

PENUNTUN PEMBELAJARAN
TEKNIK MENILAI FOTO BNO - IVP



Diberikan pada Mahasiswa Semester IV
Fakultas Kedokteran Unhas

SISTEM UROGENITAL
FAKULTAS KEDOKTERAN
UNIVERSITAS HASANUDDIN
2017

TEKNIK MENILAI FOTO BNO-IVP

(digunakan oleh **Peserta**)

Beri nilai untuk setiap langkah klinik dengan menggunakan kriteria sebagai berikut:

1. **Perlu perbaikan:** langkah-langkah tidak dilakukan dengan benar dan atau tidak sesuai urutannya, atau ada langkah yang tidak dilakukan.
2. **Mampu:** Langkah-langkah dilakukan dengan benar dan sesuai dengan urutannya, tetapi tidak efisien
3. **Mahir:** Langkah-langkah dilakukan dengan benar, sesuai dengan urutan dan efisien.

TS Tidak Sesuai: Langkah tidak perlu dilakukan karena tidak sesuai dengan keadaan.

TUJUAN INSTRUKSIONAL UMUM (TIU)

Mahasiswa diharapkan mampu melakukan penilaian pada beberapa hasil pemeriksaan radiologis kasus-kasus sistem Urogenitalia

TUJUAN INSTRUKSIONAL KHUSUS (TIK)

Setelah melakukan latihan keterampilan ini, mahasiswa diharapkan mampu :

1. membaca dan menilai hasil foto BNO
2. membaca dan menilai hasil foto IVP

INDIKASI

1. Bila terdapat kelainan pada ginjal, ureter dan vesica urinaria.
2. Mencari secara tepat gangguan aliran urine pada traktus uropoitika
3. Batu saluran kemih merupakan penyebab tersering
4. Menilai fungsi ginjal

ALAT YANG DIPERLUKAN

1. Satu unit mesin x-rays
2. Bahan kontras (dye)
3. Infus set

ACUAN

Persiapan: Membersihkan daerah abdomen dengan laxativa atau menggunakan enema untuk mengeluarkan massa feses dari perut. Penderita juga diminta untuk tidak makan 8-12 jam sebelum dilakukan test ini

Prosedur : Untuk foto BNO, setelah melakukan fase persiapan, penderita langsung menuju ke ruang foto untuk pengambilan foto abdomen.

Pada IVP, penderita berbaring dan dilakukan infus kontras media lewat pembuluh darah vena di tangan. Kemudian foto akan dilakukan pada interval 0, 5 mnt, 10 mnt, dan 20 mnt. Interval 0 adalah saat kontras dimasukkan sevara intravena. Test ini selesai, bila setelah 20 menit telah didapatkan gambar kedua ginjal, ureter dan vesica urinaria.

References :

1. Peacock WF. Urologic stone disease. In: Tintinalli JE, Krome RL, Ruiz E, eds. *Emergency Medicine: A Comprehensive Study Guide*. 4th ed. McGraw-Hill; 1995:549-53.
2. Schneider RE. Genitourinary procedures. In: Roberts JR, Hedges JR, eds. *Clinical Procedures in Emergency Medicine*. 3rd ed. WB Saunders Co; 1998:978

DESKRIPSI KEGIATAN

Kegiatan	Waktu	Deskripsi
# 1. Pengantar	2 menit	Pengantar
# 2. Bermain Peran Tanya & Jawab	30 menit	<ol style="list-style-type: none"> 1. Mengatur posisi duduk mahasiswa 2. Seorang dosen memberikan contoh bagaimana cara melakukan Pemeriksaan dan penulisan hasil foto BNO & IVP. Mahasiswa menyimak/ mengamati peragaan dengan menggunakan Penuntun Belajar 3. Berikan kesempatan kepada mahasiswa untuk bertanya dan dosen memberikan penjelasan tentang aspek-aspek yang penting
# 3. Praktek cara memeriksa dengan Umpan Balik	100 menit	<ol style="list-style-type: none"> 1. Mahasiswa dibagi menjadi pasangan-pasangan. Seorang instruktur diperlukan untuk mengamati 3 pasangan. 2. Setiap pasangan berpraktek melakukan

SISTEM UROGENITALIA

		<p>pemeriksaan foto secara serempak</p> <ol style="list-style-type: none">Instruktur berkeliling diantara mahasiswa dan melakukan supervisi menggunakan ceklisInstruktur memberikan tema khusus umpan balik kepada setiap pasangan
# 4. Curah Pendapat/ Diskusi	15 menit	<ol style="list-style-type: none">Curah Pendapat/Diskusi : Apa yang dirasakan mudah? Apa yang sulit? .Dosen menyimpulkan dengan menjawab pertanyaan terakhir dan memperjelas hal-hal yang masih belum dimengerti
Total waktu	150 menit	

PENUNTUN PEMBELAJARAN

TEHNIK MEMERIKSA DAN MENILAI HASIL FOTO BNO DAN IVP (digunakan oleh Peserta)

- Beri nilai untuk setiap langkah klinik dengan menggunakan kriteria sebagai berikut:
1. **Perlu perbaikan:** langkah-langkah tidak dilakukan dengan benar dan atau tidak sesuai urutannya, atau ada langkah yang tidak dilakukan.
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 3. **Mahir:** Langkah-langkah dilakukan dengan benar, sesuai dengan urutan dan efisien.
- TS Tidak Sesuai:** Langkah tidak perlu dilakukan karena tidak sesuai dengan keadaan.

NO.	LANGKAH / KEGIATAN	KASUS		
		1	2	3
PERSIAPAN		1	2	3
1.	Pasanglah foto pada light box			
2.	Periksalah identitas pasien (Nama/umur) pada foto			
3.	Periksalah ada tidaknya marker (R/L,D/S) pada foto			
4.	Periksalah kondisi foto : - mencakup T12 – symphysis os pubis - perhatikan faecal mass (berhubungan dengan persiapan penderita)			
MEMBACA DAN MENILAI HASIL FOTO BNO		1	2	3
5	Lakukan identifikasi contour ginjal, psoas line, dan tulang-tulang			
6.	Lakukan identifikasi ada tidaknya bayangan radiopak pada lintasan traktus urinarius			
7.	Tuliskanlah hasil pengamatan saudara			
MEMBACA DAN MENILAI HASIL FOTO IVP				
8.	Perhatikanlah bentuk, ukuran dan letak ginjal			
9.	Perhatikanlah fungsi ekskresi & sekresi kedua ginjal			
10	Perhatikanlah pelvicalyceal system kedua ginjal (apakah ada tanda-tanda bendungan atau tidak)			
11	Perhatikanlah bentuk, ukuran ureter dan apakah ada tanda-tanda bendungan			
12.	Perhatikanlah keadaan vesica urinaria			
13.	Tuliskanlah hasil pengamatan saudara.			

NEPHROLITHIASIS

Background: Passage of a urinary stone is the most common cause of acute ureteral obstruction and affects as many as 12% of the population. The pain may be some of the most severe pain that humans experience, and complications of stone disease may result in severe infection; renal failure; or, in rare cases, death.

Pathophysiology: In patients with stone disease, more than 1 of 3 general mechanisms is likely to be active. These include the following: (1) the possible presence or abundance of substances that promote crystal and stone formation; (2) a possible relative lack of substances to inhibit crystal formation; and (3) a possible excessive excretion or concentration of salts in the urine, which leads to supersaturation of the crystallizing salt. The greater the degree of supersaturation, the greater the rate of growth of the calculi.

Stasis or anatomic factors can also contribute to the development of stone disease. These include ureteropelvic junction (UPJ) obstruction, horseshoe or ectopic kidney, autosomal dominant polycystic kidney disease, and vesicoureteral reflux. Calyceal diverticula, the result of anomalous budding of the calyceal system, is also associated with stone disease. In 10-40% of calyceal diverticula, stones are present. These range from a few large calculi to many tiny seed calculi and to the microscopic "milk of calcium."

Medullary sponge kidney is another common anatomic cause of renal calculi. The pathologic process in medullary sponge kidney is renal tubular ectasia. Calculi form in approximately 50% of patients. The calcifications form in the medulla but frequently pass into the collecting system. They are usually bilateral and diffuse, but they may also be unilateral or segmental. On intravenous urography (IVU), pyramidal clusters of calculi within the dilated tubules classically become obscured or appear enlarged after contrast material surrounds them in the dilated tubules.

Calcium stones account for 75-85% of urinary stones. Approximately one half of calcium stones are composed of a mixture of calcium oxalate and calcium phosphate. They demonstrate intermediate fragility to extracorporeal shock wave lithotripsy (ESWL). Approximately three eighths of calcium stones are formed of only calcium oxalate dihydrate. These may be spiculated, dotted, mulberry, or jackstone in appearance. Usually, these stones are fragile in response to ESWL. The remaining one eighth of stones are composed of calcium phosphate (apatite) or calcium monohydrate. These stones are the densest and, consequently, the least responsive to ESWL.

Calcium stones have numerous causes. Approximately 85% of calcium stones are idiopathic, or primary. Idiopathic hypercalciuria occurs in more than one half of patients with calcium oxalate stones. Most causes of hypercalciuria are

absorptive. Increased absorption in individuals after a normal diet causes an elevation of serum calcium levels and a suppression of parathyroid function as an abnormal response to vitamin D. Approximately 10% of cases of primary hypercalciuria are renal in origin. The inability of the kidney to conserve calcium results in low serum calcium concentrations, which stimulate parathormone secretion.

The remaining 15% of calcium stones are secondary to some discernible etiology. Most commonly, they result from hyperparathyroidism, which is found in 5-10% of patients with stones. In this situation, hypercalcemia and increased absorption lead to hypercalciuria. Patients with the stones are treated with surgical removal of the parathyroid adenoma or hyperplasia. Calcium stones can also occur in approximately 15% of patients with sarcoidosis in whom the production of activated vitamin D by macrophages is abnormal.

Renal tubular acidosis (RTA) is an additional fairly common secondary cause of calcium stones. In type I (distal) RTA, kidneys have a decreased ability to lower urine pH levels, which may be primary or secondary to a variety of renal injuries. The injured distal tubule loses the ability to maintain the hydrogen-ion gradient. This, in turn, causes alkaline urine, hypercalciuria, and hyperphosphaturia. Nephrocalcinosis or urolithiasis is seen in as many as 70% of patients with type I RTA. Conversely, type II (proximal) RTA is associated with increased bicarbonate loss, which helps keep stones from forming. Type IV RTA commonly is seen in medical renal disease and does not predispose patients to stone formation.

Immobilization of an individual causes rapid mobilization of the calcium in bones, and this is an important mechanism in patients with spinal cord injury, who may develop stones within weeks to months of immobilization. Hyperoxaluria is another, less common, secondary cause of calcium stone formation and most often results from inflammatory bowel disease, bowel surgery, vitamin C overdose, or renal failure. Primary hyperoxaluria is a rare autosomal recessive disease. Other secondary causes include milk-alkali syndrome, use of steroids, Cushing syndrome, hypervitaminosis D, paraneoplastic phenomenon, and multiple myeloma.

Magnesium ammonium phosphate (struvite) stones account for approximately 10-20% of urinary stones. These stones are lucent but complex with calcium phosphate. On occasion, they enlarge and branch (staghorn). Although they fragment easily, patients with these stones usually are treated with percutaneous fragmentation and extraction because of the large size of the stones and, usually, the presence of infection. Struvite stones are caused by urea-splitting bacteria such as *Proteus*, *Klebsiella*, and *Pseudomonas* species. However, as many as one half of patients have an underlying metabolic cause for stone disease; therefore, metabolic evaluation is indicated. Combined obstruction and infection frequently cause renal destruction and, potentially,

renal failure if both kidneys are affected.

Uric acid stones account for 5-10% of urinary stones. These small smooth stones usually appear radiolucent on conventional radiographs but opaque on CT scans. Predisposing factors include acidic concentrated urine, excess urinary uric acid, small-bowel disease or resection, gout, and cell lysis (eg, resulting from treatment of leukemia or from starvation). Treatment and prevention for these stones is alkalinization and dilution of the urine.

Cystine stones account for only approximately 1% of urinary stones. These ground-glass stones, which result from cystinuria (a rare autosomal recessive metabolic disorder), are homogeneous; less opaque; and less fragile than other stones, especially if they are smooth.

Several other less common forms of urolithiasis may produce stones that appear relatively lucent, even on CT scans. Inspissation of indinavir, an antiretroviral protease inhibitor used to treat HIV infection, may cause stones that appear lucent on CT scans. Matrix stones formed from inspissated mucoproteins in patients with a chronic *Proteus* infection may demonstrate soft tissue attenuation on CT scans. Stones can also be caused by metabolic byproducts and drugs (eg, sulfa drugs, salicylates, triamterene ephedrine).

Frequency:

- In the US: Renal calculi occur in 5-12% of the American population, and they are bilateral in 10-15% of patients. The prevalence of urinary lithiasis is as high as 2-3% in the general population.
- Internationally: A slightly lower prevalence of urinary stones is found in less developed countries, possibly because of diets lower in protein.

Mortality/Morbidity:

- Passage of a renal stone is the most common cause of acute ureteral obstruction. When this occurs, pressure in the collecting system and renal blood flow acutely increase, followed by decreased blood flow after 1-2 hours. Hematuria usually occurs. This can be intermittent or persistent and microscopic or gross. However, as many as 10% of patients with acute stones may not have hematuria.
- Acute ureteral obstruction by stone causes severe, colicky (intermittent) flank pain that can radiate throughout the groin, testicles, back, or periumbilical region. Some patients with renal calculi may have no symptoms at all. Stones smaller than 4 mm pass spontaneously in approximately 80% of patients. Stones that are 4-6 mm pass in approximately 50% of patients, whereas stones larger than 8 mm pass

in only approximately 20% of patients.

- Occasionally, recurrent infection may result in pyelonephritis or abscess. Stones can cause renal scarring, damage, or even renal failure if they are bilateral. In 10% of patients, stones recur within 1 year. This percentage increases to 50% within 10 years.

Race: Urinary stones occur more often in white populations than in black populations. They are also more prevalent in highly developed countries, possibly as a result of a higher protein diet.

Sex: Males are at a greater risk than females, with a male-to-female ratio of 3:1 (except for struvite stones and in black populations).

Age: Stones are uncommon but not unknown in children. The peak age for development is in persons aged 40-60 years.

Clinical Details: Acute ureteral obstruction by stone causes severe colicky (intermittent) flank pain that can radiate throughout the groin, testicles, back, and periumbilical region. Some patients with renal calculi may have no symptoms at all.

Hematuria usually occurs. It can be intermittent or persistent and microscopic or gross. However, as many as 10% of patients with acute stones may not have hematuria.

Occasionally, recurrent infection may result in pyelonephritis or abscess. Stones can result in renal scarring, damage, and renal failure.

Preferred Examination: The goals of imaging are to determine the presence of stones within the urinary tract, evaluate for complications, estimate the likelihood of stone passage, confirm stone passage, assess the stone burden, and evaluate disease activity.

When acute flank pain suggests the passage of a urinary stone, many methods of examination can be used. Often, conventional radiography is initially used to screen for stones, bowel abnormalities, or free intra-abdominal air. Radiographs can also be used to monitor the passage of visible stones.

IVU (excretory urography) provides important physiologic information regarding the degree of obstruction. Ultrasonography (US) is useful in young or pregnant patients and in patients allergic to iodinated contrast material. US is also helpful in problem solving.

All of these methods have become less useful with the advent of more sensitive and specific nonenhanced CT scanning. When CT is available, it is

now considered the examination of choice for the detection and localization of urinary stones. Almost all studies conducted to date show that IVU provides no additional clinically important information after nonenhanced CT is performed. As a result of the higher radiation dose of CT, conventional or digital radiography should be used to monitor the passage of stones if radiographic follow-up studies are indicated and if the stone is visible on conventional radiographs.

Limitations of Techniques: Because of the higher radiation dose with CT, conventional or digital radiography should be used to monitor the passage of stones if radiographic follow-up is believed to be indicated and if the stone is visible on conventional radiographs. Pregnant or pediatric patients may be imaged with US first to avoid radiation exposure. The rare false-negative finding is usually due to reader error or a protease-inhibitor CT-lucent stone. False-positive results are usually due to phleboliths adjacent to the ureter. In some cases, intravenous contrast material may be needed to opacify the ureter.

US has limited sensitivity for smaller stones, and does not depict the ureters well. It should be used mainly in patients who are young, those who are pregnant, or those undergoing multiple examinations (eg, patients with spine injury).

IVU is the traditional examination for the assessment of urinary stone disease, and it does provide physiologic information related to the degree of obstruction. The radiation dose is generally smaller than that of CT, but it is of the same order of magnitude. Intravenous contrast is required, with resultant risks of an allergic reaction or nephrotoxicity. IVU is less sensitive than CT, especially for small or nonobstructing stones.

DIFFERENTIALS

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[Appendicitis](#)

[Cholecystitis, Acute](#)

[Cholelithiasis](#)

[Colon, Diverticulitis](#)

[Crohn Disease](#)

[Duodenum, Ulcers](#)

[Epididymitis](#)

[Gastric Ulcer](#)

[Gout](#)

[Meckel Diverticulum](#)

[Midgut Volvulus](#)

[Nephrocalcinosis](#)

[Obstructive Uropathy, Acute](#)

Ovarian Torsion
Ovarian Vein Thrombosis
Pancreatitis, Acute
Pancreatitis, Chronic
Papillary Necrosis
Pelvic Inflammatory Disease/Tubo-ovarian Abscess
Renal Cell Carcinoma
Renal Vein Thrombosis
Retroperitoneal Fibrosis
Testicular Torsion
Transitional Cell Carcinoma
Tuberculosis, Genitourinary Tract
Ureterocele
Ureteropelvic Junction Obstruction, Congenital
Vesicoureteral Reflux
Wilms Tumor
Xanthogranulomatous Pyelonephritis

Other Problems to be Considered:

Blood clot
Fungus ball
Calcifications in tumors such as renal cell carcinoma
Complicated renal cysts
Infection
Abscess
Infarcts
Hematoma
Malakoplakia
Atherosclerotic calcification
Biliary colic
Ulcer disease
Diverticulitis

X-RAY

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Findings:

Conventional radiography

Conventional radiography is often performed as a preliminary examination in patients with abdominal pain possibly resulting from urinary calculi. These images should be obtained before contrast material is administered to prevent obscuring calcifications within the collecting system or calyceal diverticula.

Conventional radiographs should include the entire urinary tract, and, often, 2 images are required.

- Stones are often found at key points of narrowing such as the UPJ, the ureterovesical junction (UVJ), and the point at which the ureter crossing the iliac vessels. An addition site is on the right side where the ureter passes through the root of the mesentery.
- Calcium stones as small as 1-2 mm can be seen. Cystine stones as small as 3-4 mm may be depicted, but uric acid stones are usually not seen unless they have become calcified.
- An erect or posterior oblique radiograph obtained on the side of the calcification may help in distinguishing urinary stones from extraurinary calcifications. This view can also depict calcifications that are projected over the sacrum or transverse processes on the frontal view.
- Preinjection renal tomography may depict additional stones, and it can be used to confirm the relationship of stones to the kidneys.
- Because stones are more visible with a lower peak kilovoltage (kVp), maintaining a maximum of 60-80 kVp is best, if possible. Larger patients may require a higher peak kilovoltage for acceptable exposure and scatter. In this situation, compression of the abdomen and collimation is critical.
- Mild bowel preparation may be helpful for increasing the sensitivity of conventional radiography for small stones in patients undergoing screening or follow-up observation for stones.
- Typically, phleboliths are round or oval, and they may demonstrate a central lucency. However, they are often difficult to distinguish from ureteral calculi. Phleboliths in the pelvis are usually located lower than and lateral to the ureter, but they overlap with the ureter. Because gonadal veins parallel the upper ureters, contrast enhancement may be needed to opacify the ureter and demonstrate the extraurinary location of phleboliths in the gonadal veins.

Intravenous urography

IVU is useful for confirming the exact location of a stone within the urinary tract. IVU depicts anatomic abnormalities such as dilated calyces, calyceal diverticula, duplication, UPJ obstruction, retrocaval ureter, and others that may predispose patients to stone formation or alter therapy. Because contrast agents can obscure stones in the collecting system, scouting the entire urinary tract prior to their administration is critical.

When an acute urinary stone is the primary consideration, compression may not be used to increase sensitivity for detection of low-grade obstruction. A caveat is that the contralateral kidney may have an abnormality that requires

ureteric compression for adequate examination. In rare cases, the use of compression has been associated with forniceal rupture.

When a stone causes acute obstruction, an obstructive nephrogram may be present. This may be prolonged and hyperopaque, with increasing opacity over time. The nephrogram of acute obstruction is usually homogeneous, but may also be striated or occasionally not visible on radiographs.

Other signs include delayed excretion, dilatation to the point of obstruction, or blunting of the calyceal fornices. Immediately after the passage of a stone, residual mild obstruction or edema can be detected at the UVJ. Delayed images may be needed to opacify to the point of the obstruction, but using gravity to position the more opaque and more distal contrast material–laden urine is also possible by placing the patient in a prone or erect position.

Extravasation of urine at the fornices may result in pyelosinus or pyelolymphatic extravasation, which is often first indicated by blurring of the calyceal fornices. Greater extravasation may outline the collecting system, and the contrast may dissect into the perinephric space; however, if the urine is not infected, this is usually clinically insignificant.

Degree of Confidence: Although 90% of urinary calculi are opaque on abdominal radiographs, the sensitivity for the prospective identification of individual stones is only 50-60%, and the specificity is only approximately 70%. Approximately 10% of stones are radiolucent on conventional radiographs.

False Positives/Negatives: Occasionally, false-positive findings result from extrarenal calcification, but these are usually correctly identified with IVU. Lucent stones appear as filling defects on IVU, but they are not distinguished from non–stone-filling defects such as transitional cell carcinomas or blood clots. US and CT are effective tools in making this distinction; however, much of the ureter cannot be visualized with US.

Findings: With a sensitivity of 94-97% and a specificity of 96-100%, helical CT is the most sensitive radiologic examination for the detection, localization, and characterization of urinary calcifications; therefore, helical CT is considerably more effective than IVU. Helical CT scans frequently depict non-obstructing stones that are missed on IVU. CT is faster and no contrast agent is needed in most patients. CT easily differentiates between non-opaque stones and blood

clots or tumors (compared with IVU, which may depict only a filling defect). In addition, helical CT is better than US or IVU in detecting other causes of abdominal pain. In fact, in most studies, IVU added little or no information.

Rarely, pure matrix stones may demonstrate soft-tissue opacity on CT scans, and indinavir stones appear lucent. However, all other stones appear opaque on CT scans.

Technique

Because stones in the collecting system may be obscured by contrast material, nonenhanced CT is usually performed. Helical CT is important to avoid missing stones because of section misregistration. A 5-mm helical technique with a pitch of 1.5:1 or less is preferred, although some radiologists choose to use a pitch of as much as 2:1. The kidneys and, if possible, the entire abdomen should be scanned during a single breath hold to prevent section misregistration.

Because patients with stones are often young and because stone disease may recur, minimizing the radiation dose is critical. A fairly high level of noise as a result of the inherently high contrast levels is tolerable in most patients. Reported radiation doses for CT are 2.8-4.5 mSv compared with 1.3-1.5 mSv for a 3-image IVU. However, the uterine dose is approximately 0.006 Gy for 4-image IVU compared with 0.0046 Gy for nonenhanced CT.

At the authors' institution, approximately 12% (10-20%) of patients who undergo nonenhanced CT for possible urinary stones receive intravenous contrast material for further evaluation. To discern between phleboliths and urinary stones, 50 mL of low-osmolar contrast agent should be administered. After 3-5 minutes, a 5-mm helical scan is obtained through the area of concern. Fewer contrast-enhanced studies are needed with increasing experience. Soft tissue around the rim of a calculus can differentiate it from a phlebolith. A phlebolith may have a comet tail of soft tissue extending from it; this finding differentiates it from a calculus. On CT scans, phleboliths do not have radiolucent centers, as often seen on plain radiographs.

When contrast-enhanced scans are required to evaluate pain not related to stones, routine abdominal and/or pelvic CT should be performed. In this situation, 100-150 mL of a low-osmolar oral and rectal contrast agent is used, and a 5-mm helical CT scan is obtained with a pitch of 1.5:1. Patient selection determines the number of examinations needed.

Stones at the UVJ may be difficult to distinguish from stones that have already passed into the bladder. If the distinction changes therapy, a repeat scan through the UVJ in the prone position may be helpful. Stones that have already passed into the bladder will drop into a dependent location.

CT findings

CT may depict the following:

- Stones in the ureter
- Enlarged kidneys
- Hydronephrosis (83% sensitive, 94% specific)
- Perinephric fluid (82% sensitive, 93% specific)
- Ureteral dilatation (90% sensitive, 93% specific)
- Soft-tissue rim sign (good positive predictive value with a positive odds ratio of 31:1)

The amount of perinephric fluid is correlated with the degree of obstruction seen on IVU, and as with the obstruction, the amount of fluid is correlated with the likelihood of stone passage. Normal hyperattenuating renal pyramids sometimes are seen. These indicate that significant obstruction is not present. However, this finding has been seen with proven ureteral calculi and is often absent in patients without stones. For this reason, the usefulness of IVU is limited. If contrast material is administered, a delayed or hyperattenuating nephrogram may also be visible on CT scans if the ureter has an obstruction.

Conventional radiography may be helpful in visualizing larger stones, once they are identified on CT scans, to provide a baseline to follow passage of the stone. If kidney, ureter, and bladder radiographs fail to depict the stone, CT may be needed to follow its passage. Approximately 40-55% of stones are not visible on abdominal radiographs. Almost no stones with attenuation values of less than 200 HU are visible, and repeat CT scans are usually required if passage of the stone is to be followed. Cystine and urate stones have an attenuation of 100-500 HU; calcium stones usually demonstrate attenuation higher than 700 HU. Considerable overlap exists in the CT attenuation values of calcium stones.

Degree of Confidence: Individual CT signs are associated with varying degrees of confidence, as noted in CT findings above.

False Positives/Negatives: False-positive results are almost exclusively the result of a phlebolith adjacent to the ureter. False-negative results are primarily due to indinavir radiolucent stones and error. CT scans often suggest an alternative or additional

