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Fişa suspiciunii de plagiat / Sheet of plagiarism's suspicion	
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OA	McANINCH, J.W. Injuries to the Genitourinary Tract. In: TANAGHO, E.A., McANINCH, J.W. (Eds). General urology. 13th edition. Los Altos, California: Lange Medical Publications. 1992.
Incidenţa minimă a suspiciunii / Minimum incidence of suspicion	
p.124: Figura 10-2a,2b	p.311: Figure 18-4
p.125: Figura 10-3	p.312 – 313: Figure 18-15, Figure 19-15.
p.126: 14s – p.126: 27d	p.314: 11s– p.314:06d
p.129: 17s - p.129:70d	p.316: 04d – p.316:36d
p.133: Figura 10-14	p.319: Figure 18-11
p.136: Figura. 10-16	p.321: Figure 18-14
p.137: Figura. 10-17	p.324: Figure 18-17
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Note: By „p.72:00" one understands the text ending with the end of the page 72. By „p.00:00" one understands the taking over from the initial point till the last page of the current chapter, entirely.

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a) Prin „provenienţă" se înţelege informaţia din care se pot identifica cel puţin numele autorului / autorilor, titlul operei, anul apariţiei.

b) Plagiatul este definit prin textul legii[1].

> *„ …plagiatul – expunerea într-o operă scrisă sau o comunicare orală, inclusiv în format electronic, a unor texte, idei, demonstraţii, date, ipoteze, teorii, rezultate ori metode ştiinţifice extrase din opere scrise, inclusiv în format electronic, ale altor autori, fără a menţiona acest lucru şi fără a face trimitere la operele originale…".*

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> *„…este un element de comunicare prezentat în formă scrisă, ca text, imagine sau combinat, care posedă un subiect, o organizare sau o construcţie logică şi de argumentare care presupune nişte premise, un raţionament şi o concluzie. Piesa de creaţie presupune în mod necesar o formă de exprimare specifică unei persoane. Piesa de creaţie se poate asocia cu întreaga operă autentică sau cu o parte a acesteia…"*

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> *iii) Cele două opere conţin piese de creaţie identificabile comune care posedă, fiecare în parte, un subiect şi o formă de prezentare bine definită.*
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[1] Legea nr. 206/2004 privind buna conduită în cercetarea ştiinţifică, dezvoltarea tehnologică şi inovare, publicată în Monitorul Oficial al României, Partea I, nr. 505 din 4 iunie 2004
[2] ISOC, D. *Ghid de acţiune împotriva plagiatului: bună-conduită, prevenire, combatere*. Cluj-Napoca: Ecou Transilvan, 2012.
[3] ISOC, D. *Prevenitor de plagiat*. Cluj-Napoca: Ecou Transilvan, 2014.

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18 Injuries to the Genitourinary Tract

Jack W. McAninch, MD

EMERGENCY DIAGNOSIS & MANAGEMENT

About 10% of all injuries seen in the emergency room involve the genitourinary system to some extent. Many of them are subtle and difficult to define and require great diagnostic expertise. Early diagnosis is essential to prevent serious complications.

Initial assessment should include control of hemorrhage and shock along with resuscitation as required. Resuscitation may require intravenous lines and a urethral catheter in the seriously injured patient. In men, before the catheter is inserted, the urethral meatus should be examined carefully for the presence of blood. Once the intravenous lines are established, if any suspicion of renal or ureteral injury is entertained, contrast material should be injected intravenously for later x-ray study.

The history should include a detailed description of the accident. In cases involving gunshot wounds, the type and caliber of the weapon should be determined, since high-velocity projectiles cause much more extensive damage.

The abdomen and genitalia should be examined for evidence of contusions or subcutaneous hematomas, which might indicate deeper injuries to the retroperitoneum and pelvic structures. Fractures of the lower ribs are often associated with renal injuries and pelvic fractures with bladder and urethral injuries. Diffuse abdominal tenderness is consistent with perforated bowel, free intraperitoneal blood or urine, or retroperitoneal hematoma. As an aid to diagnosis of intraperitoneal injuries, a small catheter inserted percutaneously into the abdomen followed by irrigation will help detect free intraperitoneal blood.

Initial radiographic studies should be done in the trauma unit, if possible, before moving the patient. Plain films of the abdomen will disclose early excretion of contrast material injected at the time intravenous lines were inserted. Lower rib fractures, vertebral body and transverse process fractures, and pelvic fractures may be associated with severe urinary tract injuries. Early extravasation of contrast material may be noted with renal, ureteral, or bladder injuries.

Patients who do not have life-threatening injuries and whose blood pressure is stable can undergo more deliberate radiographic studies. This provides more definitive staging of the injury.

Special Examinations (Figs 18–1 through 18–3)

When genitourinary tract injury is suspected on the basis of the history and physical examination, additional studies are required to establish its extent.

A. Catheterization and Assessment of Injury: Assessment of the injury should be done in an orderly fashion, so that accurate and complete information is obtained. This process of defining the extent of injury is termed "staging." The algorithms (Figs 18–1 through 18–3) outline the staging process for urogenital trauma.

1. Catheterization–Blood at the urethral meatus in men indicates urethral injury; catheterization should not be attempted if blood is present, but retrograde urethrography should be done immediately. If no blood is present at the meatus, a urethral catheter can be carefully passed to the bladder to recover urine; microscopic or gross hematuria indicates urinary system injury. If catheterization is traumatic despite the greatest care, the significance of hematuria cannot be determined, and other studies must be done to investigate the possibility of urinary system injury.

2. Excretory urography–Immediately after intravenous lines have been established and the resuscitation process has begun, 150 mL (2 mL/kg) of contrast material can be injected intravenously by push technique. As hypotension is overcome and renal perfusion improves, plain abdominal films will permit adequate visualization of the kidneys. This technique allows evaluation of renal injuries without undue delay before emergency operations, if indicated. If renal injury seems likely from the urogram, nephrotomography should be done immediately. In most cases, it is not necessary to inject more contrast medium, since adequate contrast medium remains, and tomography will give additional information regarding parenchymal injuries.

3. Retrograde cystography–Filling of the bladder with contrast material is essential to establish whether bladder perforations exist. At least 300 mL of contrast medium should be instilled for full vesical distention. A film should be obtained with the bladder

filled and a second one after the bladder has emptied itself by gravity drainage. These 2 films will establish the degree of bladder injury as well as the size of the surrounding pelvic hematomas.

4. Urethrography–A small (12F) catheter can be inserted into the urethral meatus and 3 mL of water placed in the balloon to hold the catheter in position. After retrograde injection of 20 mL of water-soluble contrast material, the urethra will be clearly outlined on film, and extravasation in the deep bulbar area in case of straddle injury—or free extravasation into the retropubic space in case of prostatomembranous disruption—will be visualized.

5. Arteriography–Arteriography may help define renal parenchymal and renal vascular injuries. It is also useful in the detection of persistent bleeding from pelvic fractures for purposes of embolization with Gelfoam or autologous clot.

6. Computed tomography–CT scans can help in assessing the size and extent of retroperitoneal hematomas and renal parenchymal trauma. It is a noninvasive test that gives accurate and fast information when excretory urography does not adequately establish the degree and extent of renal injury.

B. Cystoscopy and Retrograde Urography: These studies are seldom necessary, since information can be obtained by less invasive techniques.

C. Abdominal Sonography: This study has not been shown to add substantial information during initial evaluation of severe abdominal trauma.

INJURIES TO THE KIDNEY

Renal injuries are the most common injuries of the urinary system. The kidney is well protected by heavy lumbar muscles, vertebral bodies, ribs, and the viscera anteriorly. Fractured ribs and transverse vertebral processes may penetrate the renal parenchyma or vasculature. Most injuries occur from automobile accidents or sporting mishaps, chiefly in men and boys. Kidneys with existing pathologic conditions such as hydronephrosis or malignant tumors are more readily ruptured from mild trauma.

Etiology (Fig 18–4)

Blunt trauma directly to the abdomen, flank, or back is the most common mechanism, accounting for 80–85% of all renal injuries. Trauma may result from motor vehicle accidents, fights, falls, and contact sports. Vehicle collisions at high speed may result in major renal trauma from rapid deceleration and cause major vascular injury. Gunshot and knife wounds cause most penetrating injuries to the kidney; any such wound in the flank area should be regarded as a cause of renal injury until proved otherwise. Associated abdominal visceral injuries are present in 80% of renal penetrating wounds.

Pathology & Classification (Fig 18–5)

A. Early Pathologic Findings: Lacerations from

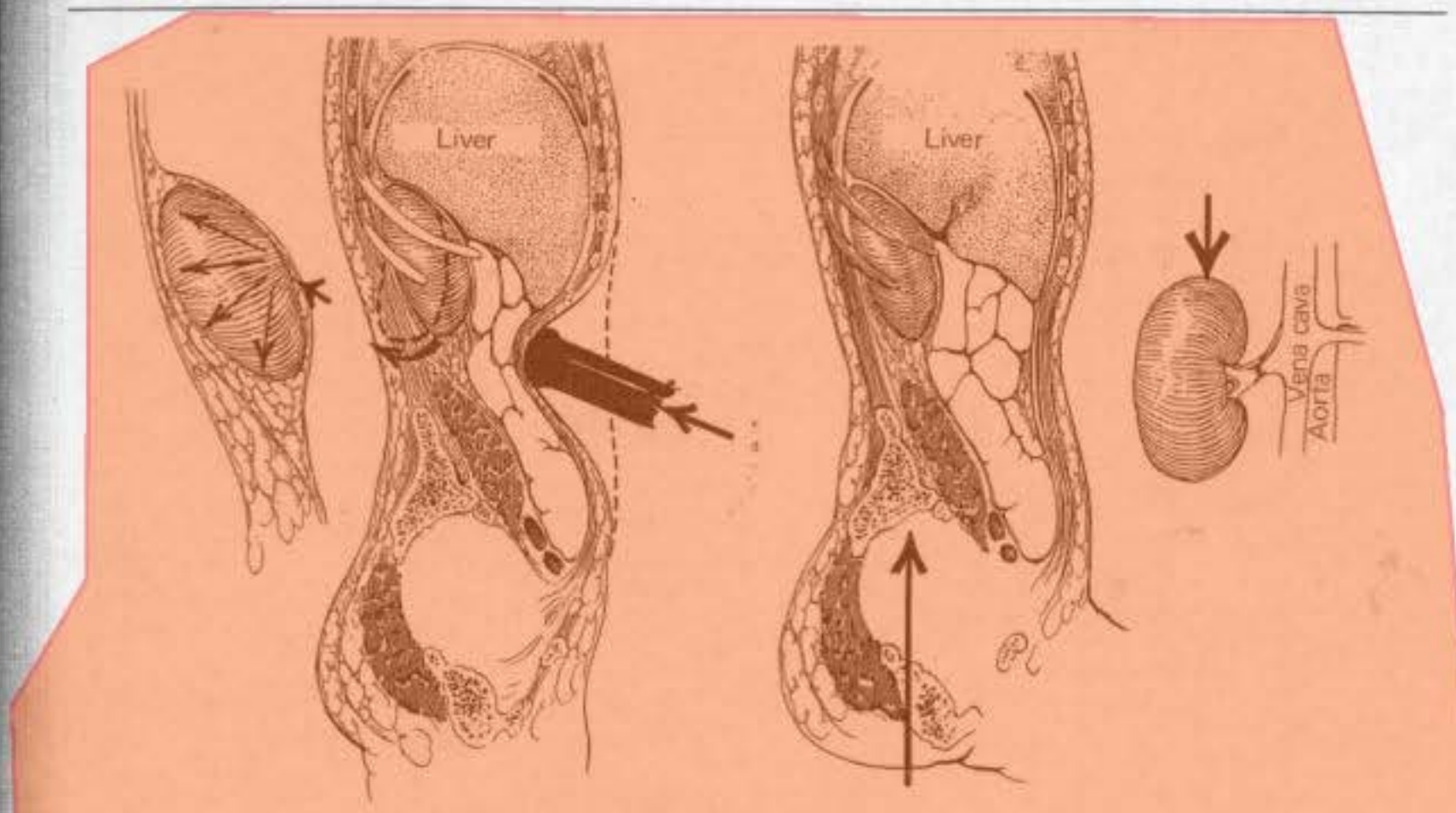
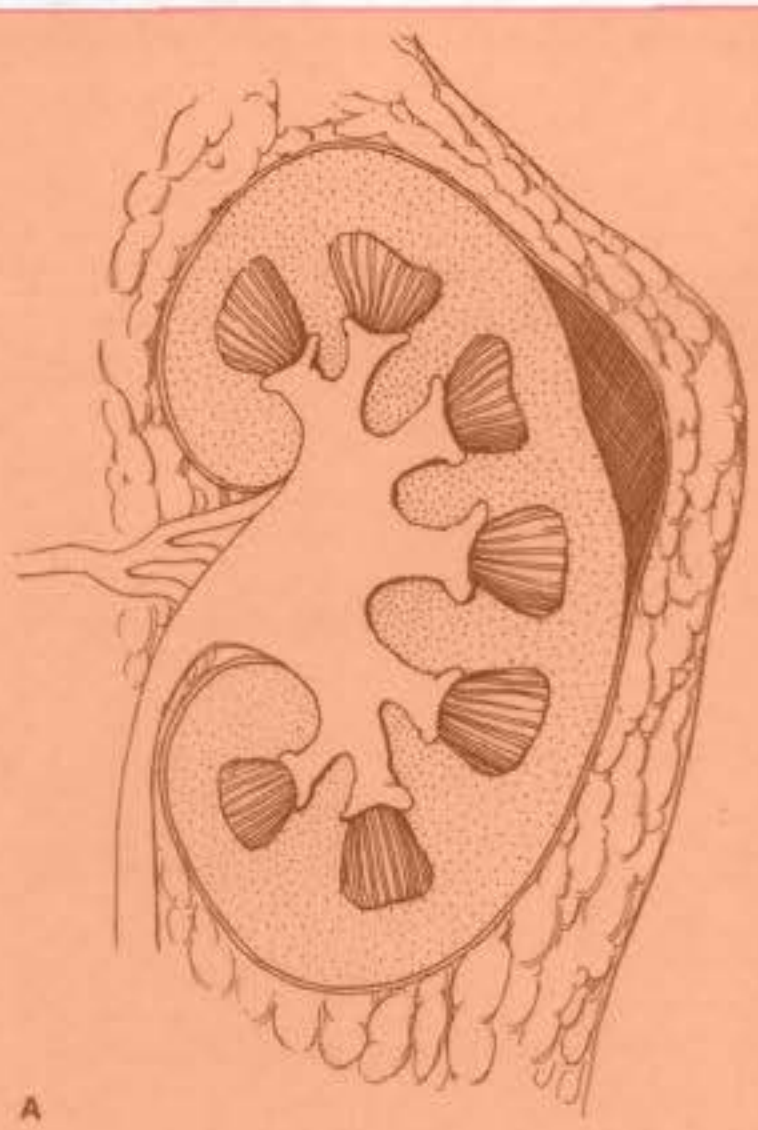
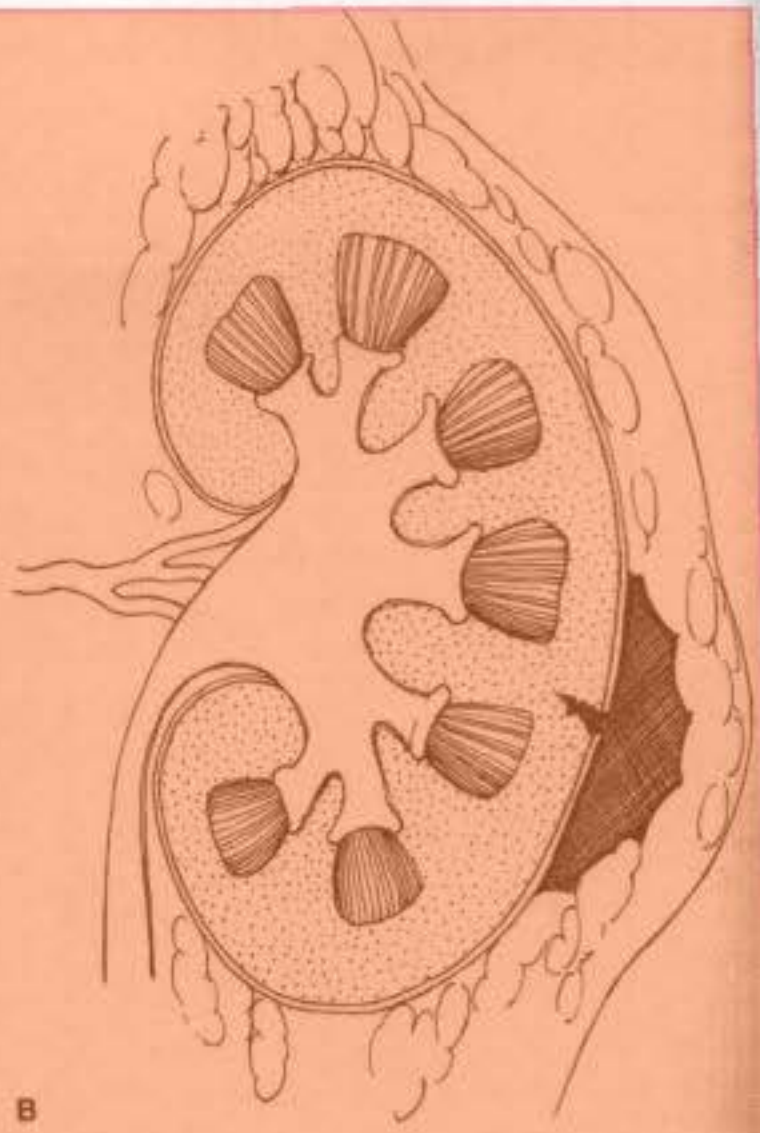
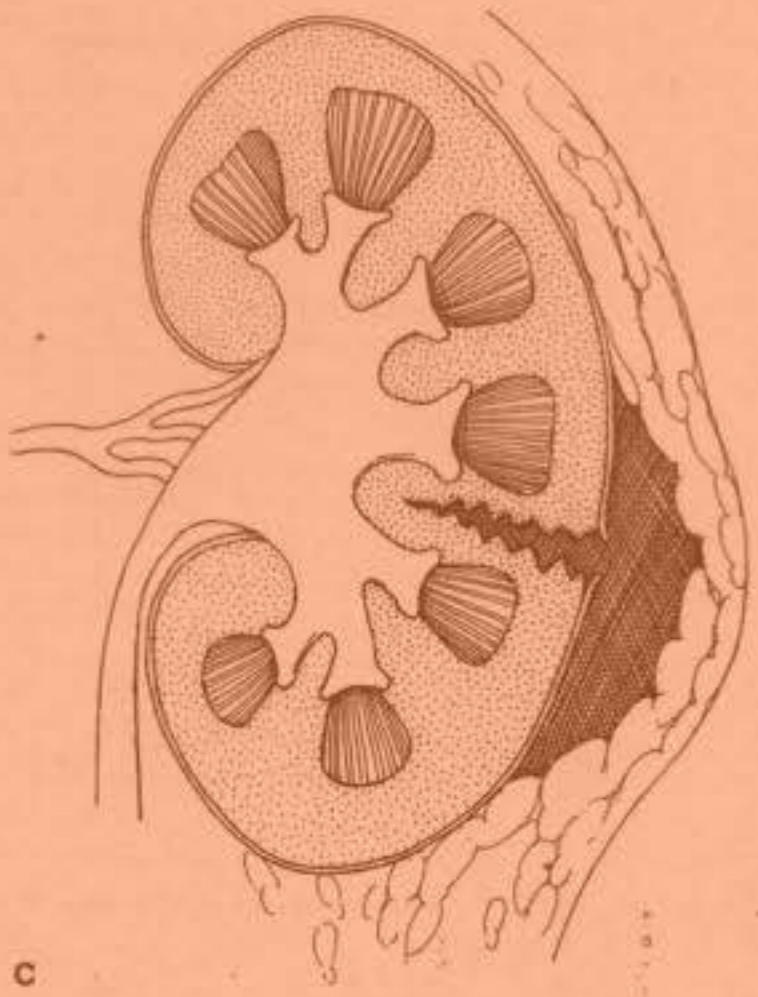


Figure 18–4. Mechanisms of renal injury. ***Left:*** Direct blow to abdomen. Smaller drawing shows force of blow radiating from the renal hilum. ***Right:*** Falling on buttocks from a height (contrecoup of kidney). Smaller drawing shows direction







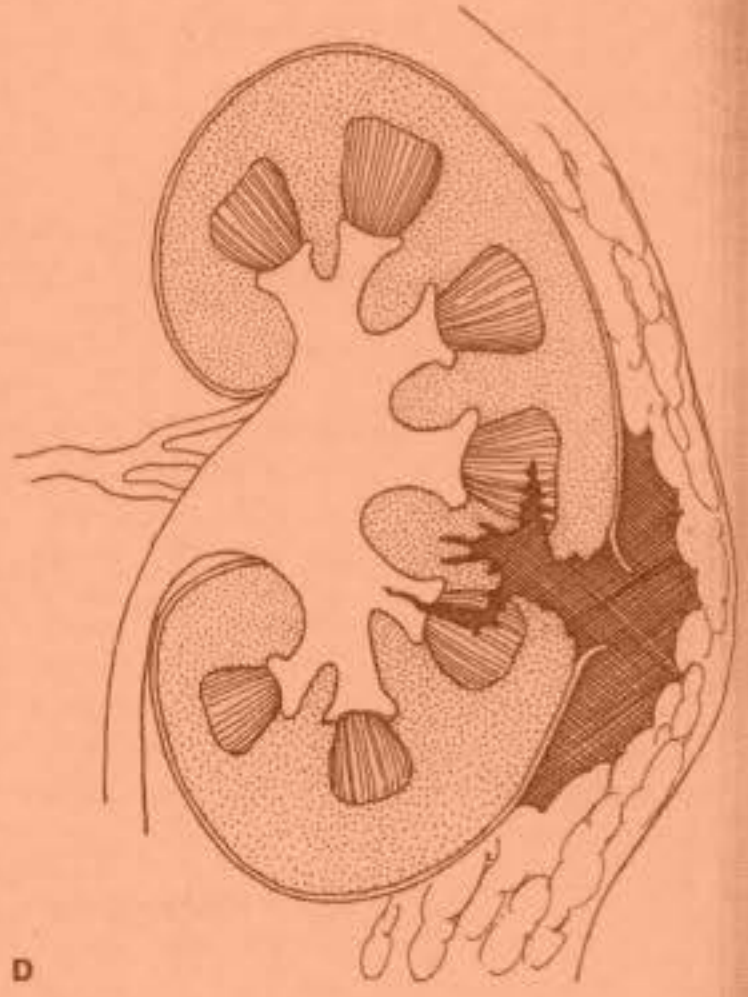
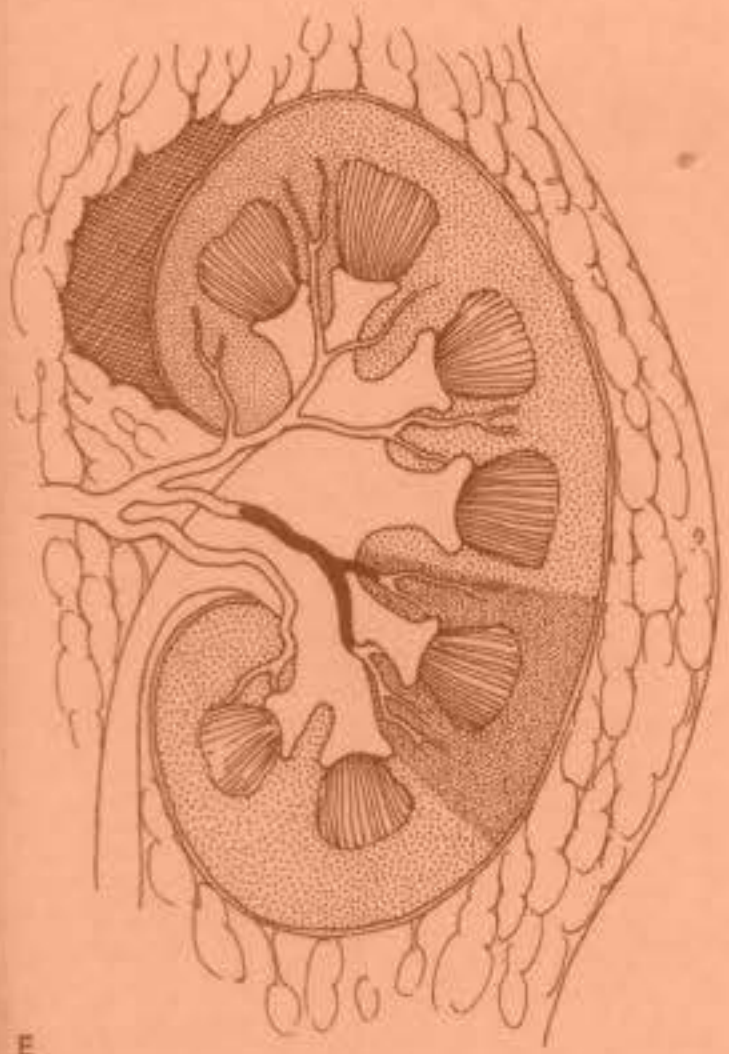


Figure 18–5. Classification of renal injuries. Grades I and II are minor. Grades III, IV and V are major. ***A:*** Grade I—microscopic or gross hematuria; normal findings on radiographic studies; contusion or contained subcapsular hematoma without parenchymal laceration. ***B:*** Grade II—nonexpanding, confined perirenal hematoma or cortical laceration less than 1 cm deep without urinary extravasation. ***C:*** Grade III—parenchymal laceration extending less than 1 cm into the cortex without urinary extravasation. ***D:*** Grade IV—parenchymal laceration extending through the corticomedullary junction and into the collecting system. A laceration at a segmental vessel may also be present. (*continued*)



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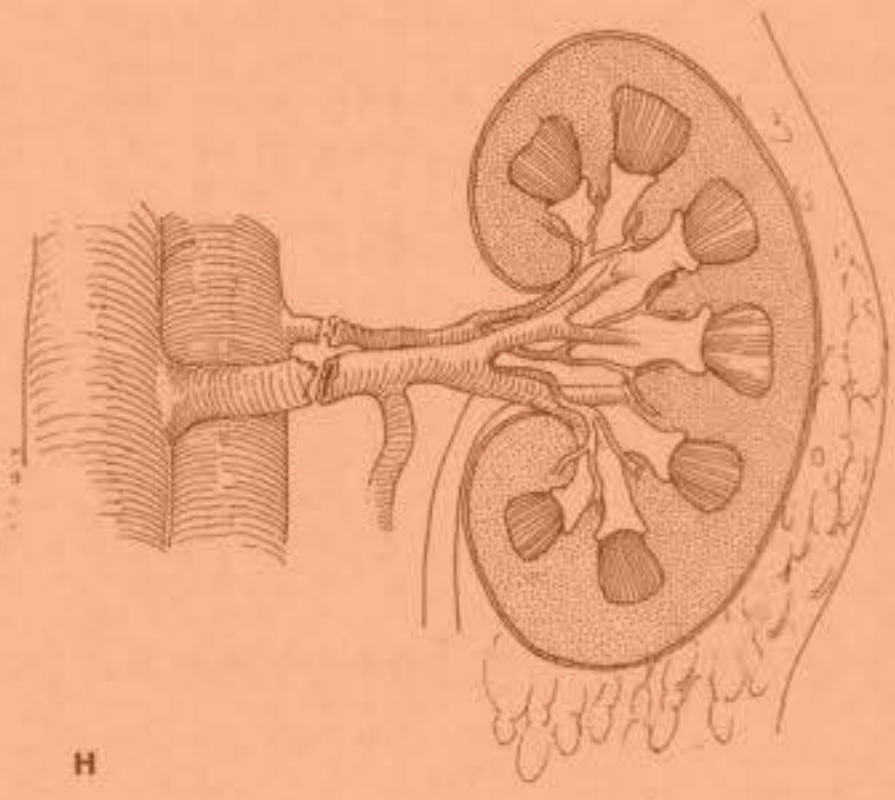

H

Figure 18–5 (cont'd). ***E:*** Grade IV—thrombosis of a segmental renal artery without a parenchymal laceration. Note the corresponding parenchymal ischemia. ***F:*** Grade V—thrombosis of the main renal artery. The inset shows the intimal tear and distal thrombosis. ***G:*** Grade V—multiple major lacerations, resulting in a "shattered" kidney. ***H:*** Grade V—avulsion of the main renal artery and/or vein.

blunt trauma usually occur in the transverse plane of the kidney. The mechanism of injury is thought to be force transmitted from the center of the impact to the renal parenchyma. In injuries from rapid deceleration, the kidney moves upward or downward, causing sudden stretch on the renal pedicle and sometimes complete or partial avulsion. Acute thrombosis of the renal artery may be caused by an intimal tear from rapid deceleration injuries owing to the sudden stretch.

Pathologic classification of renal injuries is as follows (Moore et al, 1989):

1. Minor renal trauma–(85% of cases.) Renal contusion or bruising of the parenchyma is the most common lesion. Subcapsular hematoma in association with contusion is also noted. Superficial cortical lacerations are also considered minor trauma. These injuries rarely require surgical exploration.

2. Major renal trauma–(15% of cases.) Deep corticomedullary lacerations may extend into the collecting system, resulting in extravasation of urine into the perirenal space. Large retroperitoneal and perinephric hematomas often accompany these deep lacerations. Multiple lacerations may cause complete destruction of the kidney. Laceration of the renal pelvis without parenchymal laceration from blunt trauma is rare.

3. Vascular injury–(About 1% of all blunt trauma cases.) Vascular injury of the renal pedicle is rare but may occur, usually from blunt trauma. There may be total avulsion of the artery and vein or partial avulsion of the segmental branches of these vessels. Stretch on the main renal artery without avulsion may result in renal artery thrombosis. Vascular injuries are difficult to diagnose and result in total destruction of the kidney unless the diagnosis is made promptly.

B. Late Pathologic Findings: (Fig 18–6.)

1. Urinoma–Deep lacerations that are not repaired may result in persistent urinary extravasation and late complications of a large perinephric renal mass and, eventually, hydronephrosis and abscess formation.

2. Hydronephrosis–Large hematomas in the retroperitoneum and associated urinary extravasation may result in perinephric fibrosis engulfing the ureteropelvic junction, causing hydronephrosis. Follow-up excretory urography is indicated in all cases of major renal trauma.

3. Arteriovenous fistula–Arteriovenous fistulas may occur after penetrating injuries but are not common.

4. Renal vascular hypertension–The blood flow in tissue rendered nonviable by injury is compromised; this results in renal vascular hypertension in about 1% of cases. Fibrosis from surrounding trauma has also been reported to constrict the renal artery and cause renal hypertension.

Clinical Findings & Indications for Studies

Microscopic or gross hematuria following trauma

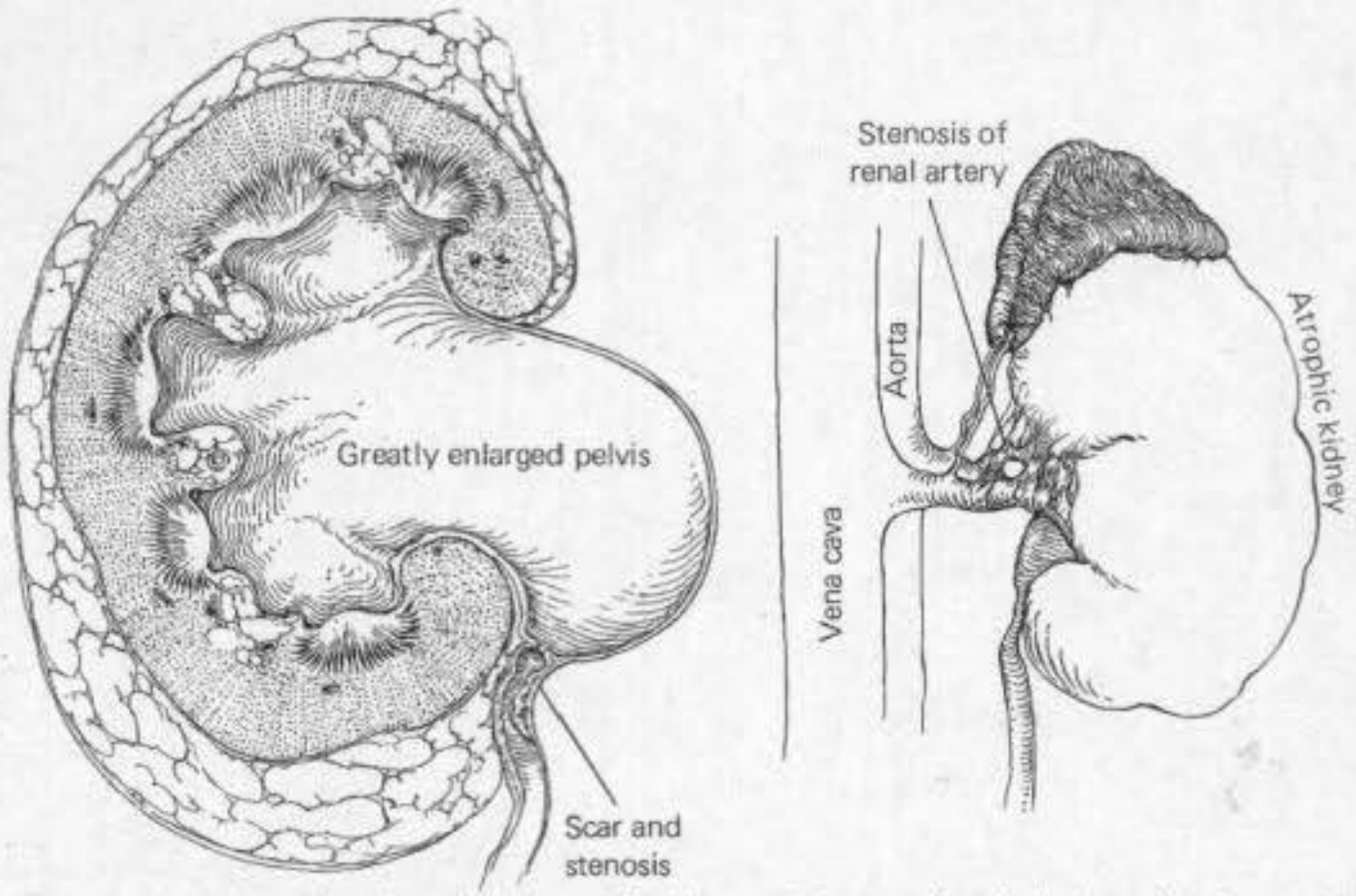

Figure 18–6. Late pathologic findings in renal trauma. ***Left:*** Ureteropelvic stenosis with hydronephrosis secondary to fibrosis from extravasation of blood and urine. ***Right:*** Atrophy of kidney caused by injury (stenosis) of arterial blood supply.

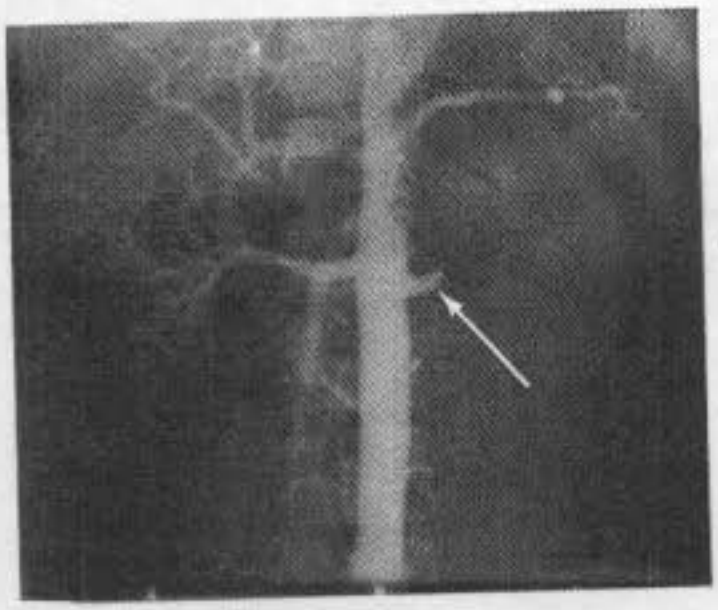

Figure 18–8. Arteriogram following blunt abdominal trauma shows typical findings of acute renal artery thrombosis (***arrow***) of left kidney.

ing vascular spasm, and absence of the kidney (either congenital or from operation).

Computed tomography (CT scan) has proved to be an effective means of staging renal trauma. This noninvasive technique provides excellent definition of parenchymal lacerations, clearly defines extravasation, shows extension of perirenal hematoma, defines nonviable renal tissue, and outlines surrounding organs such as the pancreas, liver, and major vessels (Fig 18–9).

Radionuclide renal scans have been used in staging renal trauma. However, in emergency management, this technique is less sensitive than arteriography or CT scan.

Differential Diagnosis

Trauma to the abdomen and flank areas is not always associated with renal injury. In such cases, there is no hematuria, and the results of excretory urography are normal.

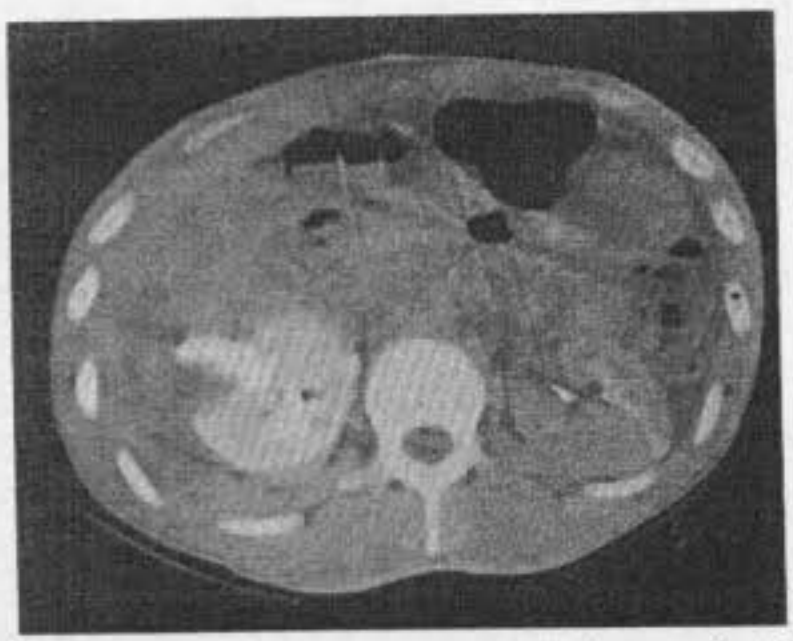

Figure 18–9. CT scan of right kidney following knife stab wound. Laceration with urine extravasation is seen. Large right retroperitoneal hematoma is present.

Complications

A. Early Complications: Hemorrhage is perhaps the most important immediate complication of renal injury. Heavy retroperitoneal bleeding may result in rapid exsanguination. Patients must be observed closely, with careful monitoring of blood pressure and hematocrit. Complete staging must be done early (Fig 18–1 through 18–3). The size and expansion of palpable masses must be carefully monitored. Bleeding will cease spontaneously in 80–85% of cases. Persistent retroperitoneal bleeding or heavy gross hematuria may require early operation.

Urinary extravasation from renal fracture may show as an expanding mass (urinoma) in the retroperitoneum. These collections are prone to abscess formation and sepsis. A resolving retroperitoneal hematoma may cause slight fever (38.3 °C [101 °F]), but higher temperatures suggest infection. A perinephric abscess may form, resulting in abdominal tenderness and flank pain. Prompt operation is indicated.

B. Late Complications: Hypertension, hydronephrosis, arteriovenous fistula, calculus formation, and pyelonephritis are important late complications. Careful monitoring of blood pressure for several months is necessary to watch for hypertension. At 3–6 months, a follow-up excretory urogram should be obtained to be certain that perinephric scarring has not caused hydronephrosis or vascular compromise; renal atrophy may occur from vascular compromise and will be detected by follow-up urography.

Heavy late bleeding may occur 1–4 weeks after injury.

Treatment

A. Emergency Measures: The objectives of early management are prompt treatment of shock and hemorrhage, complete resuscitation, and evaluation of associated injuries.

B. Surgical Measures:

1. Blunt Injuries–Minor renal injuries from blunt trauma account for 85% of cases and do not usually require operation. Bleeding stops spontaneously with bed rest and hydration. Cases in which operation is indicated include those associated with persistent retroperitoneal bleeding, urinary extravasation, evidence of nonviable renal parenchyma, and renal pedicle injuries (less than 5% of all renal injuries). Aggressive preoperative staging allows complete definition of injury before operation.

2. Penetrating Injuries–Penetrating injuries should be surgically explored. A rare exception to this rule is when staging has been complete and only minor parenchymal injury, with no urinary extravasation, is noted. In 80% of cases of penetrating injury, associated organ injury requires operation; thus, renal

of urinary extravasation, maintenance of urinary diversion, and easy removal.

Prognosis

The prognosis for ureteral injury is excellent if the diagnosis is made early and prompt corrective surgery is done. Delay in diagnosis worsens the prognosis because of infection, hydronephrosis, abscess, and fistula formation.

INJURIES TO THE BLADDER

Bladder injuries occur most often from external force and are often associated with pelvic fractures. (About 15% of all pelvic fractures are associated with concomitant bladder or urethral injuries.) Iatrogenic injury may result from gynecologic and other extensive pelvic procedures as well as from hernia repairs and transurethral operations.

Pathogenesis & Pathology (Fig 18–11)

The bony pelvis protects the urinary bladder very well. When the pelvis is fractured by blunt trauma, fragments from the fracture site may perforate the bladder. These perforations usually result in extraperitoneal rupture. If the urine is infected, extraperitoneal bladder perforations may result in deep pelvic abscess and severe pelvic inflammation.

When the bladder is filled to near capacity, a direct blow to the lower abdomen may result in bladder disruption. This type of disruption ordinarily is intraperitoneal. Since the reflection of the pelvic peritoneum covers the dome of the bladder, a linear laceration will allow urine to flow into the abdominal cavity. If the diagnosis is not established immediately and if the urine is sterile, no symptoms may be noted for several days. If the urine is infected, immediate peritonitis and acute abdomen will develop.

Figure 18–11. Mechanism of vesical injury. A direct blow over the full bladder causes increased intravesical pressure. If the bladder ruptures, it will usually rupture into

Clinical Findings

Pelvic fracture accompanies bladder rupture in 90% of cases. The diagnosis of pelvic fracture can be made initially in the emergency room by lateral compression on the bony pelvis, since the fracture site will show crepitus and be painful to the touch. Lower abdominal and suprapubic tenderness is usually present. Pelvic fracture and suprapubic tenderness with acute abdomen suggest intraperitoneal bladder disruption.

A. Symptoms: There is usually a history of lower abdominal trauma. Blunt injury is the usual cause. Patients ordinarily are unable to urinate, but when spontaneous voiding occurs, gross hematuria is usually present. Most patients complain of pelvic or lower abdominal pain.

B. Signs: Heavy bleeding associated with pelvic fracture may result in hemorrhagic shock, usually from venous disruption of pelvic vessels. Evidence of external injury from a gunshot or stab wound in the lower abdomen should make one suspect bladder injury, manifested by marked tenderness of the suprapubic area and lower abdomen. Acute abdomen indicates intraperitoneal bladder rupture. A palpable mass in the lower abdomen usually represents a large pelvic hematoma. On rectal examination, landmarks may be indistinct because of a large pelvic hematoma.

C. Laboratory Findings: Catheterization usually is required in patients with pelvic trauma but not if bloody urethral discharge is noted. Bloody urethral discharge indicates urethral injury, and a urethrogram is necessary before catheterization (Figs 18–1 through 18–3). When catheterization is done, gross or, less commonly, microscopic hematuria is usually present. Urine taken from the bladder at the initial catheterization should be cultured to determine whether infection is present.

D. X-Ray Findings: A plain abdominal film will generally demonstrate pelvic fractures. There may be haziness over the lower abdomen from blood and urine extravasation. An intravenous urogram should be obtained to establish whether kidney and ureteral injuries are present.

lower abdominal pain and inability to urinate. A history of crushing injury to the pelvis is usually obtained.

B. Signs: Blood at the urethral meatus is the single most important sign of urethral injury. The importance of this finding cannot be overemphasized, because an attempt to pass a urethral catheter may result in infection of the periprostatic and perivesical hematoma and conversion of an incomplete laceration to a complete one. The presence of blood at the external urethral meatus indicates that immediate urethrography is necessary to establish the diagnosis.

Suprapubic tenderness and the presence of pelvic fracture will be noted on physical examination. A large developing pelvic hematoma may be palpated. Perineal or suprapubic contusions are often noted. Rectal examination may reveal a large pelvic hematoma with the prostate displaced superiorly. Rectal examination can be misleading, however, because a tense pelvic hematoma may resemble the prostate on palpation. Superior displacement of the prostate does not occur if the puboprostatic ligaments remain intact. Partial disruption of the membranous urethra (currently 10% of cases) is not accompanied by prostatic displacement.

C. Laboratory Findings: Anemia due to hemorrhage may be noted. Urine cannot usually be obtained initially, since the patient should not void and catheterization should not be attempted.

D. X-Ray Findings: Fractures of the bony pelvis are usually present. A urethrogram (using 20–30 mL of water-soluble contrast material) will show the site of extravasation at the prostatomembranous junction. Ordinarily, there is free extravasation of contrast material into the perivesical space (Fig 18–15). Incomplete prostatomembranous disruption will be seen as minor extravasation, with a portion of contrast material passing into the prostatic urethra and bladder.

E. Instrumental Examination: The only instrumentation involved should be for urethrography. Catheterization or urethroscopy should not be done, because these procedures pose an increased risk of hematoma, infection, and further damage to partial urethral disruptions.

Figure 18–15. Ruptured prostatomembranous urethra shows free extravasation on urethrogram. No contrast medium is seen entering the prostatic urethra.

Differential Diagnosis

Bladder rupture may be associated with posterior urethral injuries. An intravenous urogram should be considered part of the assessment. Delayed films should be obtained to demonstrate the bladder and note extravasation. Cystography cannot be done preoperatively, since a urethral catheter should not be passed. Careful evaluation of the bladder at operation is necessary.

The anterior portion of the urethra may be injured as well as the prostatomembranous urethra.

Complications

Stricture, impotence, and incontinence as complications of prostatomembranous disruption are among the most severe and debilitating mishaps that result from trauma to the urinary system.

Stricture following primary repair and anastomosis occurs in about half of cases. If the preferred suprapubic cystostomy approach with delayed repair is used, the incidence of stricture can be reduced to about 5%.

The incidence of impotence after primary repair is 30–80% (mean, about 50%). This can be reduced to 10–15% by suprapubic drainage with delayed urethral reconstruction.

Incontinence in primary reanastomosis is noted in one-third of patients. Delayed reconstruction reduces the incidence to less than 5%.

Treatment

A. Emergency Measures: Shock and hemorrhage should be treated.

B. Surgical Measures: Urethral catheterization should be avoided.

1. Immediate management–Initial management should consist of suprapubic cystostomy to provide urinary drainage. A midline lower abdominal incision should be made, care being taken to avoid the large pelvic hematoma. The bladder and prostate are usually elevated superiorly by large periprostatic and perivesical hematomas. The bladder will often be distended by a large volume of urine accumulated during the period of resuscitation and operative preparation. The urine is often clear and free of blood, but gross hematuria may be present. The bladder should be opened in the midline and carefully inspected for lacerations. If a laceration is present, the bladder should be closed with absorbable suture material and a cystostomy tube inserted for urinary drainage. This approach involves no urethral instrumenta-

Figure 18–17. Injury to the bulbous urethra. ***Left:*** Mechanism: Usually a perineal blow or fall astride an object; crushing of urethra against inferior edge of pubic symphysis. ***Right:*** Extravasation of blood and urine enclosed within Colles' fascia (see Fig 1–9).

is local pain into the perineum and sometimes massive perineal hematoma. If voiding has occurred and extravasation is noted, sudden swelling in the area will be present. If diagnosis has been delayed, sepsis and severe infection may be present.

B. Signs: The perineum is very tender, and a mass may be found. Rectal examination reveals a normal prostate. The patient usually has a desire to void, but voiding should not be allowed until assessment of the urethra is complete. No attempt should be made to pass a urethral catheter, but if the patient's bladder is overdistended, percutaneous suprapubic cystostomy can be done as a temporary procedure.

When presentation of such injuries is delayed, there is massive urinary extravasation and infection in the perineum and the scrotum. The lower abdominal wall may also be involved. The skin is usually swollen and discolored.

C. Laboratory Findings: Blood loss is not usually excessive, particularly if secondary injury has occurred. The white count may be elevated with infection.

D. X-Ray Findings: A urethrogram, with instillation of 15–20 mL of water-soluble contrast material, will demonstrate extravasation and the location of injury (Fig 18–18). The contused urethra will show no evidence of extravasation.

E. Instrumental Examination: If there is no evidence of extravasation on the urethrogram, a urethral catheter may be passed into the bladder. Extravasation is a contraindication to further instrumentation at this time.

Differential Diagnosis

Partial or complete disruption of the prostatomembranous urethra may occur if pelvic fracture is present. Urethrography will usually demonstrate the location and extent of extravasation and its relationship to the urogenital diaphragm.

Complications

Heavy bleeding from the corpus spongiosum injury may occur in the perineum as well as through the urethral meatus. Pressure applied to the perineum over the site of the injury usually controls bleeding. If hemorrhage cannot be controlled, immediate operation is required.

The complications of urinary extravasation are chiefly sepsis and infection. Aggressive debridement and drainage are required if there is infection.

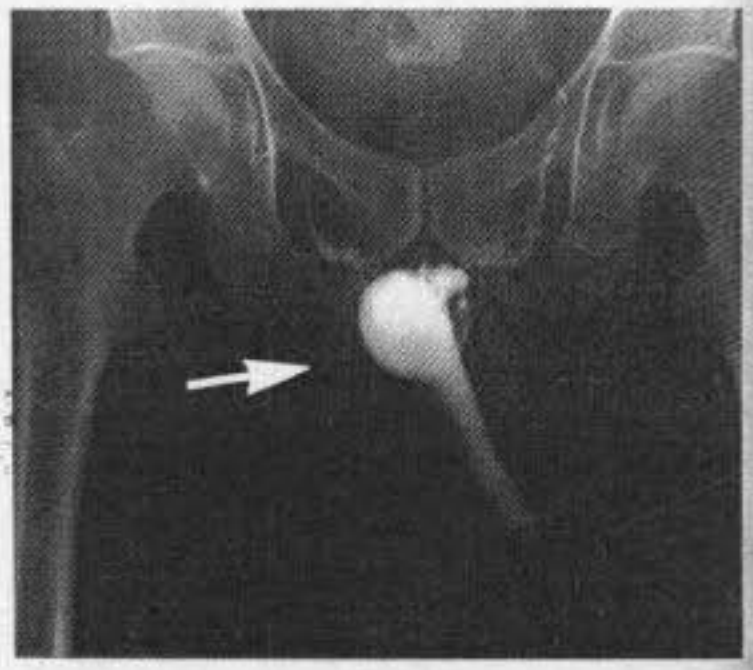

Figure 18–18. Ruptured bulbar (anterior) urethra following straddle injury. Extravasation (***at arrow***) on urethrogram.

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