6. Changing concepts in the diagnosis and treatment of closed renal injuries

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Direct force is responsible for all closed kidney injuries except those involving the pedicle. Underlying parenchymal disease strongly predisposes the kidney to injury. Accurate diagnosis is crucial to rational treatment, and this is accomplished by infusion pyelography, angiography, retrograde pyelography and scanning. Treatment of kidney injuries has classically been conservative, except when the clinical course or the nature of pre-existing disease make an operation essential, but the current trend is towards more aggressive surgical treatment. This applies not only to pedicle injuries but also to major parenchymal trauma, and it is rendered feasible by precise diagnosis and improved surgical technique.

La force directe est responsable de toutes les lésions rénales contondantes, à l'exception de celles qui affectent le pédicule. Une maladie sous-jacente du parenchyme prédispose fortement aux lésions rénales. Un diagnostic précis est essentiel à la mise en route d'un traitement rationnel; il faut appel à la pyélographie par infusion, à l'angiographie, à la pyélographie rétrograde et à la scintigraphie. Le traitement des lésions rénales a toujours été conservateur, sauf lorsque l'évolution clinique ou la nature d'une maladie préexistant rendent une intervention nécessaire; la tendance actuelle est toutefois de recourir à un traitement chirurgical plus agressif. Ceci s'applique non seulement aux lésions du pédicule, mais aussi aux traumatismes majeurs du parenchyme, et c'est rendu possible grâce à un diagnostic précis et une technique chirurgicale améliorée.

During the past 25 years, the pathogenesis of renal injury has become clearer, new diagnostic techniques have been developed while others have been refined, and experience in renal surgery has accrued from kidney transplantation and as a result of the treatment of renovascular hypertension. Although most cases of renal injury are managed conservatively, certain severe renal injuries are now treated operatively, as soon after injury as is feasible, and there is growing support for surgical treatment even in less severe injuries. In this report the advances in diagnostic techniques and the newer concepts of renal injury are described and the current, sometimes divergent, opinions regarding the indications for surgery discussed.

Pathogenesis of renal injury

Injury may vary from minor contusion to extensive laceration of the parenchyma, laceration of the pelvis or injury to the pedicle (Fig. 1). Closed injuries are usually due to direct force applied to the organ, although this is far less likely to injure the kidney than other intra-abdominal solid organs because the kidneys are small, mobile, posteriorly placed and well protected by muscle and by the rib cage.

The true and false capsules and the surrounding perinephric fat add further physical protection but, more important, they provide an effective tamponade against continuing blood loss. That these anatomic features are important in protecting the kidney is demonstrated by the fact that renal abnormalities, which alter the size, mobility, or internal structure of the organ, are associated with a much higher incidence of injury. The incidence of pre-existing renal disease varies between 3.5 and 21% (average, 9.5%) 1,3-10.

The figure is lowest in adults and highest in children because the younger the patient, the greater the likelihood of congenital renal malformation and, consequently, the greater the susceptibility to injury. The conclusions of Mertz, Wishard and Nourse 11 were that the diseased kidney is "more easily injured, more likely to be severely injured and more likely to require surgical attention". A notable corollary to the resistance of the normal kidney to injury is that, when renal injury occurs concomitant damage to more susceptible structures is likely. Approximately 75% of kidney injuries are associated with major injuries elsewhere and approximately 40% are associated with major intra-abdominal injuries. 14

A traumatic force compatible with patient survival seldom injures both kidneys directly. One functioning kidney is almost always preserved so that restoration of the function of the injured kidney is not urgent. (This, and renal tamponade, are the two factors that allow satisfactory conservative management in most cases.) If the second kidney is involved, injury is usually indirect, due to the development of tubular necrosis from shock or hypoxia associated with the other injuries.

Damage to the renal pedicle is much less common than injury to the renal parenchyma but it is associated with far greater morbidity. 17,18 The pathogenesis of pedicle injury has justifiably received much attention in the past decade and it appears likely that the mechanism of pedicle injury is quite different from that of parenchymal injury.

The commonest pedicle injury, due to blunt trauma, is renal artery thrombosis, but renal artery rupture and vein laceration can also occur. The experiments of Bergan 19 demonstrated that the intima of an artery is far more susceptible to stretch injury than are the outer layers of the vessel. As Collins and Jacobs 20 suggested, traumatic renal artery thrombosis probably results from the sudden deceleration that occurs upon impact. This proposed mechanism is in keeping with the work of Bergan 19 and most reports stress a higher incidence of left-sided injury. The left kidney is more mobile and the left

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renal artery is therefore more susceptible to stretch injury, whereas the right renal artery is better supported by the midline structures. This mechanism also is compatible with the rarity of parenchymal damage associated with pedicle injuries, except in open trauma such as gunshot wounds.17

Diagnosis of renal injury

Accurate monitoring of the clinical progress of the injured patient is complemented by various diagnostic tests that, in most cases, allow the type and extent of kidney injury to be exactly delineated. The combined clinical and investigative information enables rational therapy to be planned.

Excretory urography

This is the oldest contrast examination used in the diagnosis of renal injury following the demonstration of blood in the urine. Because renal injury is not invariably associated with hematuria the indications for this procedure must be reassessed. Excretory urography should be performed, even in the absence of hematuria, whenever the history or the physical examination raises the possibility of kidney injury or whenever the mechanism of injury suggests that the condition for pedicle damage might have been present at the time of trauma. A major advance in excretory urography has been the replacement of the single-dose intravenous pyelogram by the infusion pyelogram with or without tomograms.5 This greatly improves visualization of the renal architecture and its diagnostic accuracy regarding renal function. Tomography is especially useful when overlying bowel gas obscures anatomic detail. The result of these changes has been to improve the proportion of diagnostically contributory examinations from 40% to over 90%,8 and the infusion pyelogram is rapidly replacing the standard intravenous pyelogram as the initial screening radiograph for the diagnosis of renal injury in the severely injured patient. A standard urogram is usually adequate for diagnostic purposes in injuries ranging from minor to moderately severe.

Successful excretory urography is dependent on the glomerular filtration rate so the timing of the radiograph should coincide with the restoration of adequate blood pressure. The failure to do so may lead not only to inadequate examination but possibly to incorrect diagnosis, because nonfunction may be attributed to renal injury rather than to prerenal causes.

An excretory urogram may show changes both in renal architecture and in renal function. Anatomic changes may vary from blunting of a single calyx to major disruption of the renal outline with loss of the psoas shadow and urine extravasation. Loss of function may be segmental or total. Total loss of function is an ominous sign and it requires immediate investigation to rule out the possibility of renal artery thrombosis.

The conclusion of Sargent and Marquardt1 in 1950, regarding nonfunction, was that “complete non-function, in the excretory urogram, is a not uncommon finding even in minor injuries. It, therefore, must be discounted as evidence of serious injury.” With improved urographic technique, change has occurred in the interpretation of this radiographic sign, as noted by Stables and colleagues18 as follows: “If no evidence of contrast medium excretion by 1 kidney can be seen by 20 to 30 minutes after injection, arrangements for renal arteriography should be commenced, unless the patient’s general condition demands immediate operation.”

Angiography

Angiography has evolved as the second of the four major diagnostic techniques used to assess renal injury. It is indicated whenever the diagnosis remains inconclusive after excretory urography, particularly when unilateral nonfunction is demonstrated.7,12,18 Unilateral nonfunction in an injured kidney implies arterial thrombosis and, as Stables and associates18 pointed out, the only permissible investigation under these circumstances is an angiogram. Speed is of the essence if the ischemic kidney is to be salvaged and there is no place for delayed intravenous pyelograms performed in the hope that function will ultimately be demonstrated.18

Angiography should now be considered a standard method of radiographic diagnosis in an emergency basis in any hospital handling major trauma. Angiograms of high quality are essential if the examination is to be useful. If an adequate diagnosis is not provided by the flush angiogram, selective studies should be performed.

The angiogram shows the renal blood supply in two ways; first by demonstrating the actual vascular pattern and second by nephrographic staining. The normal vascular pattern may be distorted by splaying, compression or pruning of vessels, or by complete occlusion of the renal artery. The nephrogram may be intact or it may show segmental loss due to renal ischemia. One must not forget the occurrence of renal laceration with an intact arterial tree and the possibility of serious venous bleeding without arterial disruption.

Retrograde pyelography

Although excretory urography followed by angiography is the preferred sequence of investigation, some urologists proceed to retrograde pyelography if the standard intravenous pyelogram is not diagnostic. Parenchymal damage is not as well shown by retrograde pyelography as by angiography and, as Petry,5 observed, “There may be uncertainty whether contrast extravasation represents laceration or technical error.” Another objection to retrograde pyelography is the need for cystoscopic equipment and for the lithotomy position, which may be difficult to achieve because of fractures or other problems in the severely injured patient. A clear-cut indication for retrograde pyelography is the suspicion of pelvic or ureteric rupture.

Renal scanning

Renal scanning with technetium glucoheptonate or technetium polyphosphate provides a measure of renal blood flow when obstruction is present. Cockett and colleagues,2 in a review of 207 cases of blunt renal trauma, concluded that the renal scan is an excellent diagnostic test and that it and the arteriogram are the most informative tests. They also noted that the scan can be performed in the anterior and the posterior position.

Unless anterior placement of the probes is possible renal scanning may be difficult in the severely injured patient, and most urologists would agree that the scan lacks the precision of the pyelogram or the angiogram and that this allows for misinterpretation. Often it is the expertise of the examiner that is critical.

Ultrasond

Beta-scan ultrasonography is now being used, as Taylor reports elsewhere in this issue (p 599), in the diagnosis of blunt abdominal trauma. As far as urologic investigation is concerned the main urologic indication for ultrasound is in the diagnosis of renal masses. Too little information is available to provide meaningful comment regarding its ultimate role in renal trauma. Being a noninvasive procedure, its special virtues include the relative ease of performance, economy, lack of complications and uniform patient acceptance.

Treatment of kidney injuries

The aims of treatment are to prevent mortality, to reduce morbidity, to obviate late complications and to restore maximal renal function in the shortest period of time.
Injuries demanding immediate operation

Renal pedicle damage, whether due to vessel rupture or thrombosis, is an indication of immediate operation because this provides the only hope for cure. Despite an increasing awareness of pedicle injury successful treatment with salvage of the kidney is infrequent. The low salvage rate, even with aggressive surgical treatment, stresses the importance of prompt and accurate diagnosis. Renal artery thrombosis may respond to thrombectomy if treated early but resection and reanastomosis, or by-pass graft, should probably be performed in addition to thrombectomy in order to prevent rethrombosis. Thrombokinases have been used plus heparinization. (Technetium scans provide an accurate measure of blood flow in the postoperative period.) In spite of vigorous surgical treatment secondary nephrectomy is often required. Hemodialysis is the only recourse in the bilateral lesion.

Renal pedicle disruption often results in nephrectomy and this is more frequent with vein injuries than with arterial injuries. Rupture of the renal pelvis is amenable to primary repair with nephrostomy drainage. Pelvic repair may be possible either directly or by the use of a capsular flap. An omental flap improves the operative success rate.

Injuries for which treatment is controversial

These injuries are the major contusions and the intrarenal and transcapsular lacerations.

With uncontrolled bleeding, urinary extravasation with an expanding mass, or subsequent development of a perinephric abscess, few would disagree with Morrow and Mendez that surgical treatment is required. A laparotomy, performed primarily to treat other abdominal injuries, provides the opportunity to explore the injured kidney and, under these circumstances, many urologists would explore the major contusion or laceration using appropriate vascualr control. It also provides the opportunity for arrest of hemorrhage and for accurate renal debridement and drainage. It results in a shorter convalescence and it should prevent most of the late complications. Furthermore, it obeys the accepted surgical principle that the source of retroperitoneal hemorrhage should be located and arrested. If an adequate excretory urogram is not available at the time of laparotomy this should be performed in the operating room prior to exploration of the retroperitoneal space. Manual diagnosis, particularly of the pedicle injury, is notoriously unreliable.

The area of controversy — and perhaps evolution — in the treatment of kidney injuries concerns those cases of major laceration and contusion in which the preceding conditions do not exist. The initial management of these injuries is conservative. There is little doubt that, if this program is pushed to the extreme, operation can be avoided in most cases, but prolonged morbidity, infection, loss of function, calcification or late hypertension may result. Approximately 5% of cases require delayed operations for drainage or nephrectomy. Some authors, deny the importance or the frequency of late complications; they point out that it is the associated injuries that usually influence the clinical course and not the kidney injury, and there is still strong support for a strictly conservative approach. Vermillion, McLaughlin and Frister, in a review of 92 cases from 1963 to 1968, concluded that early operation, designed to prevent late sequels, results in many unnecessary procedures on kidneys that would have healed if left to themselves.

This position is disputed by Cass and Ireland, who compared the two forms of treatment in an analysis of 172 cases seen from 1959 to 1971. Their general conclusions were that surgical treatment resulted in less morbidity than conservative treatment. Initially, their rate of kidney loss was three times greater with surgical therapy, but this difference was eliminated when the technique of preliminary vessel control was introduced.

A valid comparison of one form of treatment versus the other is impossible because of the widely differing circumstances in different published series. No standard method of treatment has yet been agreed upon and the matter is still in a state of flux although there is a trend towards earlier surgical treatment. The matter will not be resolved without properly controlled prospective studies.

Emergency or semieergency surgery for kidney rupture is best carried out through an incision that provides access to the renal vessels before Gerota's fascia is opened. The long midline incision is the one most often used for laparotomy, but a transverse incision also provides good exposure to both kidneys. The technique described by Scott and Selzman permits access to both renal pedicles, and kocherization gives much the same exposure. The planned approach to the kidney through a "bloodless" field allows for precise conservative surgical treatment with debridement and drainage, and no kidney should have to be sacrificed because of uncontrollable bleeding but only because of irreparable damage.

The success of conservative renal sur-

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**INDICATION:** MONISTAT Cream is indicated for the local treatment of vulvovaginal candidiasis (moniliasis).

**COMPOSITION:** MONISTAT is a water miscible, white cream containing 2% miconazole nitrate as the active ingredient.

**ACTION:** Miconazole nitrate exhibits broad-spectrum in vitro fungicidal activity. Studies with Candida albicans indicate that to low concentrations, miconazole nitrate acts primarily on the yeast cell membrane resulting in selective inhibition of the uptake of precursors of RNA and DNA (purines) and mucopeptidase (glutamime). In addition, in vitro broad-spectrum antibacterial activity has been reported (grampositive bacilli and cocci).

**CONTRAINDICATIONS:** None known.

**PRECAUTIONS:**

1. Discontinue medication if sensitization or marked irritation occurs from intravaginal use.

2. Intractable candidiasis may be presenting symptoms of unrecognized diabetes; thus appropriate urine/blood studies may be indicated in patients not responding to treatment.

3. Pregnant patients should be advised to exercise caution in the use of the vaginal applicator.

4. During therapy, it may be advisable to instruct the patient to abstain from intercourse or recommend the use of a condom.

**ADVERSE REACTIONS:** In general, the complaints reported with MONISTAT Cream concern vulvovaginal burning, itching or irritation. Of 529 pregnant and non-pregnant patients evaluated for tolerance and safety while using MONISTAT Cream, 39 reported reactions which were possibly drug-related but not severe enough to cause discontinued therapy for drug-related reasons (vulvovaginal burning and itching — 4 patients and hives — 1 patient).

**DOSEAGE AND ADMINISTRATION:** MONISTAT Cream is available in individual packages containing an 85 gram tube of 2% cream along with the ORTHO® measured dose applicator. One applicator full of MONISTAT Cream is administered intravaginally once daily at bedtime for 14 consecutive days. The course of therapy may be repeated if the patient remains symptomatic.
Additional sources


Prescribing Information

Indications: ESTRACE tablets are indicated for the symptomatic relief of menopausal symptoms.

Contraindications: Patients who have a personal history of breast or endometrial cancer, except in special circumstances, a family history of cancer, endometrial hyperplasia when estrogen not accompanied by a progestogen, thrombophlebitis, cardiovascular disease, liver dysfunction, undiagnosed vaginal bleeding or when pregnancy is suspected.

Warnings: The physician should watch for the earliest manifestations of thrombotic disorders. If these occur or are suspected, the drug should be discontinued immediately.

The pre-treatment physical examination should include a Papainicolau smear. Patients on long-term therapy should be re-examined every 6 months and have a Papainicolau smear annually.

Patients who develop visual disturbances, classical migraine, transient aphasia, paralysis or loss of consciousness should discontinue medication.

Precautions: Estrogens should be used with caution in the presence of arterial hypertension, heart and kidney disease, epilepsy and/or asthma, liver dysfunction.

Diabetic patients or those with a family history of diabetes should be followed closely for any decrease of glucose tolerance.

Adverse Reactions: ESTRACE is generally well tolerated at recommended doses. Occasional gastrointestinal disturbances, headache, vertigo and mastodynia may occur, but these complaints usually disappear with adjustment of dosage.

Dosage and Administration: Treatment is usually 1 or 2 mg daily. Dosage may be adjusted for maintenance depending on the response of the individual patient. ESTRACE is generally given for 21 days followed by a 7-day rest period.

Supply: ESTRACE tablets are available as 2 mg turquoise, scored compressed tablets—bottles of 100.

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