Abstract:
Renal glycosuria is the excretion of glucose in the urine in detectable amounts at normal blood glucose concentrations in the absence of any signs of generalized proximal renal tubular dysfunction. SGLT2 is a low-affinity sodium-glucose co-transporter responsible for the bulk of tubular reabsorption of filtered glucose. SGLT2 gene, also referred to as SLC5A2, coding sodium-glucose transporter type 2 protein localized to chromosome 6. Mutations in the gene for SGLT2 are seen with familial renal glycosuria (FRG). Glycosuria in these patients can range from 1 to 150 g per 1.73 m² per day. Karthick, a 9 years old boy born of 3rd degree consanguinous marriage came to the paediatric department with the complaint of fever for 2 days, no history of polyuria, during routine investigation urinalysis was done by dipstick method shows pH 6.3, sugar 3 plus, protein - nil. We used siemens reagent strip for urinalysis, which use GOD-POD method for glucose detection, this method is specific only for glucose and do not show other urinary sugars. Physical examination of the boy was normal. The fasting blood glucose was done which is 79mg per dl. OGTT shows normal blood glucose level with urine glucose positive in fasting, 60 minutes and 120 minutes sample. HbA1c was normal. Proximal tubular dysfunction was ruled out by normal level of excretion of sodium, phosphate, uric acid and aminoaciduria was ruled out with thin layer chromatography of urine sample compared with age matched control sample and amino acid standard. Urinalysis performed in the boys mother urine was negative for glucose and protein. Benign renal glycosuria is a self-limiting disease which is mostly asymptomatic and has a good prognosis in which medical treatment or diet limitation is not required. They can normally store and utilize glucose. The clinical and biochemical diagnosis of this case is Benign renal glycosuria, further mutational analysis of the gene coding for the transporter is needed to confirm the type of mutation.

Keyword: renal glycosuria, OGTT, SGLT2

INTRODUCTION:
Renal glycosuria is the excretion of glucose in the urine in detectable amounts at normal blood
glucose concentrations in the absence of any signs of generalized proximal renal tubular dysfunction. In general, renal glycosuria is a benign condition and does not require any specific therapy. The inherited form of this disorder is called familial renal glycosuria (FRG). The inheritance pattern is autosomal recessive, although autosomal dominance has been reported.

**HISTORY:**

Karthick, 9 years old boy born of 3rd degree consanguinous marriage came to the paediatric department with the complaint of fever for 2 days, no history of polyuria, during routine investigation urinalysis was done by dipstick method shows pH - 6.3, glucose + + +, protein - nil, specific gravity - 1.020, ketones - nil, sediments - RBC 2+, leucocytes - trace. We used siemens Multistix 10 G reagent strip for urinalysis which use double sequential enzyme reaction to detect glucose, glucose is oxidized by glucose oxidase to form gluconic acid and hydrogen peroxide and peroxidase catalyse the reaction of hydrogen peroxide with potassium iodide chromogen result in oxidation of chromogen to coloured product which is read in the urine analyzer clinitek status, bayer health care, they are specific only for glucose and do not show the other urinary sugars. The fasting blood glucose was done which is 79mg/dl.

Physical examination of the boy was normal. After recovery from fever the following investigations are performed.

### Oral glucose tolerance test

- First fasting blood and urine sample was collected, then 1.75 g/kg of glucose in 300ml water was given to the boy, after which blood and urine samples were taken at 60, and 120 min.
- Serum and 24 hour urine electrolytes done in Roche electrolyte analyser: Serum Sodium - 139 mmol/L (138-145 mmol/L)¹ Serum potassium - 4.1 mmol/L (3.4-4.7 mmol/L)¹ Serum chloride - 98 mmol/L (90-110 mmol/L)¹ Urine Sodium - 195 mmol/L Urine potassium - 85.8 mmol/L Urine chloride - 113 mmol/L (0.3-0.7 mg/dl)¹ Blood urea - 29 mg/dl (10-36 mg/dl)¹ Serum phosphorus - 4.6 mg/dl (4-7 mg/dl)¹ Serum uric acid - 3.7 mg/dl (2.5-7.5 mg/dl)¹ Serum calcium - 10.2 mg/dl (8.0-10.8 mg/dl)¹ 24hour urine phosphorus - 22.7 mg/dl, uric acid - 36.3 mg/dl and Calcium - 9.4 mg/dl. Urinary excretion of glucose – 32g/ day Hb A₁c – 4.3% (4.0-6.0%)

### Oral glucose tolerance test

<table>
<thead>
<tr>
<th>Sample</th>
<th>fasting (0 min)</th>
<th>60 min</th>
<th>120 min</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>whole blood (venous)</td>
<td>74</td>
<td>142</td>
<td>87</td>
<td>mg/dl</td>
</tr>
<tr>
<td>(GOD-POD METHOD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urine glucose (dip stick)</td>
<td>+ + +</td>
<td>+ + +</td>
<td>+ + +</td>
<td>mg/dl</td>
</tr>
</tbody>
</table>

Fractional excretion was calculated by the formula:

\[
\text{Fractional excretion (FE) } X = \frac{\text{Urine(X)}}{\text{Serum (X)}} \times 100
\]

Urine creatinine/Serum creatinine

They are specific only for glucose and do not show the other urinary sugars. The fasting and post-blood glucose was done which is 79mg/dl.

Physical examination of the boy was normal.

After recovery from fever the following investigations are performed.
Thin layer chromatography - for amino-aciduria was negative.

THIN LAYER CHROMATOGRAPHY OF URINE AMINOACIDS OF PATIENT SAMPLE WITH AGE MATCHED CONTROL AND AMINO ACID STANDARD GLY-CINE AND TYROSINE

Paper chromatography - for carbohydrates showed glucose spot.

PAPER CHROMATOGRAPHY FOR URINE SUGAR CHEMICAL TESTS

Chemical tests:
Benedict's test for reducing sugar-++++ Barfoed's test – positive in 5 minutes (monosaccharides) Seliwanoffs test for ketoses- negative Foulgers test for ketoses -negative Osazone test - glucosazole formation in 5 minutes, yellow coloured

GLUCOSAZONE:

DISCUSSION:
Glucose is freely filtered by the glomerulus with a fractional excretion of less than 0.1%. In normal adults the kidney reabsorbs approximately 180 g of glucose from the glomerular filtrate each day. Glucose transporters are predominately found in the proximal tubule that results in less than 0.5 g/d (range, 0.03-0.3 g/d)
of glucose excreted in the urine. SGLT2, a critical transporter in tubular glucose reabsorption is located in the S1 segment of the proximal tubule. SGLT2 is a low-affinity sodium/glucose cotransporter responsible for the bulk of tubular reabsorption of filtered glucose. SGLT2 are members of the SLC5A gene family (also known as the sodium substrate symporter gene family [SSSF]). SGLT2 gene (also referred to as SLC5A2 coding sodium-glucose transporter type 2 protein localized to chromosome 6). Mutations in the gene for SGLT2 is seen with familial renal glucosuria (FRG) Glucosuria in these patients can range from 1 to 150 g/1.73 m² per day.

Benign glucosuria have 3 variations and is generally discovered on routine urinalysis. Type A is so-called classic glucosuria, with reduction in both renal glucose threshold and maximal glucose reabsorption rate. In type B, a reduction in the glucose threshold, a normal reabsorptive rate, and an increased splay are observed. Type O is defined by the complete absence of glucose reabsorption. Plasma glucose concentration, glucose tolerance testing, serum insulin concentrations, and glycosylated hemoglobin concentrations are normal. Other renal tubular abnormalities are absent.

Differential diagnosis with diabetes mellitus can be easily made with simultaneous serum glucose level, morning fasting blood glucose and urinalysis, oral glucose tolerance test and glycosylated hemoglobin level. Since urinary dipstick test we performed uses glucose oxidase/peroxidase reaction, they are specific only for glucose. They do not show the other urinary sugars. In our patient urine dip stick analysis for glucose was positive, OGTT shows normal blood glucose level with urine glucose positive in fasting, 60 minutes and 120 minutes sample. HbA1c was normal. Proximal tubular dysfunction was ruled out by normal level of excretion of sodium, phosphate, uric acid and amino-aciduria was ruled out with thin layer chromatography. Urinalysis performed in the boy’s mother urine was negative for glucose and protein.

Benign renal glycosuria is a self-limiting disease which is mostly asymptomatic and has a good prognosis in which medical treatment or diet limitation is not required. They can normally store and utilize glucose. As the age advances, glycosuria decreases due to decreased glomerular filtration related with atherosclerosis, but it is a life-long condition, though it does not lead to renal dysfunction. It is recommended that growth and development in these children be followed up yearly and they should not stay in a fasting state.

CONCLUSION:
The clinical and biochemical diagnosis of this case is a Benign renal glycosuria, further mutational analysis of the gene coding for the transporter is needed to confirm the type of mutation.

BIBLIOGRAPHY:

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