Retroperitoneal Fibrosis

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Retroperitoneal Fibrosis

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INTRODUCTION

Retroperitoneal fibrosis (RPF) is defined as an inflammatory and fibrotic mass that develops in the retroperitoneum. These masses can be malignant, benign, or iatrogenic. Malignant conditions are usually classified by the primary malignancy and considered metastatic lesions with a desmoplastic reaction as opposed to RPF. The remaining cases of RPF are either a primary condition or secondary to a previous condition or treatment, such as radiation therapy to the retroperitoneum. The most common primary cause of benign RPF is termed idiopathic RPF.

Idiopathic RPF is an uncommon disease of unclear etiology in which a fibrotic process causes some degree of compression of the retroperitoneal organs. Albaran first described the disease in 1905, but it was not until Ormond reported cases of RPF in 1948 that it became a recognized clinical entity. A variety of terms have been used to describe the disorder, including Ormond’s disease, periureteritis fibrosa, periureteritis plastica, chronic periureteritis, sclerosing retroperitoneal granuloma, and fibrous retroperitonitis. The disease became acknowledged as RPF in the 1960s, and this remains the current preferred term.

Because of the typical patient presentation, urologists have an integral role in the diagnosis and management of patients with RPF. Urologists usually become involved when the mass extends laterally to envelop the ureters and causes extrinsic compression or interference with peristalsis. Idiopathic RPF most often occurs in patients aged 40 to 60 years, although it has been reported in children. RPF tends to afflict men 2 to 3 times more frequently than women.

ETIOLOGY AND PATHOLOGY

CASE 1

A 67-year-old man with a previously diagnosed 4.3-cm abdominal aortic aneurysm (AAA) undergoes a scheduled surveillance computed tomography (CT) scan, which demonstrates a 4.3 cm × 4 cm infrarenal AAA with a 2-cm circumferential layer of soft tissue mass surrounding it and encompassing the ureters. The CT scan also demonstrates moderate hydronephrosis of the right collecting system and minimal hydronephrosis of the left collecting system. The radiologist’s interpretation of these findings is RPF, inflammatory aneurysm, or a small aneurysmal leak.

- What are the identifiable causes of RPF? What is the proposed etiology of idiopathic RPF?

IDENTIFIABLE CAUSES OF A RETROPERITONEAL MASS

Malignancy

Because it can account for ureteral obstruction in approximately 10% of cases, malignancy (primary or metastatic) must be excluded as the etiology of the retroperitoneal mass prior to assigning a diagnosis of RPF. Lymphoma is the most common primary neoplasm in the differential diagnosis, with carcinoid, multiple myeloma, and sarcoma less commonly identified. Metastatic lesions from pancreatic, prostatic, rectal, colon, breast, and gastric cancer can also involve the retroperitoneum. Malignancy can usually be identified by the appearance or association of retroperitoneal lymphadenopathy, but occasionally the malignancy will have the flat, infiltrating mass appearance of RPF.

Benign Retroperitoneal Fibrosis

An identifiable cause of benign RPF is found in only approximately 30% of patients. All other patients fall under the category of idiopathic RPF. The most common known cause of benign RPF is prolonged use of medications, such as methysergide and other ergot alkaloids (ie, lysergic acid diethylamide [LSD]). Methysergide was once used to prevent recurrent migraine headaches but now is not commonly prescribed. The reported incidence of RPF in long-term methysergide users is 1%. Other medications thought to be involved in the development of RPF include β-blockers, α-blockers (ie, methylxypol, hydralazine), dopaminergic agonists (ie, pergolide, pramipexol), haloperidol, amphetamines, and phenacetine. The pathophysiology of drug-induced RPF is unknown. Ergot alkaloids
act as competitive inhibitors of serotonin receptor sites and increase endogenous serotonin levels. One proposed mechanism is that increased serotonin levels lead to fibrosis, as increased serotonin levels have also been seen in patients with sclerosis related to carcinoid tumors.\(^{19}\) Ergot alkaloids also may act as haptons, setting up an immune response (ie, hypersensitivity or autoimmune reaction), which may lead to RPF.

In addition to medications, other known causes of RPF include any retroperitoneal inflammatory process that can cause a desmoplastic fibrotic reaction encasing the retroperitoneal organs, such as blunt trauma that causes retroperitoneal hematomas, urinary extravasation from obstructing stones or ureteroscopy, colon perforation after a colonoscopy, or barium enema.\(^{13,14}\) In addition, a fibrotic reaction can be triggered by chemical irritation attributable to methyl methacrylate used in orthopaedic procedures, talcum powder used as a sclerosing agent in renal cysts, and asbestos exposure; perianeuromyal inflammation or collagen vascular disease; pancreatitis, diverticulitis, sarcoidosis, or endometriosis; and repeated cholangial infections or urinary tract infections.\(^{15,16}\) Radiation to the retroperitoneum and previous surgeries have also been known to cause fibrosis.\(^{17,18}\)

**IDIOPATHIC RETROPERITONEAL FIBROSIS**

As the term implies, the etiology of idiopathic RPF is unknown. However, many suspect that the disease is due, at least in part, to an autoimmune process. An autoimmune etiology is supported by evidence from several areas. First, much like the patient in case 1, primary RPF is often diagnosed simultaneously with atherosclerosis and AAs.\(^{10,20}\) One theory is that ceroid, a complex polymer of oxidized lipids and protein found in atherosclerotic plaques, leaks from aortic walls and acts as an antigen, initiating an autoimmune process, which in turn leads to an inflammatory response around the aorta.\(^{21}\) Another hypothesis is that patients with chronic periaortitis but without aortic atherosclerosis or aortic dilation have a systemic autoimmune vasculitis involving the aortic vasa vasorum and the small and medium retroperitoneal vessels.\(^{22}\) Other evidence supporting an autoimmune process is that RPF is often encountered in patients with other autoimmune diseases, such as juvenile rheumatoid arthritis or systemic lupus erythematosus, especially in children or young adults. Further supporting an autoimmune mechanism are the histologic findings of an inflammatory reaction, including immunoglobulin-producing plasma cells, in these patients. Finally, although RPF usually occurs as an isolated entity, it may also be part of multifocal fibrosclerosis, a rare syndrome characterized by fibrosis involving multiple organ systems. The most well-documented fibrosclerosing disorders are RPF, sclerosing mediastinitis, sclerosing cholangitis, orbital pseudotumor, and Riedel’s thyroiditis.\(^{23,24}\) The pathogenesis of these disorders is also unknown but appears to be autoimmune because of the frequent occurrence in patients with known collagen vascular disorders.

- What are the typical pathologic findings?

**PATHOLOGY**

The typical macroscopic appearance of RPF is that of a white, hard plaque of varying thickness, which is centered at the level of the fourth or fifth vertebra and surrounds the retroperitoneal organs. The mass envelops the aorta and inferior vena cava and usually extends from the aortic bifurcation up to the renal pedicle and from the aorta laterally beyond the outer edge of the psoas muscle, enveloping the ureters. However, the fibrotic process can involve almost any retroperitoneal or intraperitoneal structure and continue along major aortic branches, occasionally extending as high as the mediastinum and well below the bifurcation of the common iliac vessels.\(^{25–27}\)

Biopsy specimens most commonly reveal densely fibrotic areas of collagen with distinct areas of nonspecific chronic inflammation that contain predominantly macrophages, lymphocytes, plasma cells, and occasionally eosinophils. The macrophages are often lipid-laden, and almost all lesions have areas of perivascular lymphocytic infiltrate composed of T and B cells. Early in the disease process, the inflammatory component predominates in the fibrotic plaque, while fibrosis becomes the main feature later in the course of the disease. The infiltrating margins of the mass demonstrate more of an inflammatory process than the central portion. Therefore, depending on the stage of the RPF, biopsy can reveal an active inflammatory infiltrate or bland sheets of hypocellular collagen.\(^{28}\)

**CASE 1 RESOLUTION**

Given the patient’s symptoms, benign presentation, and incidental CT scan findings, the physician is comfortable with a diagnosis of RPF as opposed to a leaking or inflammatory aneurysm. Because the patient’s renal function is normal, ureteral stents are deemed not necessary. He undergoes an endovascular stent graft repair of his AAA and is prescribed a short course of steroid therapy consisting of prednisone 20 mg daily for 2 weeks, which is tapered to 5 mg daily for a total of 3 months of corticosteroid therapy. On follow-up imaging 3 months
later, the inflammatory layer of tissue has decreased in size and the patient's hydronephrosis has resolved.

**CLINICAL MANIFESTATIONS AND DIAGNOSIS**

**CASE 2**

A 55-year-old previously healthy man is referred to a urologist by his primary care physician for complaints of abdominal pain, malaise, and weight loss over the last several weeks. The patient reports that the discomfort is constant and is not affected by change of position. Physical examination is remarkable only for a slightly elevated blood pressure and mild edema in the extremities. Laboratory results reveal a serum creatinine level of 4.2 mg/dL and a serum potassium level of 5.3 mEq/L. Renal ultrasonography reveals bilateral hydronephrosis.

- What is the classic presentation of idiopathic RPF? What other conditions should be considered?

**CLINICAL MANIFESTATIONS**

Nonspecific symptoms and often normal physical examination findings make early diagnosis of RPF extremely difficult without a high degree of suspicion. The classic description of RPF presented by Ormond is a middle-aged patient with anuria, back pain, malaise, weight loss, and anemia. However, presenting symptoms are dictated by the extent of the disease and, depending on the organs affected, a wide variety of symptoms can occur. Most frequently, symptoms develop from ureteral entrapment, which prevents normal peristalsis and leads to obstruction and progressive hydronephrosis. Early symptoms may include vague, poorly localized flank or abdominal pain or nonspecific complaints such as malaise, anorexia, weight loss, moderate pyrexia, nausea, and vomiting. A characteristic pain occurs as often as 90% of the time in RPF. The onset of pain is subtle and usually occurs over several weeks. The discomfort is generally described as a dull ache that originates in the flank or lumbosacral region and extends anteriorly to the periumbilical region or testes. Another key feature is that the pain is constant and noncolicky and is not altered by activity, body position, or bowel movements. Patients usually present when the pain becomes unrelenting and leads to difficulty sleeping or performing routine activities. Originally, the pain was described as being relieved by aspirin but not narcotics, but this finding was likely anecdotal, as many patients have pain relief with narcotics. If initial symptoms are overlooked, renal insufficiency or anuria may be the presenting symptom, which results from significant ureteral obstruction (as described by Ormond). The fibrotic process may also cause the great vessels to become compressed. The aorta is rarely obstructed, but many patients exhibit mild edema of the lower extremities due to compression of the inferior vena cava. More severe obstruction of the inferior vena cava or iliac veins may lead to deep vein thrombosis. Arterial compromise is rare, but if the fibrotic plaque extends to arteries of the lower extremity or mesentery, claudication and intestinal ischemia can occur. Hypertension due to possible renal artery involvement may also be present.

The differential diagnosis for RPF mainly includes other causes of obstructive nephropathy, such as bladder outlet obstruction from an enlarged prostate gland (male) or large cystocele (female), bladder or prostate tumors, ureteral or urethral strictures, kidney or bladder stones, and primary malignancies. Bilateral hydronephrosis without middle or distal ureteral dilation can provide a clue as to the diagnosis, but this can also be seen with other retroperitoneal and pelvic conditions (eg, malignancy).

- What additional studies or interventions should be performed?

**DIAGNOSTIC EVALUATION**

Early diagnosis of RPF is difficult, but as the disease process progresses and signs of obstructive nephropathy become more evident, additional studies are obtained that lead to the diagnosis of RPF. Imaging studies, including ultrasonography, CT, and magnetic resonance imaging (MRI), are useful tools in the diagnosis of RPF. In addition to basic electrolyte and complete blood count panels, certain laboratory studies such as erythrocyte sedimentation rate (ESR) can also provide some important information.

**Imaging Studies**

The choice of initial imaging depends on the patient's renal function at the time of evaluation. A presumptive diagnosis of RPF can be made based on the patient's history and radiologic investigations.

In a patient with severe renal insufficiency, renal ultrasonography is often the imaging modality of first choice. Ultrasonography is useful in the evaluation of patients with unexplained renal insufficiency and azotemia to assess for hydronephrosis. Very few patients with RPF will have no evidence of hydronephrosis. Ultrasonography may also reveal a fibrotic plaque perceived...
as a poorly defined echo-free or hypoechoic periaortic mass, but this finding is nonspecific and further studies are required to confirm a diagnosis of RPF.

Patients with normal renal function can undergo intravenous pyelography (IVP; also known as excretory urography). The classic finding on IVP is medial deviation of the mid-ureter starting at the level of the third or fourth vertebra. However, medial deviation of the ureter is not a constant finding in patients with RPF and almost 20% of patients with normal results on IVP have medial displacement of the ureters (especially the right ureter) without evidence of pathologic change in the urinary tract. In RPF, medial displacement of the ureter usually extends higher than a normally deviated ureter, and the ureter may appear stiff. The obstruction should look extrinsic and compressive in nature. RPF rarely infiltrates into the ureter and, therefore, intrinsic filling defects are absent in the majority of cases.

Findings similar to those found on IVP are also noted on retrograde or antegrade pyelography (Figure 1). Pyelography can be used in patients with renal insufficiency to help in the diagnosis of RPF. However, these procedures are invasive and are usually performed after the diagnosis of RPF is suspected and ureteral stents or nephrostomy tubes are placed for decompression.

CT of the abdomen and pelvis is currently the modality of choice to visualize the extent of fibrosis and to exclude other pathology. CT images may reveal alternative pathology, such as the presence of lymphadenopathy, a primary malignancy, or bilateral obstructing nephrolithiasis. The fibrotic plaque on CT exhibits similar attenuation to muscle, and there is usually enhancement of the mass on contrast images in early stages of the disease (if renal function allows contrast to be administered). However, this finding may be absent as the disease progresses. The mass is confluent with a symmetric continuous encasement of the aorta and vena cava (Figure 2). A central plaque may not always be demonstrated on CT, and only more subtle findings, such as ureteral wall thickening, may be observed.

MRI is a useful alternative to CT in patients with impaired renal function. Morphologic findings are similar to those found on CT, but MRI has the advantage of displaying the fibrotic process in multiple planes and better delineating vascular anatomy and involvement and may be able to distinguish a benign from a malignant process with characteristics on T1- and T2-weighted images.

In patients with atrophic-appearing kidneys on CT or MRI scans or with signs of long-standing obstruction, a radioisotope renogram may be indicated to assess renal function after the initial obstruction has been resolved. Patients may be found to have a nonfunctioning kidney, which is useful knowledge in surgical planning. In addition, the diagnosis may be unclear based on other imaging modalities early in the disease process, and a radioisotope renogram may assist in confirming obstruction or identifying another cause of renal insufficiency.

**Additional Laboratory Studies**

Most patients will have had basic laboratory studies in the initial work-up leading to the diagnosis of RPF. Additional laboratory studies generally do not contribute to the diagnosis. The most representative laboratory finding is an elevated ESR or C-reactive protein (CRP), nonspecific indicators of inflammation. Following serial ESRs or CRPs may help monitor a patient’s response to steroid therapy or immunosuppressive therapy, and many authors recommend obtaining a baseline level. Some patients will also demonstrate a mild leukocytosis if currently in the active inflammatory phase of the disease. In patients in whom associated autoimmune, connective tissue, or vasculitic diseases are suspected, some authors recommend screening...
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for perinuclear antineutrophil cytoplasmic antibody (P-ANCA), rheumatoid factor, anti–double-stranded DNA, antinuclear antibodies (ANA), and antibodies against thyroid microsome and thyroglobulin. These studies may demonstrate positive titers, but these are also often nonspecific findings.37

Tissue Diagnosis

The risk of missing a malignancy on history and radiographic evaluation is minimal in a patient with no history of malignancy, no peripheral adenopathy, and classic radiologic features of RPF using CT or MRI.38 Because no imaging modality can reliably exclude a retroperitoneal malignancy, however, a biopsy is usually obtained once RPF is suspected to confirm the diagnosis and exclude a malignancy.

Percutaneous biopsy of the mass with a Trucut needle under CT guidance is minimally invasive and can provide a reasonable degree of assurance that the mass is benign. Of course, sampling errors are possible due to the limited number and areas of biopsy specimens obtained with this method. Fine-needle aspiration biopsy of the lesion under CT guidance has also been described.39,40 However, given the relatively nonspecific appearance of core biopsies, especially with fine-needle aspiration, only a stronger presumptive diagnosis can be made using tissue data in conjunction with clinical and radiologic findings.

A better tissue diagnosis can be obtained using an open or laparoscopic surgical approach. Unless radiographic findings or CT-guided biopsies are more consistent with malignancy than a benign process, biopsies should be taken at the time of planned ureterolysis. This allows a tissue diagnosis and curative intervention in the same setting, avoiding a second operation in the same anatomic area. Specimens should be sent for frozen-section analysis to confirm adequate tissue sampling and establish the diagnosis before definitive surgical management is completed.

CASE 2 RESOLUTION

The patient undergoes bilateral ureteral stenting, and his renal function normalizes. CT of the abdomen and pelvis demonstrates findings consistent with RPF, and a CT-guided biopsy is used to confirm the diagnosis. The patient is started on high-dose steroids and mycophenolate mofetil for 6 months, with minimal resolution of his mass, and subsequently undergoes bilateral hand-assisted laparoscopic ureterolysis. His stents are removed 6 weeks after surgery, and imaging reveals no further obstruction. He continues on low-dose steroids and mycophenolate mofetil for 2 years after surgery and remains recurrence-free.

APPROACH TO MANAGEMENT

CASE 3

A 42-year-old woman with a history of nephrolithiasis presents to the emergency department complaining of anuria for over 24 hours. A Foley catheter is placed with the return of only 10 mL of clear, yellow urine. A renal colic CT using stone protocol demonstrates no evidence
of obstructing stones, but moderate bilateral hydronephrosis with thickening around the aorta and ureters suggests possible RPF. The patient’s serum creatinine is 8.1 mg/dL and serum potassium is 6.2 mEq/L.

- How should this patient be acutely managed? After this patient’s renal function stabilizes, what are the long-term management options?

**ACUTE MANAGEMENT**

The acute management of RPF depends on the severity of the disease process at diagnosis. The goal is preservation of renal function. Patients who present with uremia should have urgent decompression of the collecting systems with indwelling ureteral stents or percutaneous nephrostomy tubes to protect renal function. Although patients with RPF have ureteral obstruction, ureteral stents can be passed easily without meeting significant (if any) resistance, a characteristic finding of RPF. If the patient is critically ill with anuria and hyperkalemia, nephrostomy tubes can be placed at the bedside under ultrasound guidance with local anesthesia. Internal stents can be placed at a later time. One should anticipate some degree of postobstructive diuresis and replace fluids and electrolytes accordingly. Patients with lower extremity edema should be evaluated for deep vein thrombosis with Doppler ultrasonography; anticoagulation can be initiated if deep vein thrombosis is suspected.

After the patient is medically stable and fluid and electrolytes have normalized, further medical and/or surgical therapy can be planned. Any offending medication (eg, methysergide) should be discontinued. On occasion, discontinuation of the inciting drug in patients with mild hydronephrosis may result in resolution of RPF. Once acute interventions have been completed, there is little consensus on further appropriate management.

**MEDICAL MANAGEMENT**

Idiopathic RPF has been traditionally treated with open surgical ureterolysis. However, several small case series reporting disease regression using a variety of corticosteroids and other immunosuppressive medicines alone or in combination have prompted renewed interest in medical therapy for RPF.

In the past, most physicians reserved steroid therapy for patients unfit for surgery or with extensive involvement of the main vessels. Reluctance to use steroids may have been due to the fear that a malignancy would be missed as opposed to concern for the side effects or lack of response to the therapy. The rationale for steroid therapy in RPF is based on the theory that RPF is an autoimmune process and that histologic findings have shown an inflammatory reaction, including immunoglobulin-producing plasma cells. Case reports demonstrating success with steroid therapy and current imaging modalities (to obtain percutaneous biopsies to rule out malignancy) in RPF have led to the use of glucocorticoids alone or in combination with other immunosuppressive agents as an alternative primary treatment. Proponents of primary medical therapy argue that it may avoid unnecessary surgery.

Unfortunately, there are no large clinical studies to determine the effectiveness of medical therapy in RPF. In the only prospective study of corticosteroid use alone, Kardar et al reported a success rate of 82% (9 of 11 patients) with steroid monotherapy. Patients were started on high-dose steroids (60 mg prednisolone every other day) and tapered to a maintenance dose (5 mg prednisolone daily) at 6 months (total duration of therapy, 2 years). Success was defined as regression of the fibrous plaque and resolution of ureteral obstruction. Complete disappearance of the mass occurred in 6 to 20 months. Kardar and colleagues did not provide predictors of success, but other authors have suggested that patients with systemic manifestations or laboratory evidence of acute inflammation (elevated ESR, leukocytosis) respond more favorably to steroid therapy.

Because most study populations have been small and most reports have been retrospective, there is no agreement about dose and duration of steroid therapy. Most authors agree that prolonged treatment is necessary and should be continued long enough to allow regression of the mass and to alleviate ureteral obstruction. At present, steroids are often started at a high dose until RPF begins to regress, and the dose is then tapered to a maintenance dose for up to 2 years of total therapy. For example, a dose of 60 mg prednisolone would be given on alternate days for 2 months and then tapered during the next 2 months (40 mg for 2 weeks, 20 mg for 2 weeks, and 10 mg for 2 weeks) to a maintenance dose of 5 mg daily. It is important to have the patients on concurrent gastrointestinal prophylaxis with proton pump inhibitors or H2-blockers during the initial high-dose therapy; calcium supplementation should be provided during prolonged steroid therapy.

Additional small series and case reports have shown that immunosuppressive agents such as azathioprine, cyclophosphamide, mycophenolate mofetil, and pentamidine are effective medical therapies for idiopathic RPF. These agents are usually used in combination with a reduced dose of steroids. If the fibrotic process regresses, steroids are discontinued and the immunosuppressive medication is continued for an additional 3 to
6 months. Immunosuppressants have known serious side effects (eg, severe leukopenia, sepsis, hepatitis, pancreatitis, gastrointestinal bleeding, transient diabetes), and patients must be monitored carefully during the treatment period. Immunosuppressants should be avoided in elderly or chronically debilitated individuals.

Tamoxifen, a nonsteroidal antiestrogen, is another medication used in the treatment of RPF. The exact mechanism of action is unknown, but tamoxifen has been shown to be effective in causing regression of desmoid tumors, which are also characterized by locally invasive fibrous tissue. The recommended dose of tamoxifen monotherapy for RPF is 20 mg orally daily for 12 months.

Patients on medical therapy should have CT scans at 3 and 6 months to assess for regression of the mass. If the mass does not regress on medical therapy, surgical treatment should be advised, even if the patient is symptomatically improved and has other markers of improvement, such as normalized ESR.

**SURGICAL MANAGEMENT**

Bilateral open ureterolysis with omental wrapping was previously the standard treatment of RPF. Currently, many patients will not undergo surgery until attempts at medical therapy have failed. However, in patients who require an open or laparoscopic biopsy to confirm the diagnosis, a formal ureterolysis should be undertaken at the time of biopsy. Often, these patients have not had any medical therapy for the disease. The surgical ureterolysis may be performed as an open procedure or laparoscopically. Ideally, patients will have ureteral stents already in place or placed preoperatively to aid in the identification and dissection of the ureters.

The open approach uses a midline transperitoneal incision to gain access to both ureters. Even if hydronephrosis and/or the disease appears to be unilateral, ureterolysis should be performed bilaterally. Deep biopsies of the diseased area should be sent for frozen pathology (and eventually permanent pathology) prior to proceeding with ureteral dissection. Dissection should begin at the distal, nondilated ureter to avoid injury to the thin, dilated proximal segment. Often, the dissection plane between the ureter and fibrous tissue can be identified and the surgeon can use a right angle clamp or his/her thumb to separate the ureter from the fibrous plaque.

Once the ureters are completely freed, they must be repositioned away from the fibrous plaque. This can be done by retracting the ureters laterally and securing the overlying peritoneum medially to the psoas muscle to maintain the ureters’ position laterally. Alternatively, the ureters can be placed anteriorly into the peritoneal cavity and the lateral peritoneal edges of the colon closed posterior to them. If RPF is extensive, performing an omental wrap is suggested to prevent recurrence. The omental flaps are situated off the right and left gastroepiploic arteries and can help provide vascularity to a potentially ischemic ureter.

Laparoscopic ureterolysis was first performed as a unilateral procedure by Kavoussi et al in 1992, but it has since been used for bilateral disease. Hand-assisted and robotic-assisted laparoscopic procedures are also currently used. As in open surgery, a biopsy of the disease area should be performed before formal ureterolysis. Laparoscopically dissecting the ureters is difficult, as they may be encased in dense fibrotic scar tissue (Figure 3). Omental wraps are not usually undertaken, and the ureters are generally intraperitonealized by reapproximating the posterior peritoneum beneath the ureter (Figure 4). Laparoscopic ureterolysis/biopsy is becoming the management option of choice because of the decreased analgesic requirements, shorter hospital stay, and faster recovery with this procedure.

Ureteral stents are left in place after surgical therapy for several days up to 6 to 8 weeks. Ureterolysis alone should be successful in approximately 90% of patients and results in return of normal renal function and resolution of obstruction. Signs of intrinsic involvement of the ureter and poor preoperative renal function are associated with worse outcomes.

Complications may occur, as in all surgical procedures. The most common complication of ureterolysis (open or laparoscopic) is ureteral injury. Ureteral injuries may be minor and only require repair of the ureterotomy with an absorbable suture, or the ureter may be completely avulsed requiring open repair with a Boari flap, ureteroureterostomy, autotransplantation, or ileal ureter. Given the already compromised ureteral vascularity due to the fibrotic process, even ancillary reconstructive repairs may not heal properly. Therefore, care must be taken not to place excessive traction on the ureter during dissection. Unrecognized ureterotomies may also lead to urine leakage and recurrent obstruction. If the ureter appears thin and poorly vascularized, this may be an indication to keep a stent in place for a prolonged period postoperatively and consider a formal omental wrap of the ureter.

Postoperative pulmonary embolism is also a concern in patients with RPF, who may have had compressed venous return preoperatively. Therefore, if lower extremity edema is present, preoperative Doppler ultrasonography should be performed. Routine postoperative
preventive measures, such as sequential compression devices, should be employed in all patients. Patients should also be monitored for early signs of infection and sepsis, as many patients will be on steroids and immunocompromised.

**COMBINED THERAPY**

The role of preoperative and postoperative medical therapy in the setting of surgical management of idiopathic RPF is unknown. Immunosuppressive agents may help decrease the severity of fibrosis prior to surgery or prevent postoperative recurrences. In 1971, Ross and Goldsmith first suggested surgery and steroids in combination may help to treat RPF. Baker et al retrospectively examined 60 patients with RPF and discovered that very few patients had success with either steroid or ureterolysis alone but that most patients needed both ureterolysis and steroid therapy. However, Cerfolio et al examined the role of postoperative steroids following ureterolysis in a retrospective study of 31 patients (12 steroids versus 19 no steroids) and found no difference in the restenosis rate at a minimum of 18 months follow-up.

RPF associated with inflammatory aortic aneurysms is an area in which combination surgical therapy (aortic repair and ureterolysis) can potentially be employed. Surprisingly, aneurysmectomy alone generally relieves ureteral obstruction without a formal ureterolysis. Recent reports have also shown that endovascular stent graft repair of AAAs has led to the resolution of ureteral obstruction, suggesting aneurysm repair may be indicated prior to therapy for RPF in these patients.

**FOLLOW-UP**

Recurrence of RPF following medical and/or surgical therapy has been reported as late as 9 years after treatment. Therefore, lifetime observation is necessary but usually involves only periodic serum creatinine and ESR surveillance in asymptomatic patients beyond the initial treatment phase. Patients on steroid and/or immunosuppressive therapy should have imaging every 3 months (CT or MRI) until the mass has completely regressed and ureteral obstruction resolves; this process may take up to 20 months. After the mass has resolved, imaging every 3 to 6 months is recommended while the patient remains on medical treatment and for the first year after discontinuing the medications. Patients who have undergone surgical therapy should have follow-up imaging approximately 6 to 8 weeks after stent removal. CT, MRI, IVP, radioisotope renography, and positron emission tomography have all been used as surveillance imaging. A functional study (IVP, radioisotope renography) may provide better information postoperatively because the mass will generally still be present, but the obstruction should be relieved. Positron emission tomography may be useful to distinguish active versus inactive disease in patients with significant residual periaortic masses. Postsurgical patients should have surveillance imaging every 3 to 6 months for the first year after surgery.

The appropriate management strategy for patients who have disease recurrence on surveillance is unclear. In general, patients who previously had success on medical therapy can undergo an additional short
course of steroids and/or immunosuppressive therapy to see if the disease responds again. Tamoxifen has also been used to salvage steroid failures. If the disease does not respond to additional medical therapy, surgical intervention is indicated. For patients who have failed initial surgery, a trial of medical therapy is recommended before attempting alternative surgical procedures or chronic indwelling ureteral stents or nephrostomy tubes.

**CASE 3 RESOLUTION**

The patient undergoes immediate bilateral nephrostomy tube placement, and her serum creatinine declines to a new baseline of 2 mg/dL. An oncology consultant had a high degree of concern for lymphoma, and a CT-guided biopsy is performed, which shows a paucicellular specimen inadequate for diagnosis. The patient undergoes laparoscopic biopsy, which shows fibrosis and inflammation on frozen-section analysis, and bilateral laparoscopic ureterolysis in the same setting. She has no obstruction on postoperative imaging and continues to be followed without medical therapy.

**CONCLUSION**

There is no agreed-upon diagnostic and treatment algorithm for RPF. An etiology of RPF is discovered in only approximately 30% of patients, and malignancy must always be entertained in the differential diagnosis. The cause of benign idiopathic RPF is unknown, but it is thought to be an immune-mediated disease. Preservation of renal function is the key goal in acute management of RPF. The quality of imaging studies and the ability to obtain CT-guided biopsies often allows physicians to attempt initial treatment with corticosteroids with or without other immunosuppressive agents. This may spare a patient from surgical intervention or help decrease the fibrotic burden prior to surgical intervention. If the diagnosis is uncertain or the patient fails medical therapy, surgical intervention is usually undertaken. A laparoscopic approach is reasonable at centers with experienced laparoscopic urologists. Post-treatment surveillance of patients with RPF is necessary given the possibility of short-term and long-term recurrences.

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