Feasibility of using Telemedicine for Nephrotic Syndrome in children - The Jiyyo Mitra E - Clinic Model

Dr. Amarjeet Singh[1], Dr. Meghna Bharadwaj[2], Siddharth Angrish[3], Mandeep Kaur[4]

Abstract

Childhood nephrotic syndrome is a common glomerular disease. Most (over 90%) of the children with nephrotic syndrome have minimal change disease wherein the remission of proteinuria is achieved in 90% with steroid treatment. While the goal of initial therapy is to maximize sustained remission, many patients experience multiple relapses during childhood, leading to significant morbidity and frequent hospital visits. The disease though treatable in majority has a chronic course with relapses for many years before complete remission. This leads to frequent hospital visits for specialist consults. All this puts a huge physical, economical and emotional burden on the caregivers. With the advent of technology in healthcare and focus on remote consultation it is important to reduce the burden of caregivers of such patients without compromising on patient treatment.

We report here a case of an 18-month-old child diagnosed as Idiopathic Nephrotic Syndrome treated via a telemedicine platform Jiyyo Mitra E- clinic (JMEC) located 20 km from her village which is an assisted Telemedicine platform powered with AI analytics focused on providing healthcare in remote/rural areas. Its asset light model can penetrate thousands of geographies by upgrading local medical professionals, and over 1400 Pharmacists/ Healthcare workers/ Primary health clinics / Village doctors in 200 districts and 11 states have connected themselves with mainstream health care through e-Clinic, providing better healthcare services in their neighbourhood. This study showed how smoothly and successfully a chronic pediatric ailment is managed via such remote consultation.

Keywords: Nephrotic syndrome, Remote consultation, Telemedicine.

Conflict of interest: Authors 2,3, & 4 are from Jiyyo Innovations Pvt Ltd.

Introduction

Nephrotic syndrome (NS) is a common glomerular disease in childhood, common in the age group 2 to 7 yrs. It is characterized by abnormal glomerular basement membrane permeability to plasma pro-teins (mainly albumin), resulting in massive prote-inuria (albuminuria), and varying degrees of hypo-albuminemia, edema, and hyperlipidaemia. The majority of children with nephrotic syndrome attain complete remission with corticosteroid regimen, i.e., steroid-sensitive[1].

In 90% of children the nephrotic syndrome is idiopathic and out of that 85% have minimal change disease (MCD) type, 10% have focal segmental glomerulosclerosis, and 5% have mesangial proliferation. 95% of children with MCD respond well with corticosteroids. But even many of these children have a long and protracted course of relapses before complete remission requiring frequent hospital visits. This follow-up becomes more difficult for patients living far from hospital facilities. Telemedicine to a large extent can be an answer to this problem.

Telemedicine means consultation through an electronic media where patients and doctors are at different locations. It can be audio or video consult. Video consultation and presence of healthcare workers are superior for better observation, communication and patient management. Countries like USA and Australia have been using telemedicine for many years to deliver health care services in remote and sparsely located populations but such services were not much utilised in India till the COVID era. Telemedicine can now change the scenario of the Indian healthcare system particularly in remote areas.

This case report highlights how telemedicine can

[1]Ex Prof and HOD at Dept. of Community Medicine, PGIMER, Chandigarh, 160012, [2]MD pediatrics,Pediatrician , at Jiyyo Innovations Pvt. Ltd., Chandigarh, [3]CEO, Jiyyo Innovations Pvt. Ltd., Chandigarh, [4]Patient Care Manager, Jiyyo Innovations Pvt. Ltd, Chandigarh
Corresponding author: Mandeep Kaur, Patient Care Manager, Jiyyo Innovations Pvt. Ltd, Chandigarh
Email Id: mandy@jiyyo.com

assist paediatricians in providing both inpatient and outpatient care to such cases besides educating health-care providers and patients on related issues including research. It also underscores the role of telemedicine in emergency response, disaster management, and extending paediatric care to remote and underserved communities.

Tele-consultation is effective for managing both acute and chronic conditions. Benefits include greater access for underserved populations, better health-care availability for patients in rural and inner-city areas, improved care through quicker and more accurate assessments compared to telephone consultations, and reduced costs for both the healthcare system and the patient's family[2].

Case Presentation

An 18-month-old child was brought by her parents to the JMEC in Satyanganj Ahraura, District Mirzapur, Uttar Pradesh pediatric OPD nearly 20 km from her village. She came with complaints of facial puffiness, abdominal distension on and off for many days, increased for the past four days following fever, cough and cold episodes. They initially visited a local practitioner who referred the child to Varanasi (97 km) for specialist opinion. They got to know about the nearby e -clinic from a local resident.

The Jiyyo Mitra E-Clinic (JMEC) system linked the patient to e-consultation with the paediatrician available on the panel through video consultation on March 26, 2023 (1st consultation). Since then, 18 consultation sessions have been held till Aug 6, 2024. Average duration of each consultation was 8 minutes. All sessions were video calls. Patient reports, vitals, height, weight and prescriptions were uploaded on Jiyyo app (Table 1).

Parameter	Value
Blood Pressure	90/60 mmHg- (Taken by a BAMS doctor operating)
Pulse Rate	114 bpm
Respiratory Rate	24 bpm
Temperature	100°F
Weight	13 kg
Physical Examination	Alert, febrile, facial puffiness, and pedal edema
Abdominal Examination	Abdominal distension, generalized anasarca

Table 1: Clinical Assessment on Day 1

Diagnosis

Initial laboratory testing included:

- Urinalysis
- Serum albumin measurement
- Lipid panel

The presumptive diagnosis of Nephrotic syndrome was made based upon clinical history and presence of recurrent periorbital edema, abdominal distension and pedal edema. Child looked stable with vitals within normal limits. Diagnosis was confirmed with urine protein, serum albumin level and serum cholesterol levels (Table 2 and 3). Complications were ruled out by normal kidney function tests, red blood cells in urine, and a normal ultrasound.

Test Parameter	Ist episode	Ist Relapse	2nd Relapse
Albumin	4+(31/3/23) Trace (9/4/23) Nil (27/5/23)	3+ (8/10/23) Nil (1/12/23) 2+ (19/1/24) Nil (28/1/24)	2+ (21/2/24) Nil (25/2/24) 4+ (16/3/24) Trace (4/4/24)
Serum albumin	2.5mg/dl	1.4mg/dl	1.3mg/dl
Hb,		8.6	
Pus Cell	5-6hpf	2-3/hpf	2-3/hpf
Urine Protein	-		3941 mg/l (18/3/24)
Protein/ Creatinine Ratio mg/L	-		25.6 (18/3/24)
Urine Creatinine	-		153.6mg/l (18/3/24)
BP	85/50	88/56, 19/1- 108/70 (122/73- 1st reading)	100/65

Table 2: Reports

Test Parameter	Value
Blood Urea	15 mg/dL
Serum Creatinine	0.5 mg/dL
Hemoglobin (Hb)	8.6 mg/dL
Serum Cholesterol	361 mg/dL
HBV, HCV, HIV	Negative

Table 3: Other Blood Reports

Management

First episode

Patient was initially given oral antibiotics- cefixime and paracetamol in view of fever and pus cells in urine. Urine culture was sterile. After confirming the diagnosis and ruling out other infections including tuberculosis, corticosteroid therapy (prednisolone 2 mg/kg/day) was started for 6 weeks. The child was prescribed a high protein diet with low salt intake. Urine output was monitored by frequency of micturition. Blood pressure was taken by an Ayurveda doctor at our e-Clinicusing an appropriate cuff.

Reduction of edema, increase in urine output began after 1 week. Urine protein levels also started decreasing. Edema reduced, with a concomitant decrease in urine protein levels and by 3 weeks urine albumin became nil. She received intensive phase treatment for 6 weeks followed by maintenance phase for 6 weeks in 1st episode of nephrotic syndrome.

Relapses

Child remained in remission for two months followed by recurrence of anasarca following an episode of upper respiratory infection on 8/10/23. She was started treatment on lines of first relapse after urine albumin was 4+ on two occasions and recurrence of symptoms following Pediatrician consult (Figure 3). After completion of the maintenance phase (prednisolone 1.5mg/kg/eod for 4 wks), the steroids were gradually tapered off. The patient developed on and off facial puffiness and anasarca following an episode of acute gastroenteritis in 19 Jan 2024 with urine albumin 2+. Patient was on prednisolone 0.5mg/kg/eod at that time and same was continued. Blood pressure was 108/70 (99 percentile for age and height) on two occasions so enalapril 0.1mg/kg/day was started(see Appendix C for BP chart reference).Repeat urine albumin was negative after 1 wk. 22/02/24, Patient had an episode of fever and urine albumin ranged was 2+. Treated for fever, Child was further investigated to rule out secondary nephrotic syndrome and other complications. Steroids continued with 0.5mg/kg/eod with enalapril. On 18/3/2024 Child had facial puffiness and generalised anasarca, urine albumin 4+ and spot urine protein creatinine ratio more than 2(Figure 1).

Treatment for 2nd relapse (keeping in mind the possibility of frequently relapsing nephrotic syndrome/ steroid dependent nephrotic syndrome) was initiated when and spot urine protein/ creatinine ratio was more than 2 on 18/3/24. Child was given steroids 2mg/kg/day for 10 days then shifted to 1.5mg/kg/eod for 4 wks. This period of 2nd relapse went uneventful and slow tapering of steroids started in May 24. The child developed submandibular lymphadenitis with discharge & high grade fever on June with urine albumin 2+ and variable anasarca on 2/6/24. Parents were advised admission in a local hospital but refused. Steroids were given as stress dose at 0.5mg/kg/day for 5 days. Pus culture was sterile and pus for acid fast tubercular bacilli was negative. Child responded well to oral antibiotics and became well after 1 week. In view of frequent relapsing nephrotic syndrome [3,4], it is planned to more gradually taper steroids and give low doses of steroids at 0.5mg/kg/eod for 6 months. Enalapril is continued at 0.1mg/kg/day as BP is recorded as 90 centile with treatment(see Appendix C). Plan is to give enalapril till Bp is 50 centile or less for the Age and height centile. Child's weight was 10.5 kg; height 87 cm, and BP 98/60 on last visit in JMEC and is being regularly monitored (Figure 2).

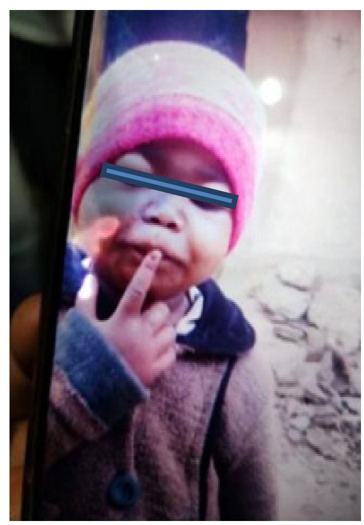

Fig-1 Before Treatment

Fig-2 After Treatment

Discussion

Nephrotic syndrome (NS) is the most common glomerular disease affecting children, frequently encountered in general paediatrics, characterized by significant proteinuria, hypoalbuminemia, and edema. Nephrotic syndrome, while affecting individuals of any age, is typically diagnosed in children aged 2-6 years old.[5, 6,] Primary also called Idiopathic Nephrotic Syndrome, its causes include minimal-change nephropathy MCD (85%) and focal glomerulosclerosis FSGS (10%), while secondary causes include systemic diseases like diabetes mellitus, lupus erythematous, amyloidosis, HIV, Hepatitis B or C infection etc. [7, 8]

Figure 3: Frothy micturition due to Protein in Urine

90% of children with nephrotic syndrome have idiopathic or primary nephrotic syndrome. This includes 3 histologic types: minimal change disease, mesangial proliferation and focal segmental glomerulosclerosis[9, 10]. But it is crucial for parents to seek regular medical check-ups for their child. Frequent hospital visits can be mentally, physically and economically draining for the caregivers[11,12]. In this patient, instead of going to a tertiary hospital 97 km away, remote video consultation (in presence of a local health practitioner) with a pediatrician was done. Child was treated as per protocols. Parents were timely educated about the chronicity of disease, complications, and side effects of prolonged steroid use. Parents maintained good follow up during the course of illness and were well compliant with medicine intake. After 2nd relapse, parents were explained chances of steroid dependent nephrotic syndrome and chances of need of Pediatric Nephrologist opinion or Renal Biopsy in future.

Cost Benefit Analysis

There is restricted / non-availability of specialists in the areas of rural Uttar Pradesh. Due to shortage of specialists, patients with serious ailments have to travel to big cities for the treatment which incurs expenditure beyond the financial capacity of the patients. This patient is till now well managed close to her village.

The Jiyyo Mitra E-Clinic is situated close to the village to provide accessible and affordable treatment. It has successfully reduced the medical expenditure burden from the shoulders of the parents. Patients can visit from 8 a.m. To 10 p.m. without taking any day off from work. This reduces expenditure of travel, accommodation, meals and saving the opportunity cost (Figure 4). The NS disease is treatable but being chronic needs frequent follow up especially during the active phase. Due to the low-cost solution, parents were able to follow up regularly which shows high acceptability of this platform. It does have an impact on the quality of life of the caregivers positively when compared to the conventional health scenario.

Conclusion

Nephrotic syndrome is a chronic ailment with treatment lasting for months to years. In this report, an 18-month-old child is being successfully treated via telemedicine; reinforcing the notion that telemedicine can be highly beneficial across various age groups and various medical conditions. The study highlights that providing access to appropriate technology and ensuring that patients and providers are adept in its use can create a robust platform for delivering medical treatment, counselling, progress monitoring,

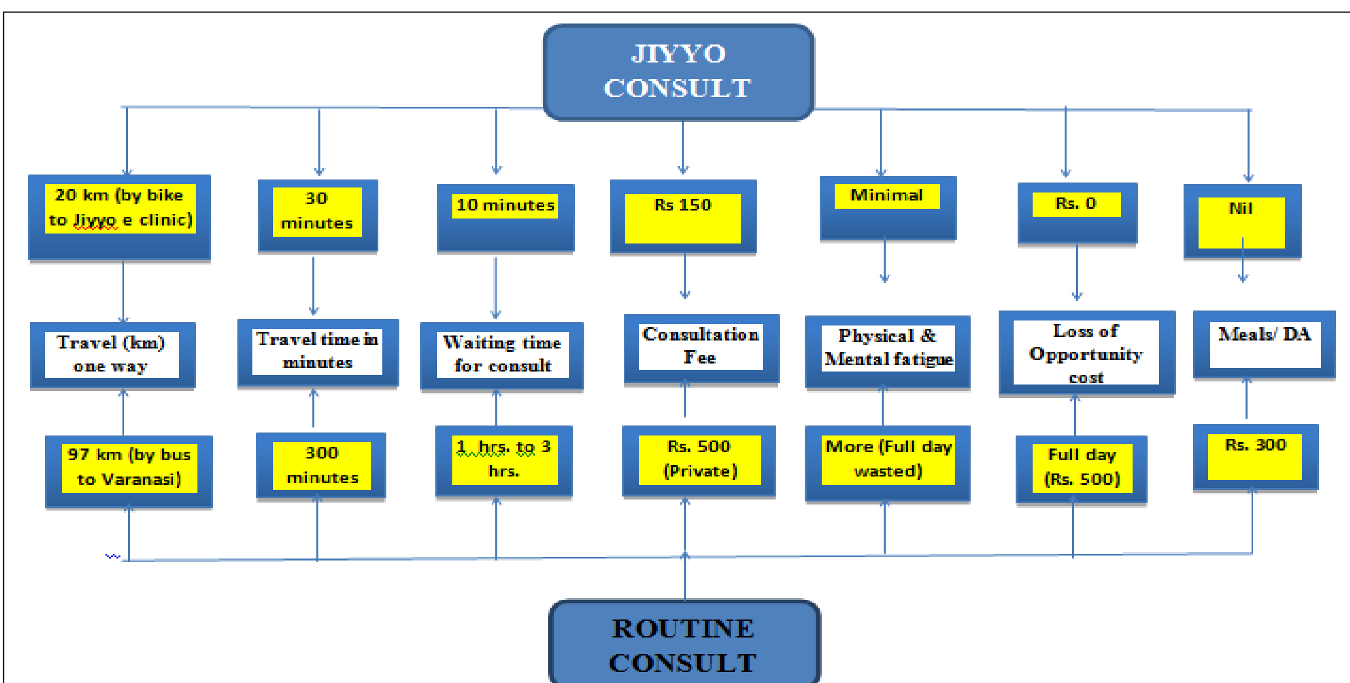

Figure 4: Jiyyo Consult System

and timely advice. Furthermore, telemedicine can substantially reduce healthcare costs by minimizing the need for physical consultations and associated expenses. Such is the capability of ourplatform, which exemplifies the effectiveness of telemedicine in modern healthcare.

APPENDIX A: Interview with patient's parents from corresponding author

Interview with patient's parents from corresponding author

1. How did you get to know about Jiyyo E- Clinic?

Respondent: I got to know from a nearby clinic run by Dr. Arora which is 20 km away.

2. How is the child feeling after treatment?

Respondent: She is feeling great. As parents we are happy too. Treatment has gone well.

3. How many times have you consulted the Doctor physically?

Respondent: I have never consulted the doctor physically but taken the video consultation for the last 2 years.

Were you explained about the disease and its chronicity?

Respondent: Yes, Doctor explained in detail about it in a understanding way.

Do you go for a Follow up Visit?

Respondent; Once a month

6. How much would you have spent otherwise if not taken tele-consultation from Jiyyo E-Clinic?

Respondent: I would have spent much more but now got treated at my home place with less funds.

7. Would you like to spread a word about Jiyyo E-clinic platform if you find someone ill?

Respondent: Yes Sir. Sure

8. Whether counselling has been done?

Respondent: Yes, It is done.

9. Do you have an issue if we publish this in the journal?

Respondent: No

APPENDIX B: Consent form

Consent form

केस रिपोर्ट : फिजिबिलिटी ऑफ़ ुसिंग टेलीमेडिसिन फॉर नेफ्रोटिक सिंड्रोम इन चिल्ड्रन - जियो मित्र इ क्लिनिक मॉडल

सब्जेक्ट 'स नाम : ___अंशी पुत्री मनीष
जनम तिथि , उम्र : _____3yrs

	Participant's initial
1. मुझे इस रिपोर्ट की जानकारी है और और मेरी मर्जी से ही यह रिपोर्ट छपी जा रही है	मनीशा
2. मैं अपनी मर्जी से इस रिपोर्ट में हिस्सा ले रहा हूँ	मनीशा
3. मुझे पता है की इस स्टडी से जुड़े लोग, एथिक समिति अथवा रेगुलेटरी अथॉरिटी, बिना मेरी इज़्ज़ाज़त मेरे हेल्थ रिकार्ड्स देख सकते हैं I मेरे स्टडी छोड़ने पर भी इससे जुड़े मेरे हेल्थ रिकार्ड्स देख सकते हैं | पर मुझे यह पता है कि मेरा नाम पता कभी भी किसी और व्यक्ति को नहीं बताया जायेगा ना ही किसी लेख में छपेगा	मनीशा
4. मुझे इस स्टडी के परिणाम के इस्तेमाल से कोई हरज नहीं है जबतक की वो साइंटिफिक कामो में उपयोग हो	मनीशा

हस्ताक्षर (और अंगूठे का निशाँ) स्टडी में हिस्सा लेने वाले के या लीगल रिप्रेजेन्टेटिव के
मनीशा
तारीख: 30 / 06 / 2024

हस्ताक्षर करने वाले का नाम : मनीशा

हस्ताक्षर ऑफ़ ऑथर
तारीख: 31 / 07 / 2024

APPENDIX C: BP centile chart for reference

Blood Pressure Levels for Girls by Age and Height Percentile*

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	83	84	85	86	88	89	90	38	39	39	40	41	41	42
	90th	97	97	98	100	101	102	103	52	53	53	54	55	55	56
	95th	100	101	102	104	105	106	107	56	57	57	58	59	59	60
	99th	108	108	109	111	112	113	114	64	64	65	65	66	67	67
2	50th	85	85	87	88	89	91	91	43	44	44	45	46	46	47
	90th	98	99	100	101	103	104	105	57	58	58	59	60	61	61
	95th	102	103	104	105	107	108	109	61	62	62	63	64	65	65
	99th	109	110	111	112	114	115	116	69	69	70	70	71	72	72
3	50th	89	87	88	89	91	92	93	47	48	48	49	50	50	51
	90th	100	100	102	03	104	106	106	61	62	62	63	64	64	65
	95th	104	104	105	107	108	109	110	65	66	66	67	68	68	69
	99th	111	111	113	114	115	116	117	73	73	74	74	75	76	76
4	50th	88	88	90	91	92	94	94	50	50	51	52	52	53	54
	90th	101	102	103	104	106	107	108	64	64	65	66	67	67	68
	95th	105	106	107	108	110	111	112	68	68	69	70	71	71	72
	99th	112	113	114	115	117	118	119	76	76	76	77	78	79	79
5	50th	89	90	91	93	94	95	96	52	53	53	54	55	55	56
	90th	103	103	105	106	107	109	109	66	67	67	68	69	69	70
	95th	107	107	108	110	111	112	113	70	71	71	72	73	73	74
	99th	114	114	116	117	118	120	120	78	78	79	79	80	81	81
6	50th	91	92	93	94	96	97	98	54	54	55	56	56	57	58
	90th	104	105	106	108	109	110	111	68	68	69	70	70	71	72
	95th	108	109	110	111	113	114	115	72	72	73	74	74	75	76
	99th	115	116	117	119	120	121	122	80	80	80	81	82	83	83
7	50th	93	93	95	96	97	99	99	55	56	56	57	58	58	59
	90th	106	107	108	109	111	112	113	69	70	70	71	72	72	73
	95th	110	111	112	113	115	116	116	73	74	74	75	76	76	77
	99th	117	118	119	120	122	123	124	81	81	82	82	83	84	84
8	50th	95	95	96	98	99	100	101	57	57	57	58	59	60	60
	90th	108	109	110	111	113	114	114	71	71	71	72	73	74	74
	95th	112	112	114	115	116	118	118	75	75	75	76	77	78	78
	99th	119	120	121	122	123	125	125	82	82	83	83	84	85	86
9	50th	96	97	98	100	101	102	103	58	58	58	59	60	61	61
	90th	110	110	112	113	114	116	116	72	72	72	73	74	75	75
	95th	114	114	115	117	118	119	120	76	76	76	77	78	79	79
	99th	121	121	123	124	125	127	127	83	83	84	84	85	86	87
10	50th	98	99	100	102	103	104	105	59	59	59	60	61	62	62
	90th	112	112	114	115	116	118	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
	99th	123	123	125	126	127	129	129	84	84	85	86	86	87	88

The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents

References

1. Saland JM, Ginsberg HN, Fisher EA. Dyslipidemia in pediatric renal disease: current Burke BL Jr, Hall RW; SECTION ON TELEHEALTH CARE. Telemedicine: Pediatric Applications. Pediatrics. 2015 Jul; 136(1):e293-308. doi: 10.1542/peds.2015-1517. PMID: 26122813; PMCID: PMC5754191.understanding and future directions. Pediatr Nephrol. 2016; 31(4):729-747. doi: 10.1007/s00467-015-3254-9.
2. Burke BL Jr, Hall RW; SECTION ON TELEHEALTH CARE. Telemedicine: Pediatric Applications. Pediatrics. 2015 Jul; 136(1):e293-308. doi: 10.1542/peds.2015-1517. PMID: 26122813; PMCID: PMC5754191.
3. Churg J, Habib R, White RH. Pathology of the nephrotic syndrome in children: a report for the International Study of Kidney Disease in Children. Lancet. 1970; 760(1):1299-1302. doi: 10.1016/S0140-6736(70)91954-7.
4. ISKDC. Nephrotic syndrome in children: prediction of histopathology from clinical and laboratory characteristics at time of diagnosis. Kidney Int. 1978; 13(2):159-165. doi:10.1038/ki.1978.23.
5. APN Study Group, the Japanese Society for Pediatric Nephrology. Evidence-based clinical practice guidelines for nephrotic syndrome 2013. Pediatr Int. 2015; 57(3):403-409. doi:10.1111/ped.12500.
6. Lewis MA, Baildom EM, Davis N, Houston IB, Postlethwaite RJ. Nephrotic syndrome: from toddlers to twenties. Lancet. 1989; 1(8649):255-259. doi: 10.1016/S0140-6736(89)91225-9.
7. Prince S, Naresh K, Tulasi R. Case Report on Paediatric Nephrotic Syndrome. EJIFCC. 2020 Jun 2; 31(2):164-168. PMID: 32549884; PMCID: PMC7294819.
8. R. Tulasi, et al. Clinical features and management of idiopathic nephrotic syndrome in children. J Nephrol Res. 2020; 7(1):22-29. doi:10.1016/j.jnephres.2020.02.003.
9. KDIGO Clinical Practice Guideline for Glomerulonephritis. Kidney Int Suppl. 2012; 2(2):139-274. doi:10.1038/kisup.2012.43.
10. Eddy AA, Symons JM. Nephrotic syndrome in childhood. Lancet. 2003; 362(9384):629-639. doi: 10.1016/S0140-6736(03)14184-0.
11. Hogan J, Radhakrishnan J. The treatment of idiopathic focal segmental glomerulosclerosis in adults. Adv Chronic Kidney Dis. 2014; 21(5):434-441. doi:10.1053/j.ackd.2014.03.010.
12. Gipson DS, Massengill SF, Yao L, et al. Management of Childhood Onset Nephrotic Syndrome. Pediatrics. 2009; 124(2):747-757. doi:10.1542/peds.2008-1559.