Obstructive Uropathy

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KEYWORDS
- Uropathy • Urinary tract • Obstruction
- Postobstructive diuresis • Benign prostatic hyperplasia

Obstructive uropathy is a relatively common condition in which an anatomic or functional problem causes obstruction to normal urinary flow. The clinical manifestations of obstructive uropathy range from little or no symptoms to florid acute renal failure. Because its prevalence increases with increasing age, the diagnosis and management of obstructive uropathy is particularly relevant to the geriatric population.

EPIDEMIOLOGY

Hydronephrosis, although indicative only of urinary tract dilation, can be a useful surrogate marker suggestive of obstruction. In a series of 59,064 autopsies, Bell[1] found the overall incidence of hydronephrosis in the general population to be 3.1%. When limited to patients aged 60 years or older, the incidence increased to 5.1%. Most of these cases occurred in men with an overall incidence of 6.2% compared with 2.9% in women and this was attributed to the increased incidence of benign prostatic hyperplasia (BPH) in this age group. When one considers the population of patients with acute renal failure, the incidence of obstructive uropathy further increases. McInnes and colleagues[2] found that among 4001 patients admitted to the geriatric units in 3 British hospitals, 6.8% were diagnosed with acute renal failure, of whom 9.5% were determined to have obstructive uropathy as the cause of their renal failure.

The US Nationwide Inpatient Sample (NIS) in 2006 recorded 343,187 discharge diagnoses of hydronephrosis, hydroureter, and/or urinary obstruction amounting to 0.9% of all discharges. Excluding diagnoses of hydronephrosis and hydroureter, which are not necessarily due to obstruction, the NIS recorded 41,144 discharge diagnoses of urinary obstruction alone. This amounted to 0.1% of all discharge diagnoses. Patients over the age of 65 years accounted for 70% of the diagnoses of urinary obstruction and men, in particular, accounted for 77% of these diagnoses.[3]

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ETIOLOGY

Urinary tract obstruction can occur at any point in the urinary tract and is classified by the level of obstruction and whether the cause is intrinsic or extrinsic to the urinary tract (**Table 1**). Renal obstruction in the elderly can be due to benign conditions such as renal cystic or calculous disease or malignant conditions such transitional cell carcinoma of the renal pelvis. Rarely, congenital megaureter and ureteropelvic junction (UPJ) obstruction, either intrinsic to the UPJ or due to extrinsic compression by a crossing vessel, can have their initial presentation at an advanced age. Along the course of the ureters, intrinsic causes for obstruction include calculi, ureteral strictures, and neoplasms of the transitional cell epithelium. Extrinsic compression can be due to vascular lesions such as aortic or iliac artery aneurysms, retroperitoneal malignancies such as colon cancer or metastatic bladder cancer, or inflammatory conditions such as retroperitoneal fibrosis. Although less common in elderly women, gynecologic malignancies may also be a source of urinary tract obstruction.

In the lower urinary tract, the most common reason for obstruction is BPH. Other causes include bladder calculi, urethral stricture, and neoplasms of the bladder, prostate, or urethra. In women, prolapse of pelvic organs such as the bladder, rectum, or small bowel through the vagina can also lead to functional outlet obstruction through kinking or compression of the urethra.[4] Iatrogenic injuries such as bladder neck contractures secondary to radical prostatectomy and urethral strictures secondary to urethral instrumentation are also possibilities.[5,6] Finally, indwelling urethral catheters, suprapubic catheters, or percutaneous nephrostomy tubes may become dislodged or kinked resulting in obstruction to urinary outflow.

Table 1 Causes of urinary tract obstruction in the elderly		
	Intrinsic	**Extrinsic**
Kidney	Calculous disease Cystic disease Renal cell carcinoma Transitional cell carcinoma of the renal pelvis Obstructive pyelonephritis Congenital fibrous ureteropelvic junction obstruction	Ureteropelvic junction obstruction as a result of a crossing vessel
Ureter	Calculous disease Stricture Transitional cell carcinoma Congenital megaureter	Aortic or iliac artery aneurysm Compression because of a vascular graft Retroperitoneal malignancy Retroperitoneal fibrosis Pelvic lipomatosis Gynecologic malignancy
Bladder	Neurogenic bladder Bladder neck contracture Malignancy of the bladder or prostate Calculous disease	BPH Prostatitis Pelvic organ prolapse
Urethra	Stricture Phimosis Meatal stenosis Malignancy of the urethra	

In addition to anatomic sources of urinary tract obstruction, functional obstruction may also be caused by a neurogenic bladder. Decreased bladder contractility may occur when parasympathetic motor innervation is interrupted after severe pelvic trauma or after extensive pelvic surgery such as abdominal perineal resection for rectal cancer. A sensory neurogenic bladder occurs when the afferent nerve fibers from the bladder are damaged and is most common because of diabetes mellitus, tabes dorsalis, or pernicious anemia. In this condition, a decrease in sensation of fullness results in chronic overdistention of the bladder which can eventually lead to stretch injury and decreased contractility. Another form of neurogenic outlet obstruction occurs with discoordination between bladder contraction and urethral sphincter relaxation termed detrusor-sphincter dyssynergia. This occurs primarily with upper motor neuron diseases such as cerebrovascular accident, Parkinson's disease, and demyelinating disorders.[7]

Functional bladder outlet obstruction may also be nonneurogenic in origin. The dysfunctional elimination syndrome is characterized by bladder and bowel dysfunction. It is thought that gross fecal impaction leads to mechanical compression of the bladder and bladder neck, which results in urinary obstruction.[8] Medications may also play a role in inducing functional bladder outlet obstruction. Anticholinergic medications commonly used for the treatment of overactive bladder, such as oxybutinin, may occasionally cause urinary retention. In addition, several other classes of medications including tricyclic antidepressants such as amitriptyline, antiemetic phenothiazines such as promethazine, and the anticonvulsant carbamazepine have significant anticholinergic effects that can lead to urinary retention.

Despite the many possible causes of obstructive uropathy, in studies of elderly patients with acute renal failure, the most common cause among all patients (male and female) was BPH.[5,9] In 47 elderly patients with obstructive uropathy as the cause of their acute renal failure, Kumar and colleagues[9] found that 38% were due to BPH, 19% were due to neurogenic bladder, and 15% were due to obstructive pyelonephritis. Calculous disease and the remaining individual malignancies each accounted for less than 10% of the total.

CLINICAL PRESENTATION

The clinical presentation of obstructive uropathy varies greatly and generally reflects the source of the obstruction. Patients with upper urinary tract obstruction of the kidneys or the ureters may present with flank pain or enlarged tender kidneys. Patients with lower urinary tract obstruction may present with symptoms of urgency, frequency, decreased force of stream, or incomplete emptying of the bladder frequently associated with BPH. Recurrent or persistent urinary tract infections are commonly associated with the prolonged urinary stasis of lower urinary tract obstruction. Those patients with significant urinary retention secondary to bladder outlet obstruction or a neurogenic bladder may also have a large, palpable, distended bladder in the lower abdomen.[10] Patients may present with anuria in those cases where the obstruction is complete, such as complete occlusion of the prostatic urethra, bilateral ureteral obstruction, or unilateral ureteral obstruction of a solitary kidney.[5,11]

In many cases, however, patients may be relatively asymptomatic and present primarily with sequelae of renal insufficiency. In their series of elderly patients with obstructive uropathy, Faubert and Porush[5] found that up to 40% were clinically uremic and presented with nausea, vomiting, and/or mental status changes. In another series, Batlle and colleagues[12] found that electrolyte disturbances consisting primarily of

hyperkalemia and nonanion gap acidosis were present in 70% of patients. Patients with chronic obstruction may further present with hypertension due to hypervolemia in the case of bilateral obstruction or to increased renin release in the case of unilateral obstruction.[13] Microscopic or gross hematuria may also be found in up to 30% of patients.[5]

DIAGNOSIS OF URINARY TRACT OBSTRUCTION

A careful history should be taken with an emphasis on potentially predisposing conditions. All medications with anticholinergic effects should be noted. The physical examination should evaluate costovertebral angle tenderness and the presence of a palpable bladder in the abdomen. A rectal examination should assess rectal tone and evidence for constipation. In men, a determination of prostate size should also be made on rectal examination. In women, a pelvic examination should be performed to identify potential pelvic organ prolapse.

After physical examination, the diagnosis of urinary tract obstruction should be directed toward localizing the site of obstruction. A test that can be performed at the bedside to help identify lower urinary tract obstruction is the determination of a patient's postvoid residual urine volume (PVR). This can be accomplished noninvasively with a commonly available ultrasound-based bladder scanner or through urethral catheterization after having a patient attempt to void when he or she feels the urge to void. Although an elevated postvoid residual urine volume in the asymptomatic patient does not appear to significantly predict the development of a future episode of acute urinary retention, an elevated PVR of greater than 150 mL in the appropriate setting of oliguria, anuria, or acute renal insufficiency is suggestive of anatomic or functional lower tract obstruction.[5,14]

In those patients who are relatively asymptomatic and present with renal insufficiency, renal ultrasound is the initial imaging test of choice. Renal ultrasound is used generally to identify anatomic abnormalities such as hydronephrosis or ureteral dilatation that are suggestive of upper tract obstruction.[5,6] In some patients, renal pelvis or ureteral dilatation can be chronic in nature, possibly because of a past history of obstruction, but not indicative of current obstruction. Although upper urinary tract dilatation is frequently suggestive of upper urinary tract obstruction, the presence of bilateral hydronephrosis or hydroureter should prompt consideration of a lower urinary tract source of obstruction. Ultrasound may also be able to identify causes of obstruction such as urolithiasis or soft tissue masses. However, it is generally less useful than other imaging modalities for this purpose.

In patients who present with symptoms of colicky flank or abdominal pain suggestive of urolithiasis, a noncontrast renal protocol CT scan will visualize most stones. The addition of intravenous contrast aids in the identification of malignancies as a cause of obstruction but may not be feasible in patients with renal insufficiency. Excretory phase imaging with an intravenous pyelogram (IVP) or CT-IVP may further show intraluminal masses or evidence for extrinsic compression of the ureters or renal pelvis. A benign entity, retroperitoneal fibrosis may be suggested by imaging showing proximal hydroureteronephrosis with medial deviation of the ureters.[15]

For patients who cannot receive intravenous contrast, noninvasive imaging studies may be unable to pinpoint the source of obstruction. In this situation, urological consultation is warranted for retrograde pyelography to identify potential anatomic causes of obstruction. In the event that retrograde pyelography is technically infeasible, antegrade pyelography through percutaneous access is an alternative.

A constellation of appropriate symptoms with confirmatory imaging findings is frequently sufficient to strongly suggest the diagnosis and cause of obstruction, as well as the need for intervention, such as in the case of acute obstruction due to urolithiasis. Occasionally, however, the clinical picture may be less clear. No evidence of ureteral or renal pelvis dilation is found in approximately 5% of patients with upper urinary tract obstruction. Such nondilated obstructive uropathy is found primarily in elderly patients.[16–18] In these situations, additional investigation is warranted.

Although ultrasound and CT imaging can identify anatomic abnormalities suggestive of upper tract obstruction, only a functional study can definitively diagnose obstruction. Formerly the gold standard functional test, the Whitaker test, involves infusion of fluid at a rate of 10 mL/min through a percutaneous nephrostomy. Intrarenal pelvis pressures greater than 22 cm H_2O are considered indicative of upper tract obstruction.[19] Currently, diuretic nuclear renography is the functional test of choice. After intravenous administration of radioisotope tracer, split renal function can be calculated. Following injection of furosemide, a radiotracer clearance half-time ($t_{1/2}$) of greater than 20 minutes would be considered positive for obstruction. A normal clearance $t_{1/2}$ would be less than 10 minutes.[20] In patients with renal insufficiency, however, diuretic renography may be of limited usefulness because of inadequate excretion of the tracer.

MANAGEMENT OF OBSTRUCTIVE UROPATHY

In patients in whom the obstruction may be self-limited, such as with small ureteral calculi, conservative management is appropriate. Renal colic may be managed with nonsteroidal anti-inflammatory drugs in the absence of renal insufficiency.[21] In addition, medical therapy with a-adrenergic antagonists or calcium channel antagonists may decrease the time to expulsion of ureteral calculi.[22,23] Patients may then subsequently be referred to a urologist for definitive management should they fail a period of conservative management.

If the obstruction appears to be chronic in nature, immediate intervention may also be unnecessary. Reasons for acute intervention, however, include fever, potentially undrained infection, uncontrollable renal colic, high-grade obstruction, bilateral obstruction, obstruction of a solitary kidney, and acute renal insufficiency. In the acute setting, lower urinary tract obstruction due to anatomic or functional bladder outlet obstruction is treated with simple urinary catheter placement. Upper urinary tract obstruction can be treated with either endoscopic retrograde placement of an indwelling ureteral stent or percutaneous nephrostomy. Although both interventions are well tolerated, ureteral stenting is less effective in treating obstruction due to extrinsic compression such as that caused by malignancy.[24] On the other hand, percutaneous nephrostomy is contraindicated in patients with uncorrected coagulopathy or platelet dysfunction.

Once the obstruction is relieved, approximately 90% of patients with lower tract obstruction or bilateral upper tract obstruction experience a postobstructive diuresis.[25] In most patients, this diuresis is a physiologic response to volume expansion and solute accumulation. Therefore, the large postobstructive urine volumes need not be replaced with the administration of additional intravenous fluid. In a few patients, a pathologic diuresis due to a renal concentrating defect sustained during the period of obstruction may develop. In all patients with postobstructive diuresis, a basic metabolic panel and magnesium level should be checked daily. Patients who develop mental status changes should have their serum electrolytes and urine

osmolarity checked at least every 12 hours and any abnormalities should be corrected as necessary.[6]

After an acute episode of obstruction has been addressed, referral to an urologist for definitive management can be made. For upper tract obstruction, various endo-scopic, laparoscopic, and open procedures are available for reconstruction. However, observations in children have shown that there is little benefit to renal-sparing inter-ventions in kidneys providing less than 10% of global renal function. In the elderly, kidneys with such poor function may be managed expectantly if they are asymptom-atic. Otherwise, such essentially nonfunctioning kidneys are generally treated with nephrectomy.[26]

For lower tract obstruction, endoscopic and open procedures may be used to treat urethral strictures, bladder neck contractures, and BPH recalcitrant to optimized medical therapy with α-adrenergic antagonists and 5-α-reductase inhibitors. Pelvic organ prolapse in women may be corrected with pessary placement or more formal surgical repair. Medications with anticholinergic effects should be discontinued as appropriate and constipation, if present, should be corrected with an appropriate bowel regimen. If there is concern for neurogenic bladder as a cause of functional lower tract obstruction, the patient may be evaluated with urodynamics and an appro-priate urinary drainage or diversion regimen selected. In some patients with sensory neurogenic bladders or altered mental status, timed or prompted voiding may be suffi-cient to promote adequate urinary drainage. In patients with poor bladder contractility or detrusor-sphincter dyssynergia, urinary drainage with clean intermittent catheteri-zation is appropriate. When this is not possible because of a patient's poor manual dexterity or a lack of caregiver assistance, placement of a suprapubic catheter or a more formal urinary diversion may be necessary. In general, because of the risk for urethral erosion, chronic indwelling urethral catheter placement is not advised.

SUMMARY

Obstructive uropathy is a condition that disproportionately affects elderly patients and, in particular, elderly men. The causes of urinary tract obstruction may be anatomic, neurogenic, or iatrogenic. Although most cases are as a result of lower urinary tract obstruction from BPH and neurogenic bladder, a variety of causes involving the upper and lower urinary tract are possible. Management of acute urinary tract obstruction is directed toward establishing drainage across or around the site of obstruction. Careful monitoring of postobstructive diuresis must be undertaken to prevent complications from the development of pathologic postobstructive diuresis.

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