RENAL PHLEBOGRAPHY UNDER RENAL VENOUS BLOCKADE*

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Modern methods for radiological and radiobiological examination of the kidney (aortography, selective renal arteriography, retropneumoperitoneum with urography, renography, renal scintigraphy), in addition to conventional procedures, have unquestionably added to the already remarkable accuracy with which kidney diseases can be diagnosed.

We have thus come to the point where the kidney may be regarded as an open book, as we are now in a position to determine its location, dimensions, outline, excretory ducts and arterial system pattern, as well as the changes it undergoes whenever a pathological condition sets in.

It must be noted, though, that none of these procedures ever advanced our knowledge of the normal morphology of the renal venous system or of its alterations under pathological conditions. Fairly frequently, for instance, cases occur where surgery must be confined to a mere exploratory lumbar incision, whenever a condition affecting the renal veins is unexpectedly revealed on the operating table. Such may be the case when the common trunk of the renal vein is obstructed by a malignant outgrowth—a condition whose frequency is known to be far from negligible, statistically speaking, when a hypernephroma is present—and we are all well aware of the risk of some reckless manoeuvre creating the conditions that may subsequently lead to a neoplastic embolism of the lung.

These are the considerations that have induced us to see whether a more thorough knowledge could be gained of the kidney's venous system—a project we have been working on since 1960.[1] And we now report the results we have been able to obtain from our study, the practical value of which we particularly wish to stress.

METHOD

Renal phlebography performed by our method of retrogradal venous catheterization under blockade and through cardiovascular channels has enabled us to acquire a few semiological data that could not be obtained by such other methods as the use of single-lumen catheters (Dalla Palma and Servello,[2] Peart and Sutton[3]), double caval blockade (Gillot),[4] transcutaneous puncture of the kidney (Gilsanz *et al.*)[5] or left spermatic vein catheterization (Viola Peluffo and Bonavita Paez).[6]

By adopting a twin-lumen catheter with a balloon which is inflated at the levels of individual renal veins, each vein being catheterized separately and in sequence, we were able to penetrate the whole venous system of the kidney in a retrograde direction with the contrast medium once the blockade had been established. Examination is performed with the patient awake, a fluoroscope being used to watch the catheter's progress from its introduction into an arm vein to the inlet of each renal vein. The contrast medium is subsequently injected and its diffusion is followed under radioscopy, whereupon X-ray pictures are taken. The procedure invariably entails taking haemodynamic readings at renal vein levels both before and after blockade, as well as caval pressure readings to determine the gradient between the renal vein and the inferior vena cava. Blood samples are also taken for oxymetric and electrolytic assays. We generally use either an USCI Dotter-Lukas No. 8·1 / 2 f. or a Rush No. 10 ch. catheter, and employ a 50% water-soluble iodate contrast medium.

RESULTS

Our method was used at the Milan University Department of General Surgery on over 300 patients suffering from a variety of kidney ailments. The angiograms of healthy kidneys closely duplicate the intraparenchymatous venous distribution of classical anatomy (Fig. 1), as further evidenced by the casts we obtained by PVC injections.

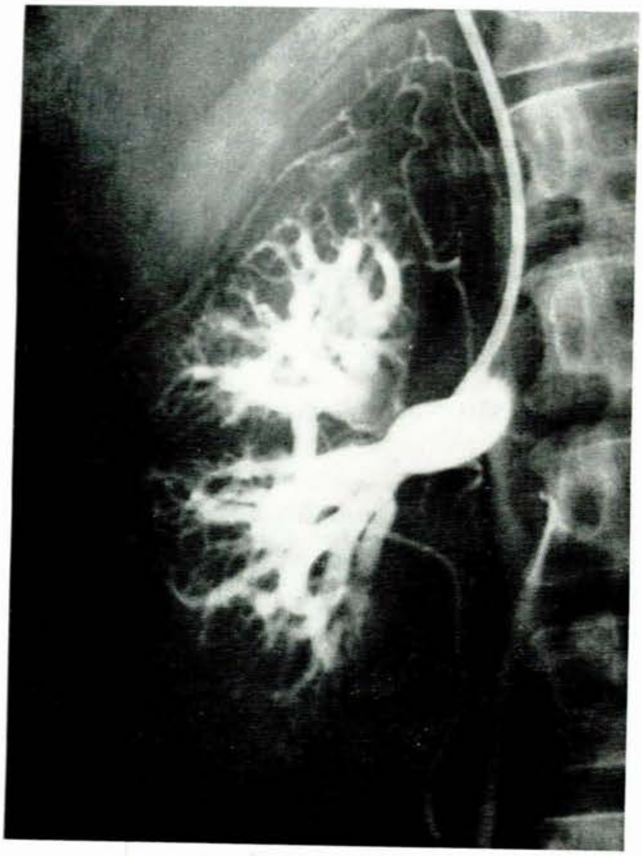

Fig. 1. Right renal phlebogram under blockade showing modal distribution of intralobal, arciform and interlobular veins, evidencing peri-ureteral and peri-capsular circulations, and providing retrogradal visualization of the right genital vein with a separate outlet into the inferior vena cava.

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The validity of our method is further substantiated by the possibility it offers of demonstrating such a collateral renal circulation as is provided on the right side by the capsular and peri-ureteral veins and on the left side by the same veins as well as by such vessels as lead to the common trunk of the renal vein, i.e. the suprarenal, reno-azygous-lumbar and genital veins.

These findings show that renal phlebography under blockade ensures a massive, homogeneous distribution of the contrast medium, while the possibility of images being formed that may be construed as functional can be ruled out.

INDICATIONS FOR RENAL PHLEBOGRAPHY

It is an absolute 'must' in cases of renal tumours. It has been proved that some of these malignancies, such as hypernephromata, have a marked tendency to thrive in venous lumina and to penetrate the larger veins until they reach the renal veins, and occasionally the cava. The tendency of kidney tumours to metastasize through venous channels is further confirmed by the frequency with which their metastases are encountered in the lungs. In such cases, renal phlebography will provide a clue as to whether the renal vein is affected by the malignancy—directly or otherwise.

Phlebograms showing a renal vein that is completely throttled (Fig. 2), inadequately filled or deviated by extrinsic compression with evidence of pathological collateral circulation patterns, will be of the greatest diagnostic value.

A caval phlebogram may be obtained simultaneously, should catheterization of the renal vein prove impossible, and will show the progress of a possible malignant offspring in the vasal lumen or the involvement, if any, of the cava from outside.

The information that can thus be obtained is of vital importance, not only for determining whether or not a tumour of the kidney may be operated upon, but also for the guidance it may provide on how surgery should be performed.

In so far as the other forms of kidney diseases (hydronephrotic, polycystic kidney, echinococcal cysts, solitary cysts of the kidney) are concerned, there will be no material difference between the phlebograms obtainable by our method and those provided by selective arteriography or aortography, as the images will be common to both methods (Fig. 3).

Although the results are identical, our method of renal phlebography is more convenient to perform and less risky for the patient. The usefulness of our method will be also evident when a kidney is functionally excluded or a stenosed renal artery is suspected—for in such cases the condition may already be indicated by our haemodynamic readings at renal vein level, the clue being provided by the fact that, while in the healthy subject the pressure promptly soars to, and levels off around, 35 - 40 mm.Hg as soon as the flow is blocked, if a condition be present involving a renal artery obstruction the pressure will either climb gradually to no more than 15 - 20 mm.Hg (incomplete obstruction) or fail to rise at all (complete obstruction).

Phlebographic features, too, will be typical—with venous branches taking a 'bundled' appearance and the contrast medium spreading rapidly throughout the organ.

Renal phlebography also allows the location, width, length and shape of the main trunk of the left renal vein to be accurately determined. Should the need arise to establish a radical portosystemic shunt (i.e. a terminolateral or termino-terminal splenorenal anastomosis) as a surgical treatment of portal hypertension, both the above data and the haemodynamic readings at renal vein level must be known in advance. And our method will provide a means for checking the permeability of a splenorenal anastomosis.

The possibility of visualizing the left suprarenal vein is still another practical application of our method. Since this vein directly abuts into the common trunk of the renal vein, the contrast medium may be made to flow back into its lumen if the blockade is performed near the cava, thus providing an accurate picture of the vein's morphology and distribution within the suprarenal gland (Fig. 4), as well as of its pathological alterations, should a suprarenal malignancy be present.

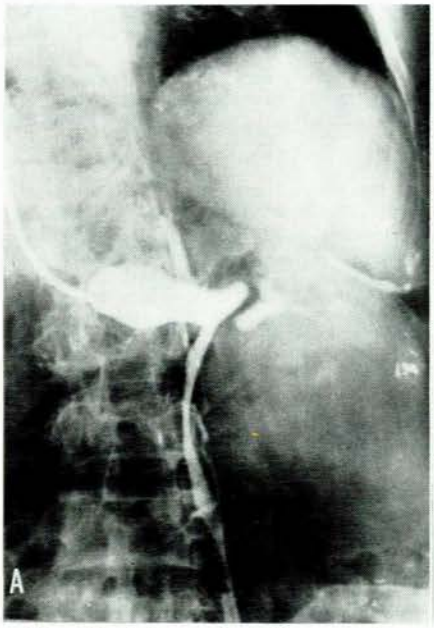

Fig. 2A. Left renal phlebogram in a case of hypernephroma. Note cut-off renal vein proper. Also visualized are the suprarenal and left genital veins, the latter featuring a broad-radius pattern due to extrinsic compression.

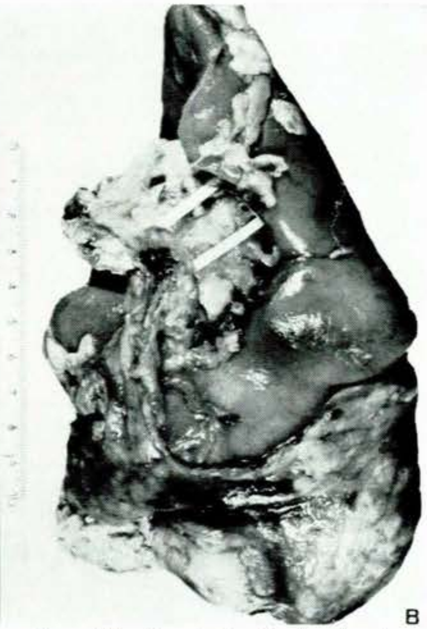

Fig. 2B. Surgical check showing malignant lump in the lower two-thirds of the kidney. The 2 arrows indicate the kidney's vascular hilum.

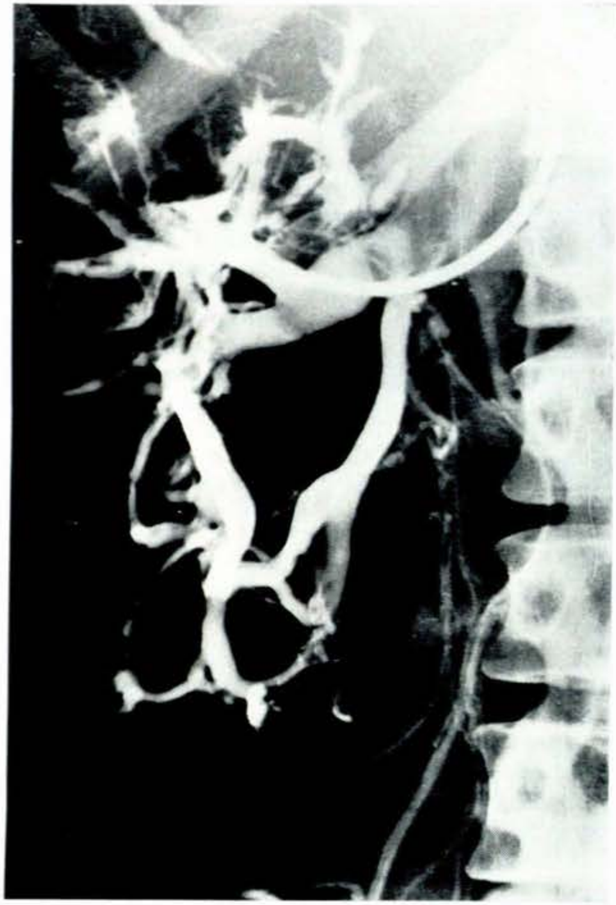

Fig. 3. Right renal phlebogram in a case of polycystic disease of the kidney. Note venous pattern tending to circumscribe intraparenchymatous cavities.

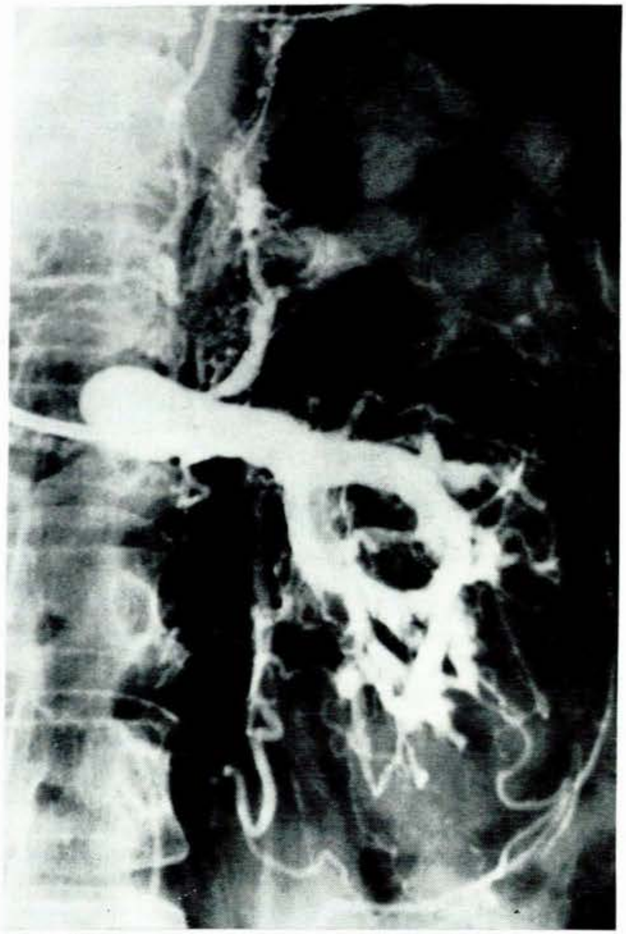

Fig. 4. Left renal phlebogram showing the suprarenal vein, its distribution branches to the gland and the collateral circulation pattern linking it to diaphragmatic veins. A hypernephroma cuts off the renal vein's upper lobal branch.

SUMMARY

A method for exploration of the renal venous system, used on more than 300 patients with kidney diseases of mainly surgical interest, is described, which consists of a separate catheterization of each renal vein, using 2-way catheters complete with balloon.

The catheter is guided under fluoroscopic control from one of the brachial veins (opened under local anaesthesia) by cardiovascular route to the opening of the renal vein selected, where the block is made, the balloon being filled with 4 or 5 ml. of 25% water-soluble iodized contrast medium, and 10 ml. of 50% iodized medium injected counterflow-wise. The images of the hilar and intraparenchymal venous distribution patterns of the kidneys appear on simultaneous radiograms.

It is thus possible to obtain an outline of the normal venous pattern of the kidneys and to identify the most significant aspects of this particular area, as represented by vascular amputations, filling defect images and evidence of pathological collateral circulations. Such an examination proves particularly valuable (*i*) for surgical purposes, (*ii*) in the diagnosis of renal tumours and of their extensions to the renal vein or the vena cava, and (*iii*) in the study of the left adrenal gland. It is also valuable in ascertaining patency of the splenorenal anastomoses.

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