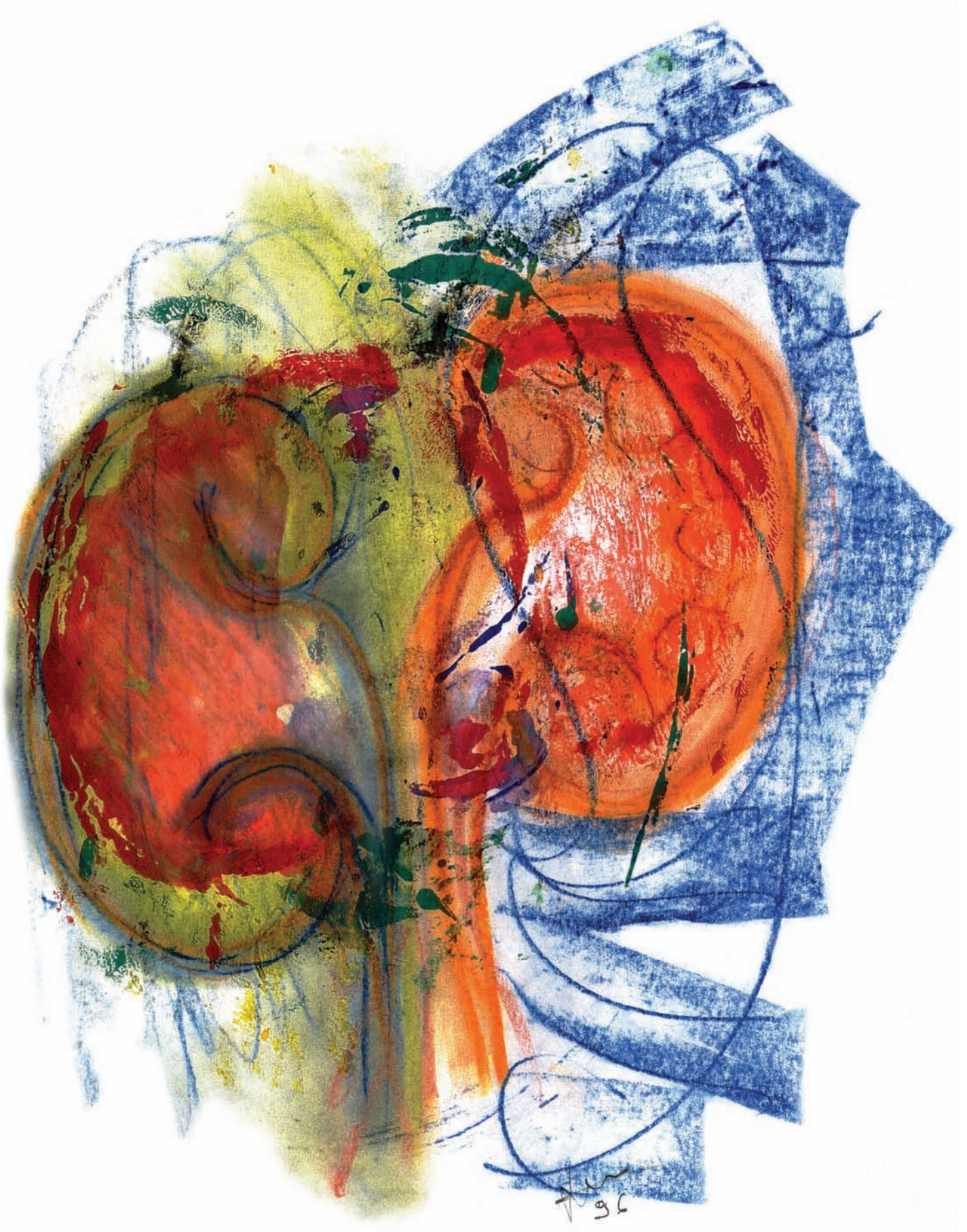

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Minimal change disease:
A case report

BY FAY M. MITCHELL-BROWN, PhD, RN, CCRN, AND TIERNAN VEISZE, SN

Abstract: Although minimal change disease (MCD) is a major cause of nephrotic syndrome in children, it's less common in adults. It develops from damage to the glomeruli with a loss of large amounts of protein in the urine. Early recognition and treatment is the key to a good outcome. This article describes the diagnosis, treatment, and nursing care of an adult with MCD.

Keywords: kidney disease, MCD, minimal change disease, nephrotic syndrome, podocytes, renal biopsy

PJ, 63, IS A WHITE male with a health history that includes hypertension, dyslipidemia, diverticulosis, and vitamin D deficiency. His surgical history includes thymus tumor removal 2 years ago and, more recently, a right total knee arthroplasty (TKA) due to end-stage osteoarthritis. He also has a family history of chronic kidney disease. Before and after the TKA, PJ had been taking a nonsteroidal anti-inflammatory drug (NSAID) in addition to an opioid for pain relief.

One week post-op, lab work revealed a serum creatinine of 1.1 mg/dL (normal range, 0.6 to 1.3 mg/dL) and a glomerular filtration rate (GFR) greater than 60 mL/min (normal range, greater than 60 mL/min). Normal lab values cited in this article were the reference ranges used at this hospital.

A month later, PJ returned to the hospital with complaints of nausea, anorexia, and ageusia (loss of taste). At this time, PJ's lab studies revealed a serum creatinine of 3.7 mg/dL and an estimated GFR of 30 mL/min. For unknown reasons, PJ was sent home despite this acute decrease in kidney function and advised to follow up with a nephrologist as soon as possible.

Two weeks later PJ returned to the ED with nausea, shortness of breath, inability to eat solid food, anasarca, and oliguria. His serum creatinine at that time was

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5.9 mg/dL; blood urea nitrogen (BUN), 46 mg/dL (normal, 6 to 18 mg/dL); serum albumin, 1.5 g/dL (normal 3.6 to 4.6 g/dL); serum cholesterol, 250 mg/dL (normal 140 to 225 mg/dL); and an estimated GFR of 18 mL/min. PJ was admitted to this rural acute care hospital with renal failure of unknown etiology.

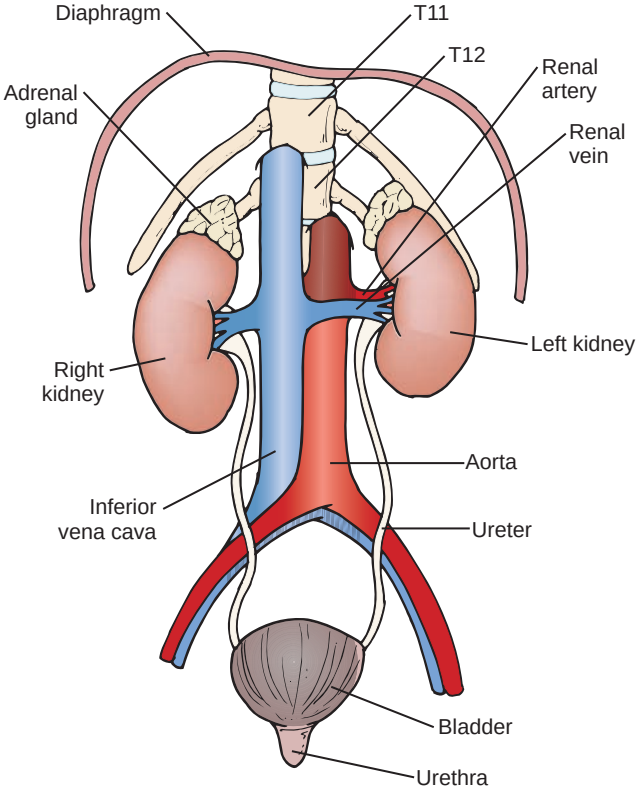
Thus began PJ's ordeal with minimal change disease (MCD), which is a major cause of nephrotic syndrome in children but less common in adults.[1] This article describes the diagnosis, treatment, and nursing care of an adult patient with MCD.

Normal anatomy and physiology

The kidneys are paired, bean-shaped organs that lie outside the peritoneal cavity in the back of the upper abdomen, one on each side of the vertebral column at the level of the 12th thoracic to 3rd lumbar vertebrae (see *Kidney and urinary tract anatomy*). Each kidney is composed of more than 1 million closely packed functional units called nephrons, each of which can produce urine. Each nephron consists of a glomerulus, where blood is filtered, and a system of tubular structures where water, electrolytes, and other substances needed to maintain the constancy of the internal environment are reabsorbed into the bloodstream and unneeded materials are secreted into the tubular filtrate for elimination (see *A closer look at the glomerulus*).[2]

MCD develops from damage to the glomeruli with a loss of large amount of protein in the urine. The disease was so named because the damage to the glomeruli cannot be seen by light microscopy.[3] Not until the invention of the electron microscope could clinicians differentiate healthy foot processes (podocytes) of the glomeruli from diseased ones. The etiology of MCD is not fully known but evidence suggests that systemic T-cell dysfunction disrupts normal glomerular filtering function, resulting in proteinuria and podocyte fusion.[1]

Kidney and urinary tract anatomy[2]



Primary vs. secondary MCD

MCD can be categorized as primary or secondary. Primary MCD, which is more common in children, means that MCD occurs for no obvious reason (idiopathic).[1] In adults, MCD is likely to be secondary to another disorder, such as Hodgkin lymphoma and/or use of certain drugs, especially NSAIDs.[1,4] (See *Prevalence of MCD*.)

Secondary MCD has also been associated with allergies, neoplasms, infections, and other glomerular diseases. Besides NSAIDs, drugs that may be implicated in the development of MCD include lithium, sulfasalazine and 5-aminosalicylic acid derivatives, pamidronate and other bisphosphonates, immunizations, trimethadione, gamma interferon, and certain antimicrobials such as ampicillin, rifampin, and cephalosporins.[1]

PJ was at an increased risk for renal dysfunction because of a significant family history of chronic kidney disease, the use of NSAIDs for pain relief, chronic hypertension, and a history a thymus tumor.[5] All these factors can contribute to the diagnosis of MCD.

Clinical manifestations

Loss of protein in the urine, mostly albumin, causes the signs and symptoms of nephrotic syndrome.[6] Albumin, a plasma protein, aids in maintaining capillary colloidal osmotic pressure that helps to retain fluid in the intravascular compartment. In hypoalbuminemia, fluid moves from the intravascular space into the interstitial or tissue spaces, as well as into the transcellular compartments such as the peritoneal cavity.[2,7] This results in anasarca.

Although albumin is the principal urinary protein, other plasma proteins, including clotting inhibitors, transferrin, immunoglobulins, and

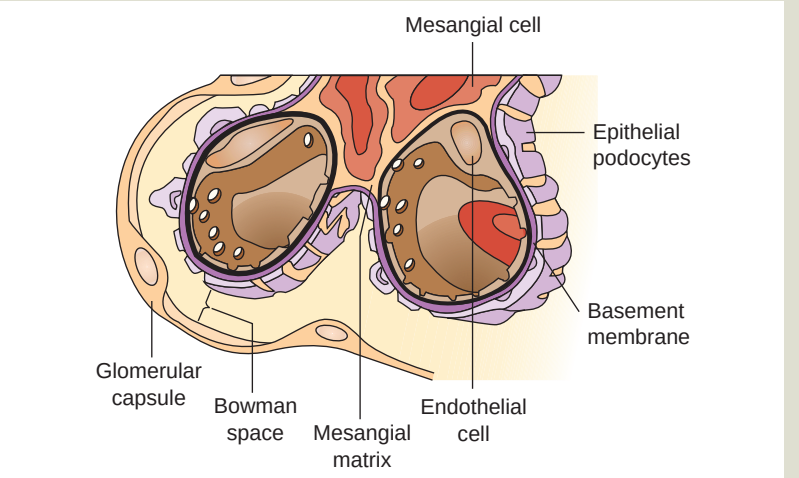
hormone-carrying proteins such as vitamin D-binding protein, may be lost as well. These losses can increase the risk of thrombosis, iron deficiency anemia, infection, and vitamin D deficiency. Decreased plasma oncotic pressure appears to stimulate hepatic lipoprotein synthesis resulting in dyslipidemia, especially hypercholesterolemia and hypertriglyceridemia.[8] PJ presented with hallmark signs of nephrotic syndrome: hypoalbuminemia, hyperlipidemia, and anasarca.

In PJ's case, the signs and symptoms of nephrotic syndrome caused by MCD have a sudden onset (over a few days to a week). This fast onset distinguishes MCD from most other causes of nephrotic syndrome, which typically have a more gradual onset.[1]

The most visible sign of MCD is generalized edema, which can be profound. Edema usually starts in the dependent areas of the body, usually the lower extremities, and progresses to the peritoneal cavity. In addition, because of proteinuria, the urine may appear foamy or frothy.

Edema and proteinuria develop rapidly, almost overnight. Other signs of MCD include weight gain, hypertension, hypercholesterolemia, thrombosis, and thromboembolism.[1] Hypovolemia may also occur due to the alteration in capillary permeability and third-space fluid shifts.

A closer look at the glomerulus[2]



The glomerulus consists of a compact tuft of capillaries, with a central region of mesangial cells and surrounding matrix, encased in a thin double-layered capsule called the glomerular capsule. Its visceral layer is composed of podocytes, epithelial cells that perform a filtering function. These large cells have numerous finger-like processes that encircle the outer surface of the capillaries. The elongated spaces between the interdigitating foot processes, called filtration slits, function as a size-selective filter that prevents proteins and large molecules that have crossed the basement membrane from entering the Bowman space.

Diagnostic testing

Appropriate routine lab studies include GFR, serum creatinine, BUN, lipid panel, and serum albumin levels. Additional diagnostic studies include:

- urinalysis. Lipiduria is usually present in nephrotic syndrome. Urinary lipid may be present in the sediment, entrapped in casts (fatty casts), enclosed by the plasma membrane of degenerative epithelial cells (oval fat bodies), or free in the urine.[8] Urine specific gravity is high because of proteinuria.
- random albumin-to-creatinine concentration ratio. In MCD, this value is in excess of 5 mg/g. PJ's result was 38 mg/g.
- 24-hour urine test for protein. A normal value is 80 mg/24 hour. PJ's result was 4,200 mg/24 hour.
- 24-hour urine creatinine clearance. This value will be decreased (normal for men, 14 to 26 mg/kg/24 hour). A result for this test could not be found in PJ's medical record.
- renal biopsy. Because the diagnosis of MCD (versus other causes of nephrotic syndrome) cannot be predictably made from the clinical presentation, a renal biopsy is almost always performed in adults, both to establish the diagnosis and to guide therapy.

PJ's clinical presentation, lab results, and renal biopsy results confirmed a diagnosis of MCD as the cause of his nephrotic syndrome.

Managing MCD

Pharmacologic treatment for MCD focuses on inducing remission to restore glomerular function and reverse the signs and symptoms of nephrotic syndrome.[6] This therapy primarily consists of corticosteroids such as prednisone or prednisolone to induce immunosuppression and decrease activity of T-cell cytokines.[9] Although children typically respond to steroids within 2 weeks and remain on steroids for another 6 weeks, adults respond much more slowly and may remain on steroids for up to 16 weeks. After treatment is initiated, 80% to 95% of all patients go into remission.[10]

On the other hand, up to 20% of patients can develop steroid resistance.[11] Immunosuppressive medications such as cyclosporine may be used to treat steroid resistance.[9,11]

Other medications are used to treat MCD symptoms as they occur; for example, anticoagulants such as warfarin to treat or prevent thrombus formation from hypercoagulability and statins to treat high serum cholesterol.[3] PJ's medications included I.V. furosemide, oral warfarin, I.V. albumin, and I.V. methylprednisolone followed by a transition to oral prednisone.

Patients with recurrent MCD may require treatment with a cytotoxic agent such as cyclosporine, but most patients respond well to standard treatment and go into remission within the first 1 to 2 months.

Patients with nephrotic syndrome pose a challenge to healthcare providers. Steroids remain the first-line treatment unless contraindicated.[11] Relapse sometimes occurs and some patients might become steroid-dependent. When patients are steroid-resistant, treatment is tailored on an individual basis with the use of nonsteroidal immunomodulatory therapies.

Kidney function typically recovers; however, if the patient suffered acute kidney injury, this may progress to chronic impairment.[11]

Nursing care

As previously discussed, renal biopsy is performed to confirm an MCD diagnosis.[3,7] The nurse should ensure that the patient has provided informed consent for the procedure and that blood specimens are drawn for type and crossmatch. Before the procedure, the nurse should review the patient's health history, lab results (including coagulation status), and perform medication reconciliation. The nurse should also confirm that antiplatelet agents and anticoagulants are held and follow up with the provider for when to restart these medications. After the procedure, a pressure dressing will be in place for 30 to 60 minutes; the nurse should keep the patient on bed rest as prescribed, obtain vital signs every 15 minutes for the first hour, and assess for flank pain, hypotension, decreasing hemoglobin and hematocrit, fever, chills, urinary frequency, and dysuria. Because bleeding is a major concern after renal biopsy, the patient must be closely monitored for suspicious signs and symptoms of overt or occult bleeding.[7]

Because patients with MCD present with hypoalbuminemia, they could also be hypovolemic. Signs and symptoms of hypoalbuminemia include localized or generalized edema, muscle cramps, weakness, and ascites. Some patients also present with vague symptoms such as malaise, fatigue, and anorexia. To treat hypoalbuminemia and hypovolemia, administer volume expansion with plasma protein such as I.V. albumin as prescribed.[3]

Edema is managed with dietary restriction of sodium, fluid restrictions, and administration of a diuretic such as furosemide, which also helps control hypertension. Keep an accurate record of intake and output, monitor serum electrolyte results, and obtain daily weights. Because diuretics can remove fluids too quickly, also monitor the patient's BP and watch for signs of hypotension such as lightheadedness or syncope.[7]

To prevent thrombosis, encourage the patient to mobilize. Pay special attention to venipuncture and I.V. insertion sites for signs of thrombus development. If indicated, anticoagulants will be prescribed.

The use of steroids to manage MCD increases the risk of infection. Some common infections associated with MCD are pneumonia, cellulitis, peritonitis, and otitis.[3] Take measures to prevent infection such as performing meticulous hand hygiene, monitor the patient closely for signs and symptoms of infection, and ensure that any diagnosed infection is treated promptly.

Patient education

Teach patients about kidney disease to increase adherence to treatment and prevent further damage to the kidneys. Effective education can empower patients to develop good self-management skills to prevent a condition such as MCD from becoming chronic and improve patient outcomes.[5] Review each prescribed medication with patients before discharge. Emphasize to the patient that the healthcare provider may adjust medications to the degree of renal dysfunction. In addition, address these topics:[3,5,7]

- Teach patients discharged shortly after a renal biopsy to inspect the site for bleeding and perform a urine dipstick test to check for blood in urine. Instruct the patient to promptly report any signs of bleeding, including bleeding at the biopsy site, to the healthcare provider. Tell patients to avoid lifting heavy objects for 5 to 7 days and to avoid taking anticoagulant drugs until directed to do so by the healthcare provider.
- Instruct patients discharged on an anticoagulant to inform the healthcare provider if they develop any bleeding, such as epistaxis; emesis; hematuria, melena, hematochezia, or hemoptysis; or oozing of blood from any site.
- Teach patients about the prescribed dietary plan, such as following a diet low in sodium and potassium and avoiding processed foods. Inform them that steroids can cause weight gain, so they should watch calories to prevent further weight gain. The recommended amount of dietary protein is variable and is best determined by the nephrologist.

Prevalence of MCD[1,4]

Typically seen in children, MCD is the single most common cause of nephrotic syndrome in the pediatric population, but 10% to 15% of MCD cases occur in adults. In children, MCD is twice as prevalent in boys compared with girls but in adults, the prevalence is the same between the genders. Asians may be at increased risk for the disease compared with other ethnic groups.

The incidence of MCD peaks in children at age 2 years, with approximately 80% being younger than 6 years at the time of diagnosis. In adults, the mean age of onset is 40.

• Warn patients not to discontinue their steroid medication abruptly. Steroids should be tapered under the direction of the healthcare provider. Advise patients to carry a medical identification card stating the name of the medication.
• Tell patients to report any serious infection or injury to the healthcare provider because the dose of steroid may need to be adjusted.
• Advise patients not to smoke. Explain that smoking slows the blood flow to the kidneys and can worsen kidney disease. Smoking can also affect the efficacy of antihypertensive medications.[12]
• Recommend regular exercise. Physical inactivity is a modifiable risk factor that can affect the course of kidney disease. Exercise can improve metabolic factors, lower BP, and help preserve kidney function.
• Caution patients about taking over-the-counter (OTC) medications, including NSAIDs, because these can be nephrotoxic. Tell patients not to take unprescribed medications or OTC products without first checking with the healthcare provider.
• Stress the importance of regular visits with the healthcare provider to monitor progress.

Education is key

Once MCD is diagnosed, the primary focus should be on tailoring treatment regimen for optimal outcome. The first-line treatment is steroid therapy. Patients who are steroid-sensitive often relapse, which prompts the consideration for second-line treatment, immunosuppression.

Patient education regarding treatment and lifestyle modifications is important to achieve remission. A timely diagnosis and treatment is necessary for a good outcome. Nurses must raise awareness and knowledge about kidney diseases by educating their patients, nurses in other areas of practice, other healthcare professionals, and members of their communities.

For PJ, the development of MCD was devastating. Earlier recognition of the red flags for kidney dysfunction would have triggered timely treatment and a better long-term outcome for this patient. ■

REFERENCES

1. Meyrier A, Radhakrishnan J. Etiology, clinical features, and diagnosis of minimal change disease in adults. UpToDate. 2017. www.uptodate.com.

2. Porth CM. *Essentials of Pathophysiology.* 3rd ed. Philadelphia, PA: Wolters Kluwer/Lippincott Williams & Wilkins; 2011.

3. National Kidney Foundation. Minimal change disease. www.kidney.org/atoz/content/minimal-change-disease.

4. Vivarelli M, Massella L, Ruggiero B, Emma F. Minimal change disease. *Clin J Am Soc Nephrol.* 2017;12(2):332-345.

5. Rivera S. Identifying and eliminating the barriers to patient education for patients in the early stages of chronic kidney disease. *Nephrol Nurs J.* 2017;44(3):211-216.

6. Cara-Fuentes G, Clapp WL, Johnson RJ, Garin EH. Pathogenesis of proteinuria in idiopathic minimal change disease: molecular mechanisms. *Pediatr Nephrol.* 2016;31(12):2179-2189.

7. Lewis S, Dirksen S, Heitkemper M, Bucher L. *Medical-Surgical Nursing: Assessment and Management of Clinical Problems.* 10th ed. St Louis, MO: Elsevier; 2017.

8. Kelepouris E, Rovin BH. Overview of heavy proteinuria and the nephrotic syndrome. UpToDate. 2018. www.uptodate.com.

9. Meyrier A. Treatment of minimal change disease in adults. UpToDate. 2016. www.uptodate.com.

10. Skorecki K, Chertow G, Marsden P, Taal M, Yu A, Walter W. *Brenner & Rector's The Kidney.* 10th ed. Philadelphia, PA: Elsevier; 2015.

11. Hogan J, Radhakrishnan J. The treatment of minimal change disease in adults. *J Am Soc Nephrol.* 2013;24(5):702-711.

12. National Kidney Foundation. Smoking and your health. www.kidney.org/atoz/content/smoking.

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