Is there a role for the intravenous urogram in the 21st century?

For debate

Over the last two decades, there have been major advances in methods of medical imaging that have brought great benefits to patients both for diagnosis and for treatment. There has been an increasing tendency for some of these new imaging modalities to be dependent on highly sophisticated technology. The belief has developed amongst doctors who use these tech-

niques that newer is necessarily better. Just as patients (and some doctors) now often believe that anything done with a laser represents the best that can be offered, so there is a tendency to demand that newer techniques in imaging should always be offered as the preferred option. In urological practice that philosophy is questionable.

AHN WHITFIELD¹, HN WHITFIELD²

¹The Churchill Hospital, Oxford, UK

²Harold Hopkins Department of Urology, The Royal Berkshire Hospital, Reading, UK

CORRESPONDENCE TO:

Mr HN Whitfield, Consultant Urological Surgeon, Harold Hopkins Department of Urology, The Royal Berkshire Hospital, Reading, UK

Computerised tomography (CT) is an invaluable diagnostic tool. The suggestion has been made that CT can, and should, replace the intravenous urogram (IVU) in a number of common clinical scenarios. This viewpoint deserves to be analysed critically.

The requirements of the clinician for the management of the patient must be the driving force behind the decision governing the choice of investigation. The general principles which influence the choice are so simple that they can be overlooked (Table 1).

Renal colic

The commonest situation in which the CT is now being suggested as an alternative to an IVU is in the investigation of suspected renal colic.¹⁻³ The diagnosis can be confirmed using either CT or IVU. There is no absolute right and wrong which is to be preferred. The criteria in Table 1 can be used in the development of the pros and cons. Moreover, the clinician may be asking questions that differ in important ways from those that seem important to radiologists.

The clinician is not primarily focused on the question: 'Is this patient experiencing renal colic?' The clinical picture is so characteristic that there is usually little room for doubt.⁴ The patient may have experienced the same symptoms before. The presence of red blood cells on a urine dip stick is further confirmation. The clinician wants to know:

1. What is causing the obstruction? Is there an opaque stone or is the obstruction by a non-opaque 'something', e.g. a

uric acid calculus, a sloughed papilla, a blood clot or an Indinivan stone?

2. What is the size of the obstructing 'something'?
3. At what level is the obstruction?
4. What is the diameter, the position and the tortuosity of the ureter above the obstruction? Is there any clue about these features of the ureter below the obstruction?
5. Is there any clue for how long the obstruction has been present, e.g. from the degree of dilatation of the upper urinary tract?
6. Given the information derived from the imaging, how best should the patient be managed?

Neither the CT nor the IVU is completely accurate in providing the answers to the first question; the two investigations are

Table 1 Principles of diagnostic imaging

Accurate
Safe
Available
Economical
Adaptable
Easy to interpret

Figure 1 (a) A plain abdominal X-ray showing an opacity on the left side in the bony pelvis; (b) see below

Table 2 Radiation dosage

3-shot IVU	1.5 mSv
Unenhanced CT	4.5 mSv

equally accurate in answering the second and third questions; the fourth and fifth questions are more easily answered by the IVU and less readily by CT (see below).

There are some advantages to CT compared to IVU. Most CTs performed to diagnose renal colic are unenhanced, *i.e.* without intravenous contrast material. Although the morbidity of contrast material is low, there is a finite mortality even when low osmolality contrast is used (1:40,000).⁵ Contrast material must be avoided in patients with a history of allergy, hay fever or asthma until steroid cover has been given; those on metformin must stop this drug for 24 h before any contrast. These groups cannot safely undergo an emergency IVU and, therefore, an unenhanced CT is the better option. However, the radiation dose of an unenhanced CT, let alone a CT with contrast, is substantially higher than an IVU (Table 2).⁶

There are some advantages to the IVU. In every acute hospital in the UK, there is the possibility of performing an emergency IVU 24 h a day, 365 days a year. The interpretation of the IVU is within the scope of relatively junior doctors. The availability of CT

Figure 1 (a) see above; (b) A full-length abdominal X-ray after contrast and post micturition confirming that the opacity in the bony pelvis is a stone in the lower third of the ureter

varies; few, if any, acute hospitals in the UK offer a 24-h emergency CT facility with an on-call radiologist able to reconstruct spiral images and to report on the examination straight away. The commonest site for an obstructing stone at the time of presentation is at the vesico-ureteric junction. The differentiation from a phlebolith is difficult, especially when there is no ureteric dilatation proximally (a frequent occurrence) and will require a skilled radiologist to reconstruct the images at a work station.⁷

A CT scan, however, can be performed within just a few minutes, whereas delayed films are often required with an IVU; these may prolong the examination for more than 12 h. Since the patient often needs to be admitted for pain control, this is not a major disadvantage. The minimum number of films necessary should be taken during an emergency IVU. The 'rule of six' is important. If there is no contrast in the collecting system at a given time, the next film should be delayed until 6x the interval from contrast injection and the previous film. Delayed films should always be full-length after micturition, to ensure that the juxta-vesical ureter is seen as clearly as possible (Fig. 1a,b).

When deciding on the management of a patient with a ureteric stone, consideration is given to both the length of time for which the ureter has been obstructed and the degree of obstruction. Ureteric dilatation is better judged on an IVU than a CT or by ultrasonography.

The costs of different investigations within the NHS are notoriously hard to identify. A comparison with the costs of the two investigations in the private sector would support the belief that an IVU is less costly (at a private London hospital, the charge for an IVU is £270 and for a CT of the abdomen and pelvis £924).

Other situations in which the information needed for clinical decision making in urology is best provided by an IVU are indicated below

Figure 2 (a) Plain abdominal X-ray showing opacities overlying the lower poles of each kidney; (b) *see below*

Figure 2 (a) *see above*; (b) Post contrast X-ray showing that the relationship of the opacities and the collecting system in the lower pole calices differs markedly; on the right, the stone would be suitable for ESWL and on the left a percutaneous nephrolithotomy would be required

Renal stone disease

When deciding how to manage a patient with a renal stone, the anatomy of the pelvicaliceal system is critical. The anatomy of the collecting system cannot be displayed adequately with a renal ultrasound. It is not possible to judge the width of a caliceal infundibulum or the calibre of the pelvi-ureteric junction on a CT with the same accuracy as with an IVU. The decision whether to offer a patient ESWL or a percutaneous renal procedure will depend on this information (Fig. 2a,b).

Caliceal pathology

The initial and often the most accurate imaging to demonstrate important caliceal pathology (e.g. sloughed papillae [in diabetic or analgesic nephropathy], the presence of a transitional cell carcinoma or medullary sponge kidney) is IVU.

Haematuria

The debate rages about when and how to investigate haematuria. The majority of urologists will require an IVU, a renal ultrasound and a cystoscopy for patients with macroscopic haematuria. CT can provide important information, but at the expense of a significantly increased radiation dose, since an unenhanced scan is insufficient.

Chronic upper urinary tract obstruction

One of the most difficult questions to answer in urology is whether there is chronic upper urinary tract obstruction causing pain or renal impairment or both. Dilatation of the upper urinary tract can be demonstrated by ultrasonography and CT, but there is less anatomical and pathological information from these investigations compared with an IVU. On ultrasonography, it is not possible to differentiate between a full, but unobstructed, extra-renal renal pelvis and a pelvi-ureteric junction (PUJ)

obstruction. The IVU can be tailored to answer this question if frusemide is injected intravenously some 20 min after contrast.⁸

Conclusions

In urological practice, the choice of the most appropriate diagnostic imaging is critical. Despite increasingly sophisticated advances in CT technology, it is likely that urologists will continue to request an IVU rather than a CT scan, or in situations where a CT scan has been performed, will find themselves wishing it had been an IVU.

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