Down Syndrome with End-Stage Renal Disease

Vivek B. Kute · Aruna V. Vanikar · Pankaj R. Shah · Manoj R. Gumber ·
Himanshu V. Patel · Divyesh P. Engineer · Umang G. Thakkar ·
Hargovind L. Trivedi

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Abstract Down syndrome is one of the most common genetic causes of learning disabilities in children. Although the incidence of renal and urological involvement in Down syndrome is not very common, monitoring of patients with Down syndrome for renal diseases should be done regularly as patient's age into the second and third decades. With increased survival, it appears that a growing number of these patients present with chronic renal failure. Down syndrome patients are apparently not suited for peritoneal dialysis because of lacking cooperation. This procedure can be prone to failure, mainly because of an increased risk of peritonitis. Handling such patients especially those on peritoneal dialysis is challenging. Here we report a case of Down syndrome with end-stage renal disease treated with hemodialysis for 6 months. To the best of our knowledge and current literature review this is the first case report of a patient with Down syndrome undergoing hemodialysis.

Keywords Down syndrome · End-stage renal disease · Renal transplantation · Renal replacement therapy · Hemodialysis

Introduction

Down syndrome (DS) is one of the most common genetic causes of learning disabilities in children. It has an incidence of 1 in 920 live births in India [1]. DS can affect multiple organ systems, although renal disease has been thought to be quite rare. The incidence of renal and urological anomalies has been estimated in the range of 3.5–21.4 % [2]. There is data scarcity about renal failure and renal replacement therapy (RRT) in patients with DS [3–5].

Down syndrome patients are usually not preferred for peritoneal dialysis because of mental retardation, higher risk of peritonitis caused by difficulties with maintaining personal hygiene and compliance, co-morbid conditions like decreased left ventricular function, hypothyroidism, difficult social

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All authors contributed equally to this work.

V. B. Kute (✉) · P. R. Shah · M. R. Gumber ·
H. V. Patel · D. P. Engineer · U. G. Thakkar · H. L. Trivedi
Department of Nephrology and Clinical Transplantation,
Institute of Kidney Diseases and Research Centre, Dr H L
Trivedi Institute Of Transplantation Sciences (IKDRC-ITS),
Civil Hospital Campus, Ahmedabad 380016, Gujarat, India
e-mail: drvivekkute@rediffmail.com

P. R. Shah
e-mail: drpankajrshah@yahoo.com

M. R. Gumber
e-mail: drmanojgumber@rediffmail.com

H. V. Patel
e-mail: drhvpatel2010@rediffmail.com

D. P. Engineer
e-mail: engineerdivyesh@yahoo.in

U. G. Thakkar
e-mail: umangpaedia@yahoo.co.in

H. L. Trivedi
e-mail: ikdrcad1@sancharnet.in

A. V. Vanikar
Laboratory Medicine, Department of Pathology, Transfusion
Services and Immunohematology, Institute of Kidney Diseases
and Research Centre, Dr H L Trivedi Institute Of Transplantation
Sciences, Ahmedabad, India
e-mail: vanikararuna@yahoo.com

environment and lacking cooperation [3–5]. However, recent studies suggest that, with appropriate family support and an experienced multidisciplinary team, peritoneal dialysis can be effectively performed in children with special needs or social disadvantage, or both like DS [3]. There are reports of pediatric and adult DS patients who have been treated successfully with peritoneal dialysis for more than 2 years without an episode of peritonitis [4]. However, handling such patients especially those on peritoneal dialysis is challenging, mainly because of their lack of compliance with procedure.

We report a case of Down syndrome with end-stage renal disease (ESRD) on maintenance hemodialysis (HD) for 6 months. To the best of our knowledge and current review of literature this is the first case of a patient with DS undergoing HD to be reported.

Case Report

A 22-year-old male patient with Down syndrome (estimated IQ of 40–50) was referred to our hospital for evaluation of renal failure. The patient presented with a history of decreased urine output and oedema feet. The characteristic phenotype (dysmorphic features affecting the head, neck, extremities, obesity) and karyotype performed on a blood sample confirmed the diagnosis of DS.

General Examination of the Patient

He had no history of any major illness like diabetes or hypertension. On admission, physical examination showed elevated blood pressure (150/100 mmHg), temperature was 39 °C, respiratory rate was 24 breaths/min, and heart rate was 90 beats/min. There was no history of recurrent urinary tract infections. There was no history of urinary/feecal incontinence and his daily urine output was 300–500 ml.

Family History

He had one elder brother and five elder sisters who were healthy. Father died due to coronary artery disease. 58 year old mother was potential donor for kidney transplantation.

Laboratory Investigations

Report of the baseline laboratory investigations done are shown in Table 1. Urine examination showed albumin +1, RBC 80 cells/HPF, no pus cells and no growth on culture.

Ultrasonography of abdomen showed small size of kidney on both sides with loss of corticomedullary differentiation (right kidney, 6.8 × 2.8 cm and left 6.9 × 3.2 cm).

Table 1 Baseline laboratory evaluation

Parameter	Lab value	Normal range
Hemoglobin (gm/dl)	6.3	12–16
Total white cell count ($\times 10^3/\mu\text{l}$)	7.13	4–11
Platelet count ($\times 10^3/\mu\text{l}$)	137	150–400
Pack cell volume (%)	21	37–47
Mean corpuscular volume (fL)	108	82–92
Sodium (mmol/l)	135	135–145
Potassium (mEq/l)	5.8	3.5–5.5
Creatinine (mg/dl)	12.5	0.6–1.4
Blood urea (mg/dl)	203	13–45
Calcium (mg/dl)	4.7	8.5–10.1
Phosphorus (mg/dl)	6.5	2.5–4.5
Uric acid (mg/dl)	20.7	5–7.5
Total protein (gm/dl)	6.8	6–8.3
Blood glucose (mg/dl)	85	70–110
Total cholesterol (mg/dl)	94	30–150
Triglyceride (mg/dl)	90	0–200
Serum B12 (pg/ml)	296	191–663
Serum iron (ug/dl)	69	35–150
Serum ferritin (ng/ml)	273	13–400
Total iron-binding capacity (ug/dl)	134	250–450
Parathyroid hormone (pg/ml)	1125	13–75
Thyroid-stimulating hormone (mIU/l)	8.8	0.27–4.2
T4 (nmol/l)	85	66–181
T3 (nmol/l)	1.35	1.3–3.1
24 h urine total calcium (mg)	2	42–353
24 h urine uric acid (gm)	0.003	1–1.2

Enzyme-linked immunosorbent assays for human immunodeficiency virus, hepatitis B surface antigen and hepatitis C virus were negative.

Micturating cysto-urethrogram (MCU), X-ray of the kidney, ureter, and bladder, computed tomography scan and magnetic resonance imaging of brain, fundus examination, and two-dimensional echocardiography (no endocardial fusion defects, and ventricular fusion defects) were normal.

Treatment

All three modalities of long-term RRT, i.e., HD, continuous ambulatory peritoneal dialysis (CAPD), and renal transplantation (RTx) were explained to the family members (mother and sister) who provided everyday care. His mother had played an important role in management of her son and was the key to the success of any treatment planned. RTx could not be performed due to lack of economic support.

Patient was treated with HD twice a week initially through jugular venous catheter and later on through an arteriovenous fistula for 6 months.

He received antibiotic for fever due to jugular venous catheter related infection. He received erythropoietin, multivitamin and four blood transfusions for anemia and supportive therapy with rehabilitation and dietary advice.

Discussion and Brief Review

The incidence of renal and urological involvement in DS is high enough to encourage systematic screening [6]. A variety of renal involvement in DS have been described, including ureteropelvic junction obstruction, vesicoureteral reflux, renal hypoplasia, obstructive uropathy and posterior urethral valves hypospadias, asymptomatic renal pelvic dilatation and asymptomatic kidney ectopia [6]. Thus, ultrasound should be performed in these infants early in life and, if abnormal, a MCU to rule out any urological abnormality.

Hyperuricemia and hyperuricosuria have been reported in patients with DS. Increased serum uric acid level and the eventual development of gout [7, 8] have been previously documented. Renal impairment in urate excretion in patients with DS can lead to gout [7]. Approximately one-half of individuals with DS have congenital heart disease. Endocrine abnormalities in DS include thyroid dysfunction and type 1 diabetes. Autoimmune thyroid disease is uncommon in young children with DS but is common after 8 years of age. Consequently, annual screening is important.

The long-term survival of persons with DS has dramatically increased over the past 50 years. There are no studies addressing the spectrum of glomerular lesions in these patients. Said et al. [9] reported 17 patients with DS who underwent renal biopsy. Renal involvement included renal failure, proteinuria, and hematuria. Various glomerular diseases were reported on biopsy with IgA nephropathy and focal segmental glomerulosclerosis being the most common.

DS is associated with both immune dysfunction and deficiency; particularly T cells (CD4 + and suppressor T cells) and NK cells that are thought to be related to the increased susceptibility to infection, autoimmune disorders, and malignancies [10]. It may predispose DS patients to post-infectious glomerulonephritis. It may increase morbidity and mortality after dialysis or RTx.

There are few published reports on renal transplantation in patients with Down syndrome and renal failure. Baqi et al. [3] reported 14 DS patients who received RTx. 5 grafts (35.7 %) had failed, two as a result of rejection and three due to patient death (one due to viral infection and the other two secondary to cardio-pulmonary complications). Edvardsson et al. [11] reported successful living-related RTx in an adolescent with DS.

In our patient however renal transplant could not be performed due to financial consideration. Chronic

glomerulonephritis may have caused ESRD in our patient and renal biopsy could not be performed due to bilateral small size kidney with loss of corticomedullary differentiation. Our patient also had increased serum uric acid level and endocrine abnormalities affecting the thyroid and parathyroid glands. Amongst the RRTs offered to the patient, HD was chosen and was successfully carried out with the help of his committed mother.

Conclusion

In conclusion, this case demonstrates that HD in patients with DS, can be performed successfully with meticulous care.

According to the variety of pathologies, and in order to detect early irreversible renal injury, it seems quite reasonable to perform regular monitoring of renal function in DS patients. This will help identifying renal abnormalities as well as other co-morbid condition for early diagnosis and treatment.

This case supports the decision to offer HD to a DS patient with ESRD when a caregiver is identified who can provide dedicated and meticulous care.

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Conflict of interest No conflicts of interest.

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