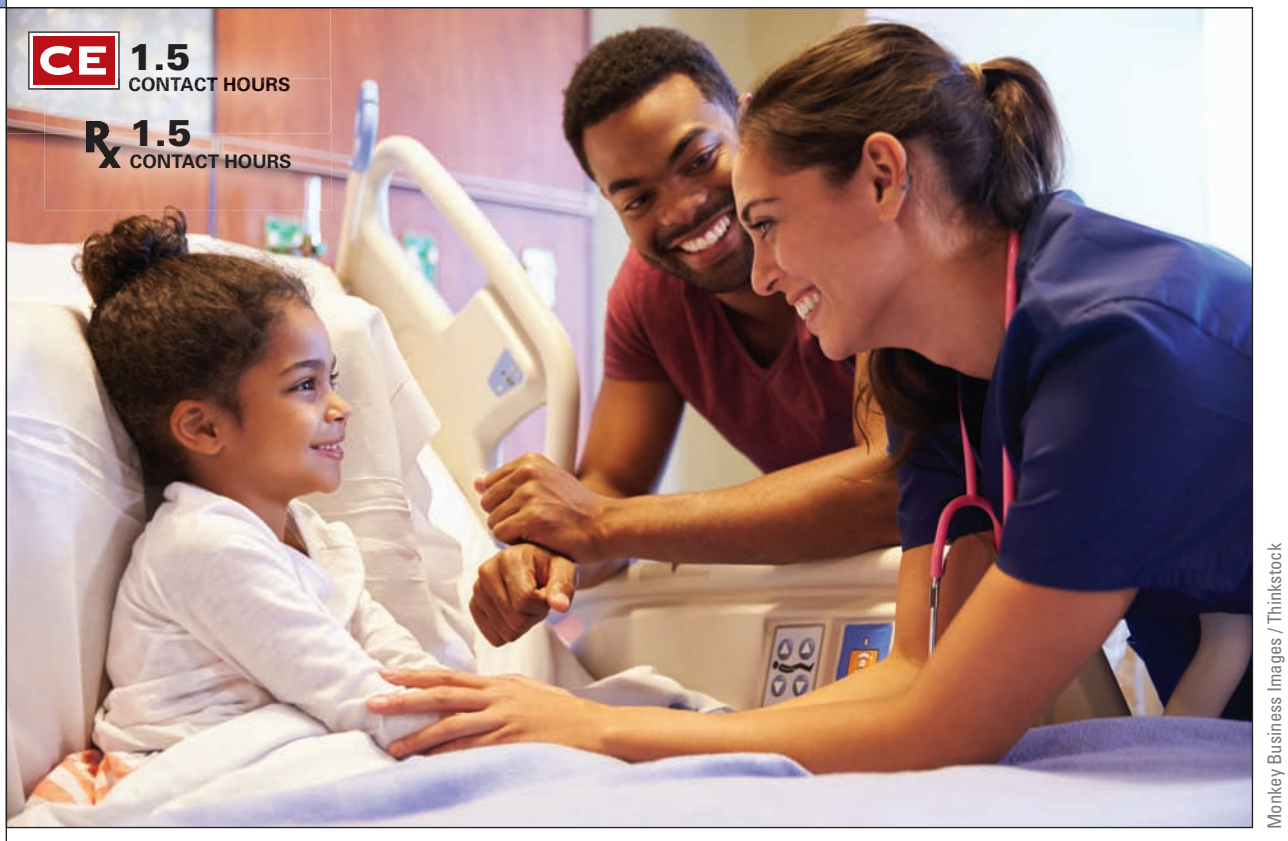

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Diagnosis and primary care management of focal segmental glomerulosclerosis in children

Abstract: Focal segmental glomerulosclerosis (FSGS) is a pattern of kidney damage that can occur in individuals at any age, including children. Pediatric patients with FSGS require medication monitoring, growth, and psychological health. This article discusses the NP's role in the clinical presentation, diagnostic workup, and treatment of FSGS in pediatric patients.

By Angela Y. Wong, MS, CPNP-PC and Rita Marie John, DNP, EdD, CPNP-PC, FAANP

JP, a 10-year-old girl, told her parents several times, "I feel puffy," before the family sought medical attention. This complaint could indicate a myriad of issues ranging from sudden weight gain to simple abdominal gas. For this child, "puffy" depicted her progressive edema—the only overt symptom of her diagnosis of focal segmental glomerulosclerosis (FSGS). Although some children with FSGS may only present with asymptomatic proteinuria at a routine physical, FSGS can affect individuals of all ages, and is a common cause of end-stage renal disease (ESRD) in children.[1]

This article discusses the pathophysiology, epidemiology, clinical presentation, and treatment options for FSGS. In addition, the article elucidates the role of the NP in managing this disease when it occurs during childhood.

Overview

FSGS is a pattern of kidney damage involving scarring of glomeruli in the kidney. This pattern of glomerulosclerosis is focal and segmental, meaning not all glomeruli are affected and only parts of the glomeruli are damaged, respectively.[2] FSGS is the most common

Keywords: end-stage renal disease, focal segmental glomerulosclerosis, kidney transplant, nephrotic syndrome, pediatrics

glomerular condition that leads to ESRD and the third most common cause of ESRD in children; approximately 50% to 70% of pediatric patients with FSGS progress to ESRD and require dialysis or kidney transplant.[3]

FSGS recurs in 30% to 40% of children who receive kidney transplants.[4] This high rate of recurrence further emphasizes the severe burden of stress this condition places on pediatric patients and their families, providing a strong incentive for additional research into the direct mechanism behind FSGS.

Epidemiology

FSGS has an estimated worldwide incidence rate of seven cases per million persons per year and is responsible for 20% of pediatric nephrotic syndromes.[1] The rate of occurrence of FSGS in patients with nephrotic syndrome is approximately 10% in children under age 6 years, 20% in adolescents, and 20% to 25% in adults.[5] Over 50% of patients will reach ESRD within 8 years, requiring dialysis or kidney transplant.

There are differences in the prevalence of FSGS among various ethnic groups. For example, the annual incidence of FSGS in Black Americans is 1.6 per 100,000, whereas in White Americans it is 0.3 per 100,000.[6] Black Americans have a 7.5% risk of progressing to ESRD, whereas White Americans have a significantly lower risk of 2%.[6]

The gene apolipoprotein L1 (APOL1) is much more frequent in Black Americans than in White Americans and is associated with a higher risk of developing FSGS.[4] The risk of developing advanced kidney disease is two to seven times greater for individuals carrying APOL1 alleles.[6]

Classification of FSGS

FSGS was initially classified into two categories: primary and secondary. The primary, or idiopathic, type arises from unknown etiology and accounts for 80% of FSGS cases.[7] Secondary FSGS has identifiable underlying causes including genetic, adaptive, virus-associated, or drug-related etiologies.[4] Recently, Rosenberg and Kopp proposed that FSGS be reclassified into six clinical forms: primary (idiopathic), adaptive, high-penetrance genetic, viral-mediated, drug-associated, and genetic APOL1 types (see *Types and causes of FSGS*).[8]

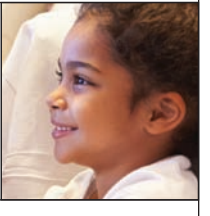
Pathophysiology

Disease pathway. FSGS is a glomerular disease characterized by injury at the glomerular epithelial cell (podocytes) and sclerosis in parts of some glomeruli.[9] Podocyte injury results in effacement of the podocyte foot processes, leading to impaired function of the glomerular filtration barrier and causes FSGS's defining feature of proteinuria.[10] This structural change to the kidney podocytes is progressive and irreversible in FSGS.

Etiology of disease

Circulating factors. In patients with primary FSGS, it is believed that circulating factors (most likely cytokines or similar molecules) play a role in the initial disease process.[8] These circulating factors are thought to induce the effacement of glomerular podocytes and remain in the body even after a kidney transplant. The factors then have the potential to cause podocyte damage and FSGS to reoccur in the transplanted kidneys. This theory of circulating molecules as the stimulant of podocyte injury may explain the high rate of reoccurrence of FSGS immediately after kidney transplants.[8]

The risk of developing advanced kidney disease is two to seven times greater for individuals carrying APOL1 alleles.



Genetics. Over 20 gene mutations are associated with changes to the podocyte structure that compromises podocyte integrity and functionality.[4] Specifically, these genes encode products that alter cellular components and disturb cell energetics.[11] Mutations causing FSGS are more common in younger patients. A study of 125 Spanish patients found that mutations were identified in 100% of cases with congenital onset, 57% of cases with infantile onset, 24% with early childhood onset, 36% with late childhood onset, and only 14% with adult onset.[12] This knowledge of genetic mutations may also provide information regarding the likelihood of responsiveness to specific treatments or the likelihood of reoccurrence of disease after kidney transplant.

Histological subtypes. FSGS is further classified into five histological subtypes based on the Columbia Classification published in the seminal paper by D'Agati

and colleagues.[13] These FSGS subtypes are based on the morphology of the specific glomerular lesions under the microscope. Specific histological subtype can play a significant role in the treatment and overall prognosis of FSGS (see *Histological subtypes of FSGS*).

Clinical presentation

The most common presenting symptom of FSGS in children is asymptomatic proteinuria during routine physical exam.[2] In cases of extreme nephron dysfunction, children may present with full nephrotic syndrome, most obviously manifesting as severe progressive edema.[14] In children, nephrotic syndrome is described as proteinuria (greater than 1 g/m^2 urine protein per day), hypoalbuminemia (less than 2.5 g/dL serum albumin), hypercholesterolemia (greater than 200 mg/dL total cholesterol), and edema.[10] Edema is present in almost half of patients at the time of disease onset and can be categorized as mild or moderate (involving the feet,

Types and causes of FSGS[8-10,34]

Types	Causes
Primary (idiopathic) FSGS	Specific cause unknown; likely cytokine acting as a circulating factor in the blood
Adaptive FSGS	• Mismatch between metabolic input and glomerular capacity • Podocyte stress with genetic susceptibility • Excessive workload on nephron due to: – Obesity – Reduced renal mass • Ischemia secondary to hypertension, renal artery stenosis
High-penetrance genetic FSGS	• Podocyte slit diaphragm – NPHS1 (nephrin), NPHS2 (podocin) – CD2-associated protein (CD2AP) • Actin cytoskeleton – ACTN4 (alpha-actinin 4) – Myosin IIA – Myosin 1E (MYO1E) • Lysosomes – Scavenger receptor class B member 2 (SCARB2)/Lysosomal integral membrane protein-2 (LIMP-2) • Mitochondria – Coenzyme Q2 (COQ2) – tRNA(Leu) – Coenzyme Q6 (COQ6) • Cellular nucleus – Wilms' tumor 1 (WT1)
Viral-mediated FSGS	• Direct viral infection of the podocyte receptors: – HIV – Parvovirus B19 – Cytomegalovirus – Epstein-Barr virus
Drug-associated FSGS	• Damage of podocytes and kidney tubules by: – Heroin – Bisphosphonate – Calcineurin inhibitors (post renal allograft) – Interferon – Lithium – Androgen use – Chronic use of nephrotoxic drugs

Histological subtypes of FSGS[4,10,20]

Variants	Lesion histology	Associations
Not otherwise specified (NOS)	• Foot-process effacement is variable • Does not meet defining criteria for other variants	• Most common variant • Other variants can evolve into NOS overtime
Perihilar	• Foot-process effacement relatively mild and focal	• More commonly associated with adaptive (secondary) FSGS
Cellular	• Foot-process effacement usually severe	• Least common variant • Possibly represents early stage of sclerotic lesions
Tip	• Foot-process effacement usually severe	• Most favorable prognosis, with high rate of response to corticosteroid therapy and low risk of progression
Collapsing	• Foot-process effacement usually severe • Severe tubular injury	• Worst prognosis, with poor response to corticosteroids and rapid progression to kidney failure

ankles, and legs) or severe (involving the abdomen or whole body).[15]

Other common presenting symptoms of FSGS include hypertension, microscopic hematuria, and dyslipidemia.[2,14] Although FSGS often presents asymptomatically or with general symptoms of nephrotic syndrome, it is impossible to diagnose on clinical presentation alone. A diagnostic workup, including kidney function tests and kidney biopsy, is essential for the exact diagnosis of FSGS.

Evaluation and diagnostic workup

A thorough workup is required to adequately rule out other glomerulopathies and to confirm the diagnosis of FSGS (see *Differential diagnoses of FSGS*).

Comprehensive history and physical exam. To distinguish between primary and secondary FSGS, taking a thorough medical history and knowing the onset of symptoms are crucial. Questions should discuss neonatal history, history of viral infections, drug use, obesity, reflux nephropathy, reduced renal mass, hypertension, and past or present medications that could contribute to FSGS.[2,8] Generally, primary FSGS is more likely than secondary FSGS to present with the symptoms of nephrotic syndrome.[1]

Lab testing. Diagnostic testing for FSGS should include kidney function tests, serum albumin, urine protein-to-creatinine ratio, and lipid profile.[2,9] If virus-related secondary FSGS is suspected, viral serology and serum antigen testing will aid in the diagnosis. The expected lab values include a decreased albumin level and elevated lipid level. Two urinary lipid metabolites (fatty acid and lysophosphatidylcholines) are being studied as possible diagnostic biomarkers for FSGS. These cytotoxic lipid metabolites, derived from damaged podocytes, are increased in the urinary analysis of patients with FSGS.[16]

Kidney biopsy. The ultimate diagnosis of FSGS depends on kidney biopsy findings that reveal a distinct pattern of glomerular scarring.[14] Biopsies of FSGS kidneys showed over 40% of glomeruli with segmental sclerosis and over 50% with global sclerosis, leaving only 8% of normal glomeruli.[9]

Genetic testing. Genetic testing may be helpful in ruling out primary FSGS for cases in which a genetic mutation is identifiable.[2] Testing for the genes that might be responsible for FSGS may aid in identifying the best treatment, recognizing patients who are at greater risk for FSGS reoccurrence after transplant, and identifying risks in other family members.[17]

Treatment

The goal of treatment is to control or eliminate proteinuria and preserve kidney function in children with FSGS.[10] Currently, there are no FDA-approved therapies for FSGS.[18] Pharmacologic treatment has a success rate of 20% to 40% with the present agents available, including angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers, corticosteroids, calcineurin inhibitors, mycophenolate mofetil, and

rituximab.[8] When medications fail, dialysis and kidney transplant become the next treatment options.

Renin-angiotensin-aldosterone system blockade. Medications that target the renin-angiotensin-aldosterone system to reduce proteinuria and prevent hypertension are the standard of care for patients with FSGS. BP control is necessary to prevent organ damage resulting from hypertension and to delay progression of glomerular damage in glomerular and kidney disorders. All patients with FSGS are encouraged to make lifestyle modifications, including a low-sodium diet, regular exercise, weight maintenance, and smoking cessation.[14] NPs should counsel adolescent and preadolescent patients regarding the risks of smoking, emphasizing the detrimental impact on their health and disease. Additionally, NPs can also recommend smoking cessation support, including computer-interactive programs, telephone counseling, or group programs.

Angiotensin-II is also thought to play a role in podocyte damage and protein leaking.[19] Renin-angiotensin-aldosterone antagonists lower glomerular filtration pressures, thereby reducing proteinuria and protecting the glomerular podocytes from further damage.[10] The reduction of proteinuria is essential in the management of FSGS, as persistent proteinuria can lead to higher risk of cardiovascular disease and long-term kidney damage.[20]

Corticosteroid therapy. Because FSGS often presents as nephrotic syndrome, patients are treated empirically with oral corticosteroids without a kidney biopsy, as 80% of children presenting with idiopathic nephrotic syndrome are diagnosed with steroid-responsive minimal change disease.[14] The standard corticosteroid treatment is oral prednisone for 4 to 6 weeks.[14] If proteinuria does not decrease by at least 20% from baseline after 2 months of therapy, this most likely denotes steroid resistance, and steroid therapy should be discontinued.[9]

Although patients with FSGS may respond to corticosteroid therapy, these patients are often never formally diagnosed with FSGS, as kidney biopsies are not routine with successful corticosteroid therapy (see *Treatment algorithm for FSGS* and *Pharmacologic therapies for FSGS*).

Calcineurin inhibitors. Calcineurin inhibitors (CNIs) are recommended as the first-line therapy for steroid-resistant nephrotic syndrome and in patients with relapsing disease.[9] Cyclosporine and tacrolimus are CNIs that act on podocyte structure, intracellular signaling, and glomerular blood flow to decrease proteinuria.[21]

While tacrolimus is effective in approximately 50% to 75% of patients and has a lower risk of kidney toxicity, it has adverse reactions of tremors, hypertension, and diabetes mellitus.[22] There is also the risk of developing serious infections or malignancies with the use of tacrolimus. Despite the effectiveness of CNIs in achieving partial or complete remission of proteinuria, relapses occur in up to 50% of patients when treatment is discontinued.[20]

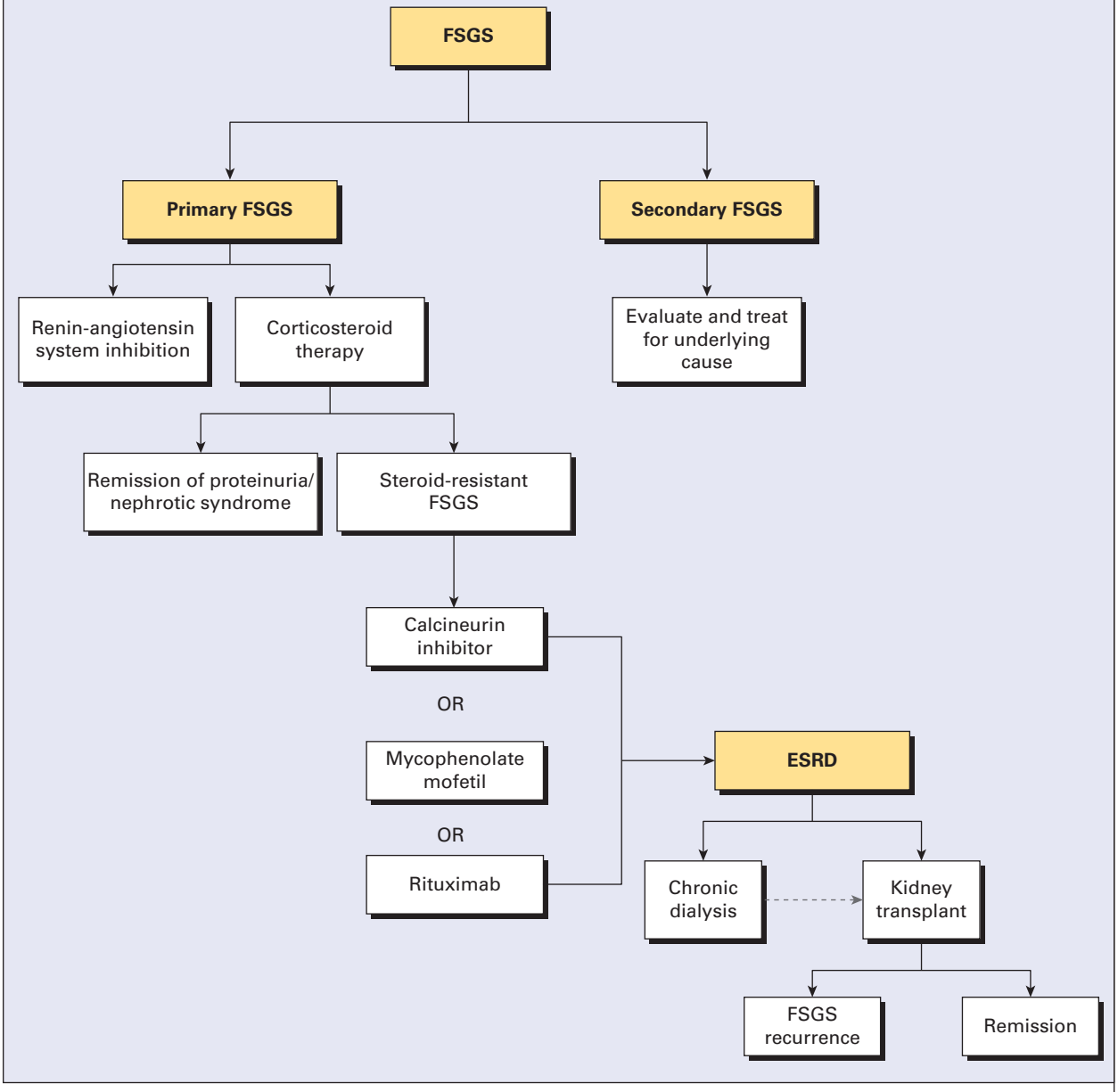
Mycophenolate mofetil. Mycophenolate mofetil, a third-line agent with an unknown mechanism of action, is often used in combination with other immunosuppressants and has milder adverse reactions than CNIs.[8,14] However, mycophenolate carries a risk of developing serious infections or malignancies, and there is a lack of data on the long-term efficacy of the drug. Additionally, there is a need for more long-term studies on its therapeutic effect on FSGS.

Rituximab. Rituximab is a monoclonal antibody that causes immunosuppression via the CD20 molecule on the surface of B-lymphocytes.[23] Although the exact therapeutic mechanism of rituximab on FSGS is unknown, a systematic review by Dogra and Kaskel suggests that rituximab reduces the occurrence of relapse in patients with steroid-resistant FSGS.[21] One retrospective cohort study in children with steroid-resistant nephrotic syndrome (24 subjects, ages 2 to 16 years, mixed genders, and various racial backgrounds) showed that rituximab therapy, followed by mycophenolate mofetil as an additive immunosuppressant, is a considerable treatment regimen in achieving and maintaining remission.[23] Patients receiving rituximab

Differential diagnoses of FSGS[4,9,10,20,21,34]

Type	Differential diagnoses
Other glomerular diseases	Minimal change disease
	Diffuse mesangial sclerosis
	Immunoglobulin A nephropathy
	Membranoproliferative glomerulonephritis
	Membranous nephropathy
	Reflux nephropathy
Acquired	Drug toxicity
	HIV
Other	Lupus nephritis
	Obesity-related glomerulopathy

Treatment algorithm for FSGS[20]



need to be monitored for severe infusion reactions during treatment.[22]

Adalimumab. Adalimumab is a monoclonal antibody that inhibits tumor necrosis factor-alpha (TNF-alpha) and its autoimmune response. It is thought that TNF-alpha, an inflammatory cytokine, sets off an autoimmune cascade that induces production of cytokines, growth factors, and oxygen radicals at the site of glomerular injury, causing direct toxicity to the glomerular epithelium.[24]

Systematic reviews have shown that adalimumab is effective in improving glomerular filtration rate (GFR) and decreasing proteinuria by more than 50%.[20,22] However, a Novel Therapies for Resistant Focal Segmental Glomerulosclerosis study showed that adalimumab was successful in preserving GFR but failed to reduce proteinuria in any of the subjects.[24] These varied results encourage further research on the role of TNF-alpha and the specific mechanism of adalimumab on glomerular filtration.

Transplant. In general, progression to ESRD occurs within 5 to 10 years.[1] The preferred treatment in most cases of pediatric ESRD is kidney transplantation, which gives children the opportunity to develop normally.[25] While this remains true for patients with FSGS, it is not guaranteed that a kidney transplant will achieve complete remission because of the high risk of FSGS reoccurrence in the transplanted kidney.

Reoccurrence. The posttransplantation recurrence risk for an initial kidney transplant ranges from 30% to 40%, whereas the risk in patients who have had more than one transplant is as high as 80% to 100% (see *FSGS recurrence risk factors*).[4,26] After transplantation, the recurrence of FSGS is observed in two patterns: early reoccurrence (defined by proteinuria within hours to days after transplantation) or late reoccurrence (which develops over months or years after transplantation).[27] Early reoccurrence is by far the most common pattern in the pediatric FSGS population. Treatment of reoccurring FSGS has yet to be standardized given the varied etiologies and individual responses to previous treatments.

Currently, plasmapheresis is the first-line treatment for reoccurring FSGS. Plasmapheresis is increasingly

Pharmacologic therapies for FSGS[14,22,24]

Treatment type	Medications	Common adverse reactions
Immunosuppressive treatment		
	• Corticosteroids – Prednisone, prednisolone	• Hyperglycemia • Weight gain • Extreme immunosuppression • Growth impairment • Behavioral changes • Sleep issues • Osteoporosis
	• Calcineurin inhibitors – Cyclosporine – Tacrolimus	• Tacrolimus: – Tremors – Hypertension – Diabetes mellitus
	• Mycophenolate mofetil	• Diarrhea • Abdominal pain • Leukopenia
	• Monoclonal antibodies – Rituximab – Adalimumab	• Adalimumab: – Edema – Fatigue – Infection – Headache – Gastrointestinal upset
Conservative treatment		
	• Renin-angiotensin-aldosterone blockade – Angiotensin-converting enzyme inhibitors – Angiotensin II receptor blockers – Aldosterone antagonists	• Hypotension • Hyperkalemia • Reduction in glomerular filtration rate
	• HMG-CoA reductase inhibitors (statins) for dyslipidemia	• Statins: – Upper respiratory tract infection – Abdominal pain – Nausea – Myalgia

studied as a treatment based on the theory of circulating permeability factors contributing to FSGS pathogenesis.[27] Given this theory that circulating factors stimulate structural damage to kidney foot-processes, plasmapheresis is hypothesized to remove these causative factors, thus treating or preventing the reoccurrence of glomerular injury in FSGS. It is most beneficial as soon as disease reoccurrence is suspected and is reported to achieve remission after 8 to 12 treatments.[18]

Ponticelli reported that in pediatric patients with reoccurring FSGS, 70% of children achieved complete or partial remission of proteinuria after receiving plasmapheresis.[28] A universally effective treatment of recurrent FSGS has yet to be established, but combination of plasmapheresis with corticosteroids, CNIs, and/or rituximab seems to have the most encouraging results.[27]

Although this high rate of FSGS recurrence post-transplantation should not be a deterrent for kidney transplantation in children, the increased likelihood of reoccurrence with subsequent transplantations should be considered closely before pursuing a second or third transplant in a patient with history of reoccurring FSGS.

Dialysis. When remission of FSGS cannot be accomplished through pharmacology or transplantation, patients may be bound to maintenance dialysis. The Kidney Disease: Improving Global Outcomes Glomerulonephritis Work Group reports that children with FSGS progressing to ESRD have a significantly reduced life expectancy of approximately 19 years following the start of dialysis and live an average of 40 years after kidney transplantation.[29] Given these statistics, the push for further research in effective treatment and sustained remission of FSGS is needed to decrease the morbidity and mortality associated with the disease.

Role of the NP

Pediatric nephrologists largely manage the treatment of children with FSGS. However, pediatric primary care providers also play an integral role in coordinating care and establishing a patient-centered medical home for children diagnosed with FSGS.

Psychosocial concerns. FSGS causes a significant impairment in the general health and happiness of affected children. Children with steroid-resistant nephrotic syndrome and FSGS report lower quality of life (QoL) in the areas of physical, emotional, and school functioning.[15,30] In addition to daily emotional, social, and psychological disruptions, the burden of FSGS also has a substantial impact on patients' family members.[29] The NP should refer families to community-based agencies to help reduce the financial hardships along with a referral to visiting nurse services that will help in developing medication regimens to diminish stress at home.

FSGS recurrence risk factors[19]

- Younger age (especially children under 6 years at FSGS onset)
- Non-Black race
- Rapid progression to ESRD in the initial kidney (< 3 years)
- Persistent proteinuria prior to transplantation
- History of FSGS recurrence in previous kidney transplants
- Nongenetic cause of FSGS

A cross-sectional study surveying 151 patients with nephrotic syndrome between the ages of 8 and 17 measured nine self-reported items: anxiety, depression, social-peer relationships, anger, fatigue, mobility, pain interference, upper extremity functioning, and asthma impact.[30] The children with active nephrotic syndrome scored lower in the areas of anxiety, pain interference, fatigue, and mobility.[30] These issues reflect the physical burden of nephrotic syndrome, its symptoms, and its intensive treatment.

The increased anxiety level in children with nephrotic syndrome suggests deeper psychosocial issues related to the loss of control over disease symptoms. The NP may help ease this stress through encouraging social support groups between children and adolescents of similar ages, thereby connecting patients with relatable experiences and psychosocial support to thwart potential anxiety and depression issues. Furthermore, children with severe kidney disease, especially those requiring exhaustive treatment regimens and frequent hospitalizations, have significant psychosocial and emotional concerns that further reduce their QoL.

For children with FSGS who require chronic dialysis, the dependence on a routine and time-consuming treatment is a troublesome burden. For example, demanding dialysis schedules and treatment complications may require children to resort to homeschooling, thereby disturbing established family routines. Wightman and Freeman reported that the burdensome dialysis schedules of children with FSGS affected the entire family by disrupting family life, creating financial hardship,

increasing parental stress, decreasing the time spent between parents and other siblings, and causing school problems in siblings.[25] Heavy disease burden due to complex treatment regimens resulted in depression, poor self-esteem, family stress, financial burden, sibling and parent absences from school and work, and overall decreased QoL in children and their families.[31]

Given the enormous burden on these families, the NP can serve as a resource to connect parents to support groups and community programs to provide a network of solidarity with families experiencing similar difficulties. The NP and the family, using shared decision-making, can develop a plan of care to improve QoL for the entire family.

Medication management. With corticosteroids as the first-line standard therapy for patients presenting with FSGS symptoms, close monitoring for adverse reactions is essential. Preventing hypertension is paramount because of the rapid progression of glomerular injury in FSGS. Renin-angiotensin inhibitors are a mainstay of FSGS treatment and require monitoring for adverse reactions of hyperkalemia and reduced GFR.[14]

Primary care providers should ensure that antihypertensive medications are taken in conjunction with a low-sodium diet and regular exercise. Additionally, emphasis should be placed on weight management for patients with FSGS, as corticosteroids and CNIs are associated with increased risk of metabolic syndrome and related disorders, including obesity, dyslipidemia, and hypertension.[32]

Growth. Children with FSGS and ESRD are at high risk of inadequate nutrition and impaired growth. Decreased linear growth is common in children with severe kidney disease and plays a role in the low health-related QoL among those with pediatric kidney disease.[31] Furthermore, ESRD has a significant influence on bone growth and mineralization in children and adolescents. The combined deleterious effects of renal osteodystrophy and corticosteroid therapy increase the likelihood of developing osteopenia, frequent fractures, and growth failure.[33]

Diet. Individualized dietary plans may need to be modified to maintain sufficient intake of calories, protein, minerals, and fluids according to each child's physiologic needs.[32] Of note, vitamin D deficiency is especially prevalent among children with chronic kidney disease.

While vitamin D deficiency is indeed common among the healthy pediatric population, levels of calcium and serum 25-hydroxyvitamin D were significantly lower in children with chronic kidney disease and even more deficient in those with severe late-stage disease.[33] Supplementation and education regarding the necessary calories, vitamins, and minerals are crucial components of managing overall health in patients with FSGS.

Conclusion

FSGS is a devastating condition that can develop in individuals of any age, including children. The disease has the potential to become a burdensome diagnosis for children and their families. For cases that are more responsive to treatment, management of medications quickly becomes a tedious responsibility. For children who receive kidney transplants, the high rate of FSGS posttransplantation reoccurrence means transplantation is not a guaranteed cure. Some children need chronic dialysis, which not only impairs independence and QoL, but also inflicts a sobering decrease in life expectancy.

FSGS imposes a noteworthy burden on the psychological and emotional health of children and their families, highlighting the importance of overall pediatric primary care. The devastating progression and prognosis of FSGS only emphasizes the need for further advancements in more effective treatments and prevention of disease reoccurrence. NP

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Diagnosis and primary care management of focal segmental glomerulosclerosis in children

TEST INSTRUCTIONS

- To take the test online, go to our secure website at **www.nursingcenter.com/ce/NP**. View instructions for taking the test online there.
- If you prefer to submit your test by mail, record your answers in the test answer section of the CE enrollment form on page 38. You may make copies of the form.

Each question has only one correct answer. There is no minimum passing score required.

Complete the registration information and course evaluation. Mail the completed form and registration fee of $17.95 to: Lippincott Professional Development CE Group, 74 Brick Blvd., Bldg. 4, Suite 206, Brick, NJ 08723. We will mail your certificate in 4 to 6 weeks. For faster service, include a fax number and we will fax your certificate within 2 business days of receiving your enrollment form. You will receive your CE certificate of earned contact hours and an answer key to review your results.

- Registration deadline is September 4, 2020.

DISCOUNTS and CUSTOMER SERVICE

- Send two or more tests in any nursing journal published by Lippincott Williams & Wilkins together and deduct $0.95 from the price of each test.
- We also offer CE accounts for hospitals and other healthcare facilities on nursingcenter.com. Call 1-800-787-8985 for details.

PROVIDER ACCREDITATION

Lippincott Professional Development will award 1.5 contact hours for this continuing nursing education activity.

Lippincott Professional Development is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

This activity is also provider approved by the California Board of Registered Nursing, Provider Number CEP 11749 for 1.5 contact hours. Lippincott Professional Development is also an approved provider of continuing nursing education by the District of Columbia, Georgia, and Florida CE Broker #50-1223.

This activity has been assigned 1.5 pharmacology credits.