later the glycosuria had as spontaneously ceased, the patient's weight had increased one stone, the polyuria and polydipsia persisted unchanged. The patient was shown personally to the Society on March 9, 1906.

Our best thanks are due to Dr. Hale White, under whose care, at Guy's Hospital, the patient was and is, and who has given us every facility in our observations.

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