

TRAUMATIC RENAL HEMORRHAGE TREATMENT BY ARTERIAL EMBOLIZATION

MARK KALISH, LENNARD GREENBAUM,* SHERMAN SILBER AND HARVEY GOLDSTEIN†

From the Sections of Urology and Radiology, University of Michigan Medical Center, Ann Arbor and the Wayne County General Hospital, Eloise, Michigan

Maximum conservation of renal parenchyma and normal renal function is mandatory in the treatment of renal trauma. Persistent hemorrhage in cases of blunt renal trauma may be managed conservatively or with early surgical intervention. Most authors agree that surgical exploration is necessary when there is significant hemorrhage evidenced by a decreasing hematocrit, hypotension and an expanding flank mass.

When conservative measures fail in the treatment of persistent hemorrhage, surgical intervention generally has been necessary. Herein is described what may well be a preferable alternative for persistent hemorrhage from renal trauma. With the availability of transfemoral selective renal arteriography, we have treated a patient with persistent hemorrhage caused by blunt trauma with a non-operative technique which resulted in prompt cessation of hemorrhage, maximum conservation of renal parenchyma, normal renal function, no attendant morbidity and to date none of the sequelae of renal trauma. To our knowledge this is the first such treatment of traumatic blunt renal hemorrhage by this method.

CASE REPORT

L. H., 488984, a 15-year-old white boy, was hospitalized with a 1-hour history of blunt left flank trauma and total, gross, painless hematuria. The vital signs were normal and physical examination was negative except for left flank and left costovertebral angle tenderness. The hematocrit was 37 volumes per cent, with a white blood count of 12,700. Liver function tests, serum amylase, serum electrolytes and coagulation studies were normal. Urinalysis revealed a pH of 6.2 plus protein, no glucose, red blood cells too numerous to

count and no bacteria on stained sediment. The blood urea nitrogen was 8 mg. per cent and serum creatinine was 0.9 mg. per cent. Excretory urography (IVP) showed a delayed left caliceal appearance with a small amount of periureteral contrast extravasation and clots in the collecting system (fig. 1, A). Initial treatment consisted of complete bed rest and intravenous fluids. The vital signs were checked frequently as was the flank for an expanding mass. Serial urine and hematocrit studies were also obtained.

Gross hematuria persisted and after 7 days in the hospital the hematocrit had decreased to 27 volumes per cent. A transfusion with 2 units of whole blood was given and a repeat IVP showed further deterioration in function with enlargement of the left kidney, subcapsular extravasation and continued clots in the collecting system (fig. 1, B). Since the urine remained bloody the patient underwent renal angiography. Two renal arteries were present on the left side. Selective catheterization of the superior renal artery was unremarkable except for minimal stretching of a capsular branch. Injection of the inferior artery revealed several areas of bleeding from branches of the superior segmental portion (fig. 2, A). Injection with 0.7 ml. autologous venous clot was given via the catheter into the distal part of the superior segmental branch. Subsequent angiography demonstrated total occlusion of the distal superior segmental branch, cessation of active hemorrhage (fig. 2, B) and a small amount of residual contrast from a previous injection.

After the clot injection the urine became macroscopically clear, vital signs were stable and hematocrit was 29 volumes per cent. A repeat angiogram in 5 days showed no evidence of extravasation. The arterial tree was almost entirely patent with only a small remaining thrombus present in the superior segmental branch (fig. 3, A). A small area of infarction estimated at less than 5 per cent of the total renal mass was demonstrated at the lateral aspect of the kidney. The patient was discharged from the hospital 4 days later with stable vital signs, clear urine and a hematocrit of 30 volumes per cent. He has remained normotensive since the procedure with normal renal function tests and a negative urinalysis. A renal arteriogram 3 months later demonstrated a normal arterial tree with no evidence of residual thrombus (fig. 3, B).

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* Current address: Department of Radiology, George Washington University Medical Center, Washington, D. C. 20037.

† Current address: Department of Diagnostic Radiology, University of Texas, M. D. Anderson Hospital and Tumor Institute, Houston, Texas 77025.

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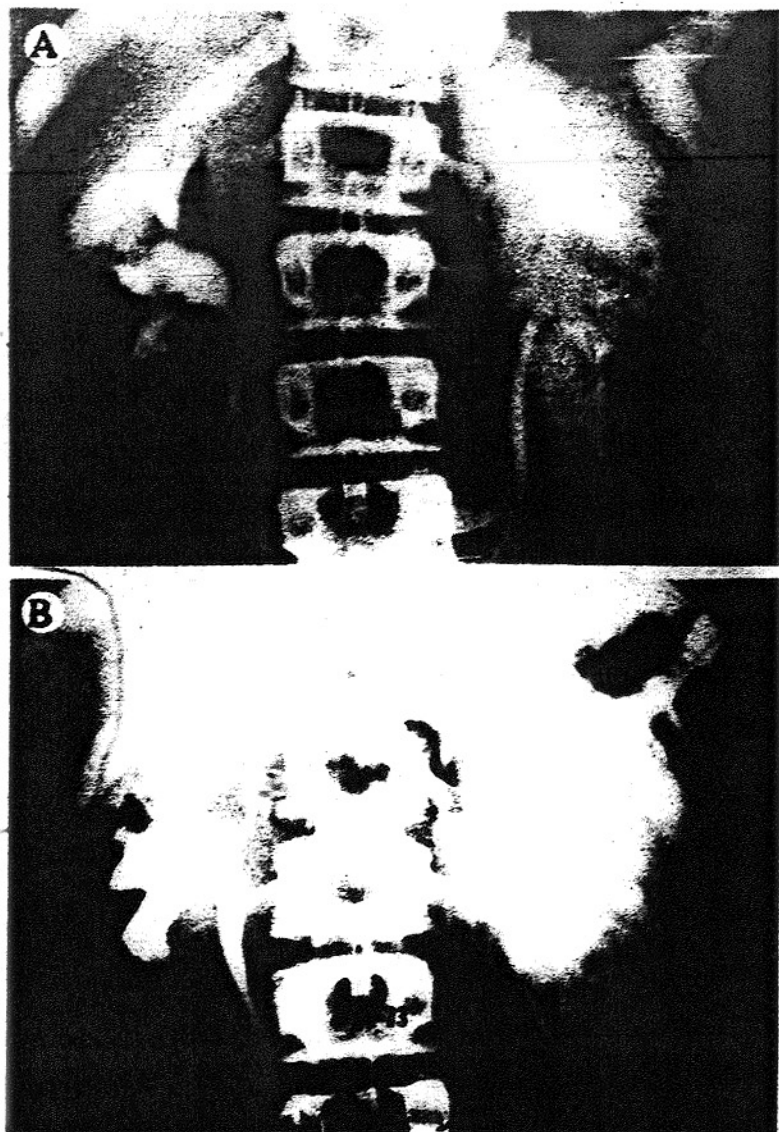


FIG. 1. A, IVP 1 hour after blunt trauma reveals delayed caliceal appearance of left kidney with small amount of periureteral extravasation (arrow) and clots in collecting system. B, IVP 1 week after trauma reveals enlargement of left kidney, subcapsular extravasation and clots in collecting system.

DISCUSSION

Iatrogenic arterial embolization for therapeutic purposes was first done in the management of large cerebral arteriovenous malformations.^{2,3} In these cases direct intra-arterial injection of plastic spheres was used. Subsequently, trans-catheter embolization with an autologous clot was reported to control upper gastrointestinal bleeding⁴ and persistent hemorrhage in pelvic fractures.⁵ Book-

² Luessenhop, A. J. and Spence, W. T.: Artificial embolization of cerebral arteries. *J.A.M.A.*, **172**: 1153, 1960.

³ Luessenhop, A. J., Kachmann, R., Jr., Shevlin, W. and Ferrero, A. A.: Clinical evaluation of artificial embolization in the management of large cerebral arteriovenous malformations. *J. Neurosurg.*, **23**:400, 1965.

⁴ Rösch, J., Dotter, C. T. and Brown, M. J.: Selective arterial embolization: a new method for control of acute gastrointestinal bleeding. *Radiology*, **102**: 303, 1972.

⁵ Margolies, M. N., Ring, E. J., Waltman, A. C., Kerr, W. S., Jr. and Baum, S.: Arteriography in the management of hemorrhage from pelvic fractures. *New Engl. J. Med.*, **287**: 317, 1972.

stein and Goldstein,⁶ and Rizk and associates⁷ reported successful trans-catheter control of renal hemorrhage secondary to percutaneous renal biopsy, with injection of autologous venous clot and subcutaneous fat, respectively. However, the technique has never been reported for hemorrhage in blunt renal trauma.

This approach offers great promise as an alternative to an operation in cases of renal trauma. It is especially useful in poor risk patients and may become the preferred treatment for many patients. In the optimal surgical handling of such cases the individual bleeding vessel can be ligated, producing a distal infarction. Usually, however, the surgeon must resort to heminephrectomy.¹ With trans-catheter embolization the dramatic recanaliza-

⁶ Bookstein, J. J. and Goldstein, H. M.: Successful management of postbiopsy arteriovenous fistula with selective arterial embolization. *Radiology*, **109**: 535, 1973.

⁷ Rizk, G. K., Atallah, N. K. and Bridi, G. I.: Renal arteriovenous fistula treated by catheter embolization. *Brit. J. Radiol.*, **46**: 222, 1973.

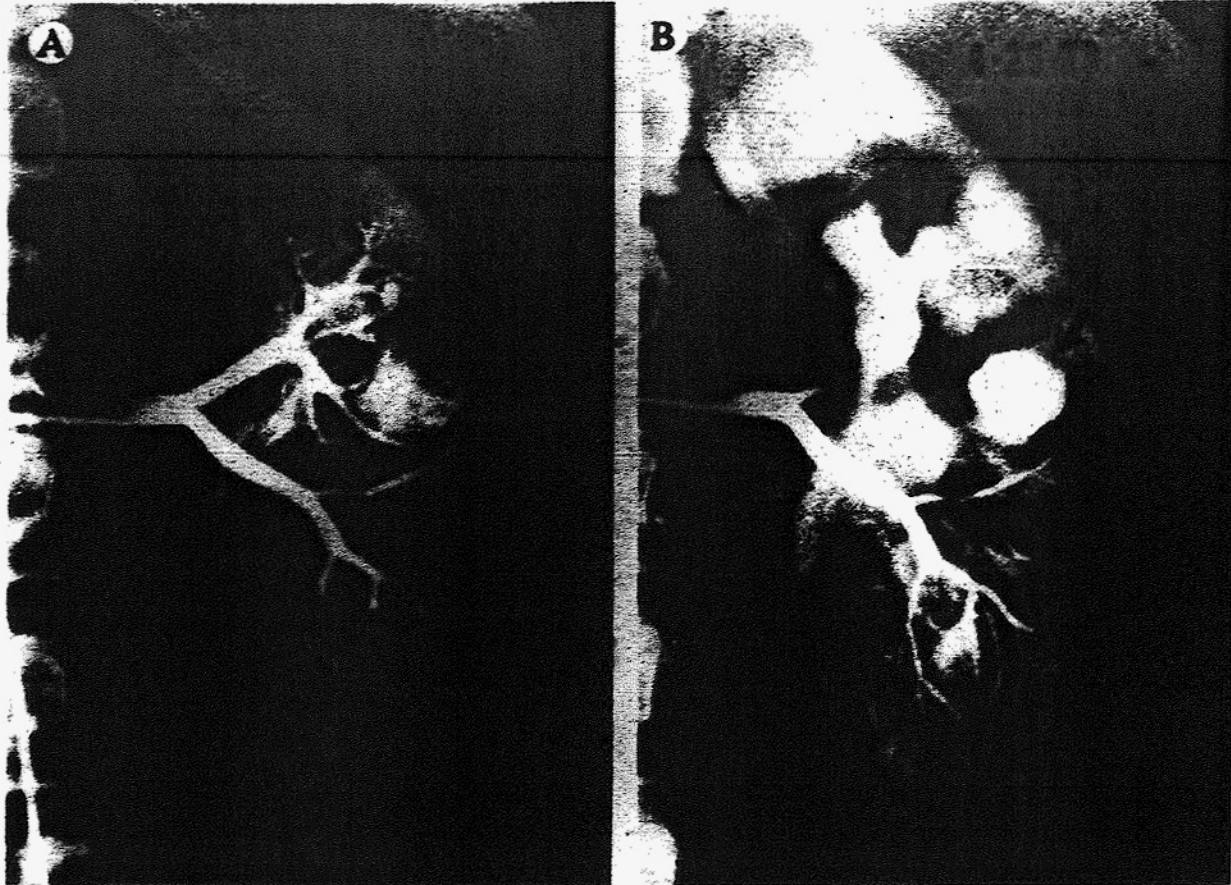


FIG. 2. *A*, arteriogram 1 week after injury with selective catheterization of inferior artery reveals several areas of bleeding from branches of superior segmental portion. *B*, arteriogram after injection of clot reveals total occlusion of superior segmental branch and cessation of hemorrhage. Extravasated contrast is residual from prior injections (arrow).



FIG. 3. *A*, arteriogram 5 days after clot injection reveals arterial tree patent with small thrombus in superior segmental branch (arrow). Focal infarcts are suggested (arrow). *B*, normal arterial tree with no evidence of residual thrombus 3 months after embolization.

tion of the embolized artery allows one to conserve virtually all renal tissue. Lucey and associates reported a 50 per cent nephrectomy rate after blunt injury but with selective arterial catheterization and embolization this rate might be significantly reduced.⁸ In our patient we believe that much more functioning renal parenchyma was conserved than would have been possible with surgical treatment.

Potential hazards exist with trans-catheter embolization that must be weighed against the alternatives of surgical intervention. To ensure control and safety the procedure must be done by angiographers experienced with selective vascular catheterization techniques. A small degree of focal renal infarction has occurred in all similar reported cases thus far, although relatively prompt lysis of thrombi in occluded vessels appears to minimize this hazard.^{9, 10} Only a small residual thrombus

was present after the procedure. However, no thrombus was noted after 3 months and there was excellent flow through previously occluded vessels.

The fortuitous presence of 2 renal arteries in our case encouraged the use of this technique, although catheter placement distal to a single renal artery should not present an obstacle. Hypertension secondary to ischemia is a theoretical possibility but, except for transient slight elevation, has not been observed in previous cases or our own. Conceivably, if hypertension were to develop an elective wedge resection of the infarcted area may be necessary.

SUMMARY

A patient with blunt renal trauma and persistent hemorrhage was treated by trans-catheter injection of autologous clot. This unique, non-operative method resulted in prompt cessation of hemorrhage. Short-term followup revealed no complications and minimal loss of functioning renal parenchyma. This method offers an acceptable and even preferable method for treating hemorrhage in selected cases of blunt renal trauma.

⁸Lucey, D. T., Smith, M. J. V. and Koontz, W. W., Jr.: Modern trends in the management of urologic trauma. *J. Urol.*, **107**: 641, 1972.

⁹Todd, A. S.: Localization of fibrinolytic activity in tissues. *Brit. Med. Bull.*, **20**: 210, 1964.

¹⁰Warren, B. A.: Fibrinolytic activity of vascular endothelium. *Brit. Med. Bull.*, **20**: 213, 1964.