ASSESSMENT OF DIFFICULT RENAL STONES

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SYNOPSIS

The difficult renal stones are the Staghorn stones, stones which cause calculous anuria and acute infections, the recurrent stones and the uric acid stones. It is emphasised that the Staghorn stones if left untreated eventually will destroy the kidney but usually over a period 5 to 10 years. In relatively young and fit patient therefore all Staghorn Stones should be removed, though asymptomatic stones in older and unfit patients can be left alone. In patient with acute infection due to stone; blood culture is more reliable than urine culture. In our local population, there is relatively a higher incidence of abnormal uric acid metabolism than abnormal calcium metabolism. Patient with uric acid abnormality can be treated with allopurinol and pure uric acid stones can be dissolved with alkalinisation of urine without surgery. Intravenous urogram (IVU) is the most important radiological assessment. In acute obstruction, excretion may be poor, even in delayed film, however, a repeat IVU in a week or two would delineate the site and degree of obstruction without the need for retrograde pyelogram. Ultrasound is useful in assessing uraemic patient with calculus anuria to detect hydronephrosis. Percutaneous nephrostomy can be used to relieve the acute obstruction and hence treat the renal failure without the need for dialysis, before definitive procedure.

INTRODUCTION

The difficult renal stones are the Staghorn Stones, stones which cause calculous anuria and acute infections, the recurrent stones and the uric acid stones. Renal stones form about 42.4% of all the urinary stones seen at our University Department of Surgery in Singapore (1). 31% of the renal stones seen are of the Staghorn type. Calculous anuria occurs in about 1% of our patients with stone disease (1), while recurrent stones, and uric acid stone form about 6.7% and 10% of patients respectively (2).

1. GENERAL ASSESSMENT

Staghorn stones are difficult in the sense that they provide a challenge to the surgeon to remove them completely with minimal trauma to the kidney and to prevent recurrence. The incidence of residual and recurrent stones are high and so is the operative morbidity. Many of these stones were left alone previously and when they cause symptoms, often nephrectomy was done as a solution. With improvement in surgical techniques such as extended pyelolithotomy and anatrophic nephrolithotomy under regional hypothermia, many of these staghorn stones can now be removed with preservation of renal function.

The natural history of these stones are such that if left alone, invariably renal function will deteriorate and eventually the kidney will be destroyed when follow up from 5 to 10 years. It may also give rise to acute infection and perinephric abscess and in a small percentage malignant change can occur (3).

With asymptomatic staghorn stone, it befalls on us to assess whether the patient will die with the stone or of the stone. Sometimes it is difficult to decide, however in general, if we assess that patient has more than 5 to 10 years of good quality life, then surgery would be advised as the staghorn stone will invariably give rise to complications and symptoms.

2. CLINICAL ASSESSMENT

Often patients with staghorn stones have minimum symptom of vague loin pain, and some are asymptomatic. In our recent analysis of 25 patients 72% had vague loin pain, 28% presented with urinary tract infection and another 28% had haematuria, while 8% was asymptomatic (4). All symptomatic stones usually require surgical removal.

Signs are usually not common. The patients with staghorn stone seldom have gross hydronephrosis to enable us to feel the kidney. Loin tenderness is more common and it usually indicates obstruction or infection. At times there may be gross pyonephrosis with minimum tenderness in the loin. If a tender mass is palpable it probably indicates a perinephric abscess.

The state of hydration of patient should also be assessed. In patient with acute on chronic renal failure due to stone disease, it is important to hydrate the patient. In renal failure due to obstructive uropathy, there is usually tubular dysfunction, rather than glomerular, resulting in sodium and water loss in the urine as the sodium was not reabsorped. Patient may be admitted in a dehydrated state and uraemic. A common mistake is to limit the intake of fluid because patient is uraemic and has poor urine output. The reverse should be the correct treatment. In uraemic patient due to obstructive uropathy, patient should be rapidly hydrated with adequate sodium replacement.

3. LABORATORY ASSESSMENT

(a) Urinalysis

This usually showed micro-scopic haematuria and pyuria. In certain type of stones the typical crystals such as uric acid or calcium oxalate may be seen. It is also important to measure the pH of the urine, as infective staghorn stones usually occur in alkaline urine while uric acid stones in acidic urine. (pH5-6)

(b) Bacteriology

Pyuria does not necessarily mean infection, and urine culture need to be done to determine the bacteria and its sensitivity to antibiotics. The commonest organism cultured in stone disease is the urea splitting organism proteus mirabilis. The others are Klebsiella, and in certain instances, troublesome pseudomonas. Blood culture should be done in patient with suspected pyonephrosis associated with stone. In such a condition, the blood culture reflect more accurately the organism causing the infection than urine culture, as shown in our recent study on acute surgical infection of the kidney (5). This is important in our assessment of patient with infection due to stones, as infection in the presence of urinary tract obstruction is a serious condition. Septicaemia occurs rapidly as a result of pyelovenous and pyelolymphatic backflow in urinary obstruction and if not treated in time with the right antibiotics, we may loose not only the kidney but the patient as well.

(c) Full Blood Count

A low haemoglobin would indicate possible chronic renal failure associated with bilateral stone disease. Increase white cell count would indicate infection.

(d) Urea, Electrolytes and Creatine

This gives a fairly good assessment of the renal function and electrolyte balance. A raise urea and creatinine would indicate renal failure, whether it is acute or chronic would depend on the history, previous readings and also the haemoglobin level. Thus a raise urea and creatinine with a low Hb would indicate chronic renal failure while a normal Hb would indicate that the renal failure is probably acute and potentially reversible, as in some cases of acute calculus anuria.

(e) Metabolic Studies and Stone Analysis

These studies are important especially in patient with recurrent, and suspected uric acid stones.

All patients with difficult renal stones should have blood calcium, phosphorous, uric acid estimated and 24 hours urinary calcium and uric acid done at some stage of their managemevt, and if the stone is available, it should be analysed.

Hyperparathyroidism giving rise to stone disease occur in about 1.2% of our stone patients (6). Idiopathic hypercalciuria is not as common as reported in the Western Literature, occurring only in about 11.8% of our patients with stone (2), instead of the reported 50 to 70% of patients (7, 8). However, the incidence of abnormal uric acid metabolism is much higher in our local population. High serum uric acid is present in about 15.8% of patients and high urinary uric acid in about 24% of our patients (2). This difference is probably due to the dietary habits of our patients. In our assessment of patients with difficult stones, it is important to diagnose patient with abnormal uric acid metabolism as they can be treated with allopurinol with good results. Hyperuricosuria has been found not only in patient with uric acid stone, but it is an important cause of calcium oxalate stone as well. The uric acid crystals act as a nidus for calcium oxalate stone to form. It has been reported that the incidence of recurrent stone can be reduced drastically in patient with hyperuricosuric calcium stone disease with allopurinol therapy (9).

Patients with pure uric acid stones which occur in about 10% of our stone formers can be successfully treated with alkalinisation of urine and allopurinol. Even large staghorn stones in the kidney can be

dissolved with sodium bi-carbonate maintaining the urinary pH more than 6.5. Over the past few years, we have documented 8 cases who were successfully treated without the need to operate on these patients (10). (Fig 1 & Fig 2)

There are two main groups of patient with idiopathic hypercalciuria, the absorptive, due to increase intestinal absorption and the renal which is due to increase renal leak. The former can be treated with cellulose phosphate or orthophosphate while the later can be treated with thiazide. However, as the incidence of idiopathic hypercalciuria is not high, we have no experience in this form of treatment.

It is important to remember that whatever the metabolic abnormalities, the common denominator for stone formation is a concentrated urine. In collecting the 24 hours urine sample, the total urine volume forms an important part of the assessment. Patients should be advised high fluid intake to maintain at least 2 litres of urine over 24 hours period.

4. RADIOLOGICAL ASSESSMENT

The intravenous Urogram (IVU) is the most important radiological investigation in our assessment of patients with difficult stones. In most cases, it can

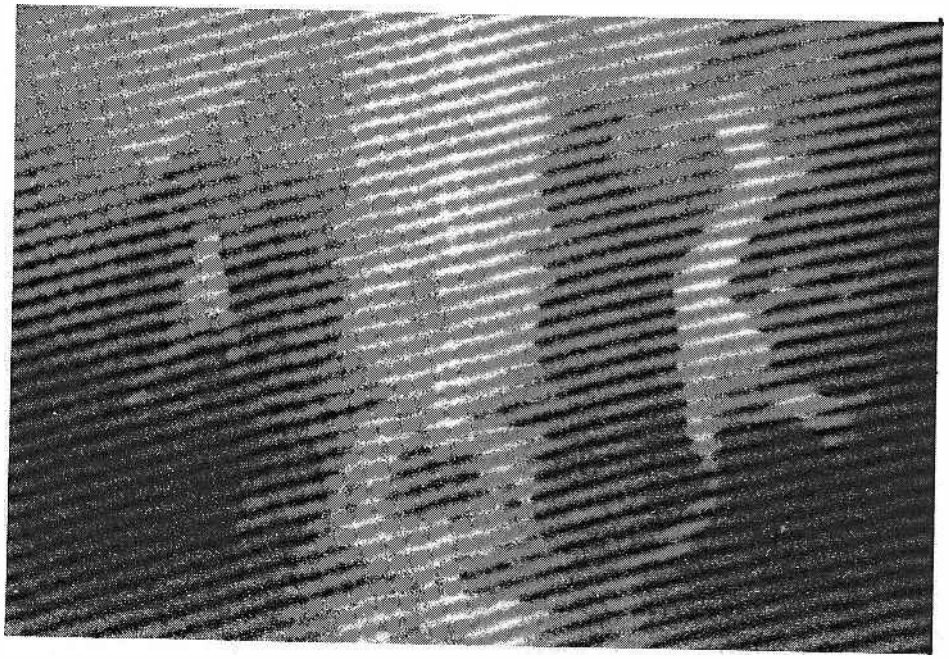

FIGURE 1: IVU showing a large radiolucent stone in the left renal pelvis.

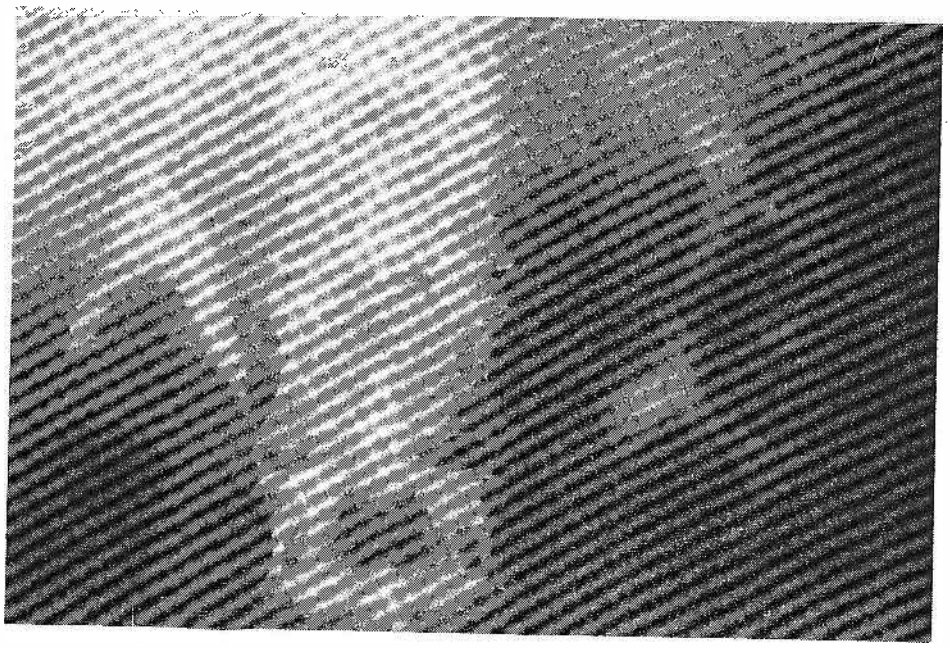

FIGURE 2: IVU of the same patient 6 months after treatment with alkalinisation of urine, showing dissolution of the stone.

confirm the site, size of the stone, whether bilateral or unilateral and reveal the degree of obstruction to the kidney. One can often tell the nature of the stone from the radiological appearance eg. the homogenous opague staghorn stones are due to triple phosphates, the spicules pelvic stones probably due to calcium oxalate, while the radiolucent stones are due to uric acid.

The excretion of the kidney also can give us a rough idea of the function of the kidney, though for more accurate estimation, renogram would need to be done.

In patient with renal failure where excretion is poor retrograde pyelogram would be required. However, it is important to realise that in an acutely obstructed kidney, excretion is poor even in delayed film. In unilateral obstruction where there is no danger of patient going into acute renal failure, one need not proceed on to do retrograde pyelogram right away involving the necessity of a cystoscopy. Instead, with an understanding of the pathophysiology of an acutely obstructed kidney, that the renal excretion will continue in time, inspite of obstruction, due to the pyelovenous and pyelolymphatic backflow, one can opt to repeat the IVU a week or two after an attack of acute obstruction. Often the repeat intraveous urogram would delineate the lesion without the need of the more invasive investigation. (Fig 3 and Fig 4)

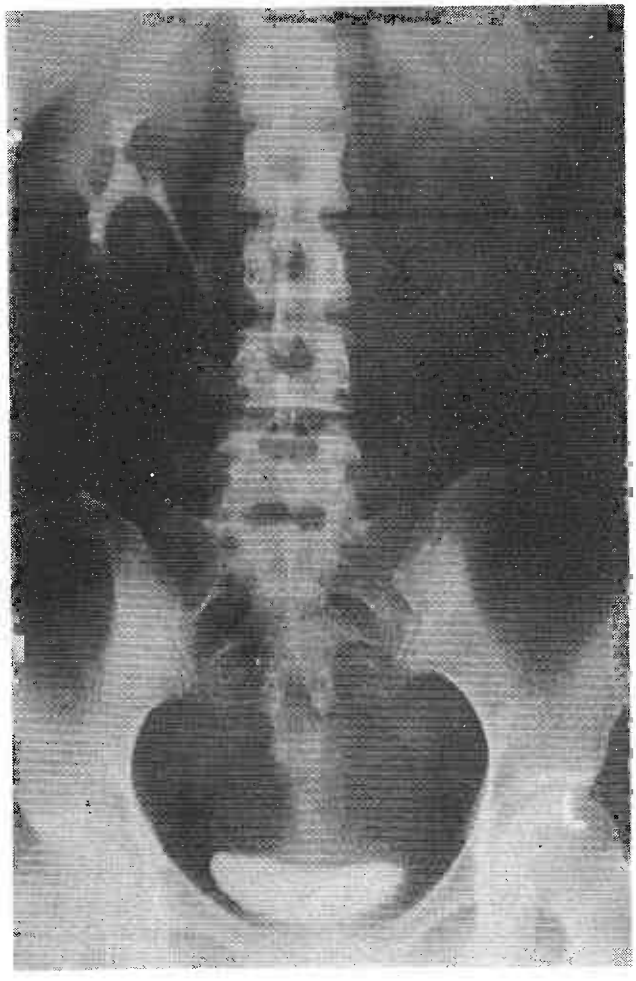

FIGURE 3: IVU of patient done at the time of acute obstruction showing a poorly excreting left kidney even in the delayed film.

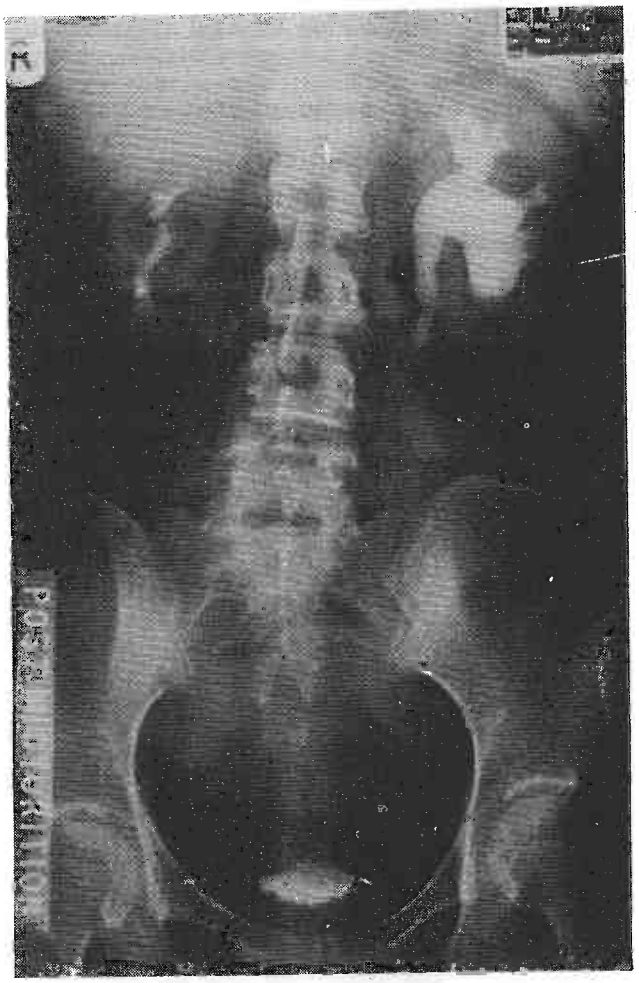

FIGURE 4: Repeat IVU of patient 2 weeks later, showing return of function and delineate the site and extend of obstruction by a radiolucent Uric Acid Stone.

When retrograde pyelogram failed to provide the necessary information, nowadays antegrade pyelogram can be performed, by means of a percutaneous puncture of the kidney. Percutaneous puncture can also serve as a useful means of temporary drainage for an obstructed and sometimes infected kidney, especially in patient with calculus anuria. Patient's renal function rapidly improves without the need for dialysis and one can then deal with a more fit patient for further surgical procedure (11).

Ultrasound is useful in assessing patient with calculous anuria. It would help to differentiate anuria due to obstruction, from anuria due to parenchyma lesion where there would be no evidence of hydronephrosis. In situation where there is hydronephrosis, percutaneous nephrostomy could be done right away to drain the obstructed kidney and the acute emergency would be over. Definitive surgery can then be planned at a later date when patient has recovered from the uraemia.

Recently CT Scan has been found to be useful in differentiating radiolucent filling defects in the renal pelvis which may be due to uric acid stones, urothelial tumour or blood clots. The uric acid stones would be denser than the other two lesions.

CONCLUSION

In our assessment of patients with difficult stones

for definitive treatment, it is important to know that,

(i) many patients with staghorn stones can now be operated on safely with reasonable degree of success in preserving renal function without the need for nephrectomy.

(ii) with proper bacteriological and metabolic evaluation and treatment the incidence of recurrent stones can be reduced.

(iii) patients with uric acid stones, even the large staghorn stones can be successfully dissolved with the simple measure of alkalinising the urine with sodium bi-carbonate and recurrence prevented with allopurinol treatment and high fluid intake.

(iv) patients with calculous anuria can be treated with percutaneous nephrostomy initially obviating the need for dialysis. Subsequent definitive surgery can then be done after he has recovered from the acute renal failure.

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