

EXTENDED NEPHROLITHOTOMY UNDER REGIONAL HYPOTHERMIA FOR STAGHORN STONES

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SYNOPSIS

The technique of extended nephrolithotomy under regional hypothermia using ice-saline slush with the renal pedicle clamped was applied in operating on 28 kidneys in 25 patients with large and or multiple kidney stones, from January 1970 to April 1982. There was no mortality and no kidney was lost. Morbidity includes one post-operative haemorrhage requiring re-operation, one patient developed septicaemia and 2 other patients had significant urinary tract infection and 6 developed wound infections.

The incidence of residual stone is high at 50%. The possible causes are analysed and remedial actions suggested. The importance of having good intra-operative X-ray is emphasised.

3 patients are known to have recurrent stones formation.

Abnormal uric acid metabolish is found to be an important cause of stone formation. 40% of stones analysed contained urates. The use of allopurinol may help to prevent recurrence of stones in this group of patients.

INTRODUCTION

Staghorn stone has been defined as a renal stone occupying the whole of the renal pelvis with extension into at least 2 major calyces (1). A compound staghorn stone is one with large mushroom type branches or with multiple daughter stones in at least 2 calyces, and would be difficult to remove completely with extended pyelolithotomy without doing multiple nephrolithotomies.

Previously, these stones had been treated conservatively, but the morbidity and mortality had been shown to be high with a mortality of 28% with many developing pyonephrosis and a number of them developing carcinoma on long term follow up(1).

With the introduction of a simple method for regional renal hypothermia using ice-saline slush and a better understanding of the intra-renal anatomy and blood supply of the kidney, these compound staghorn stones can now be removed with relative safety using a modification of Smith and Boyce technique for extended nephrolithotomy (2, 3).

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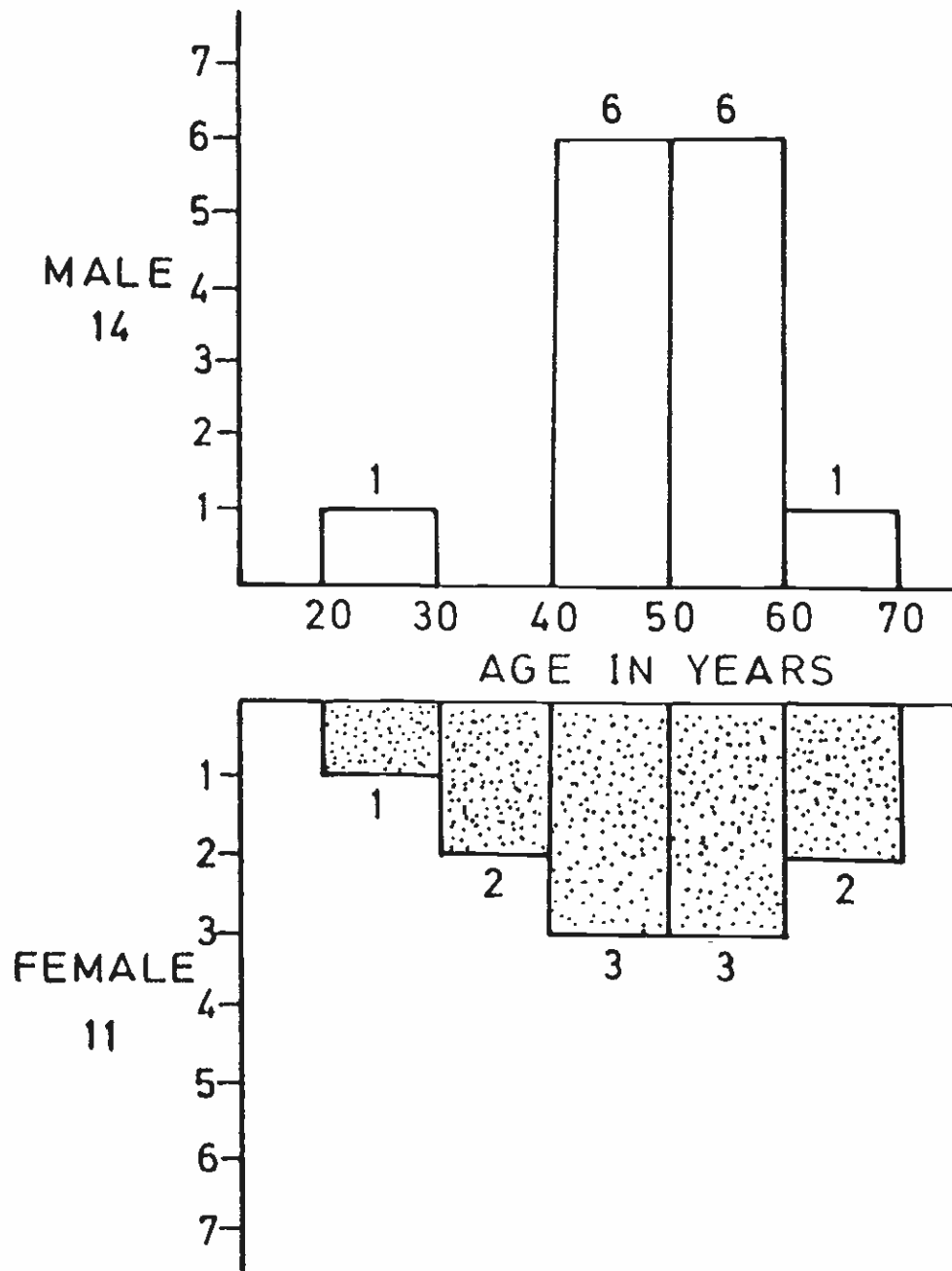


Fig.1: COMPOUND STAGHORN STONES (25 patients)
AGE & SEX DISTRIBUTION

Table I. COMPOUND STAGHORN STONES (25 patients)
SYMPTOMATOLOGY

	NO.	%
ASYMPTOMATIC	2	8
LOIN PAIN	18	72
GROSS HAEMATURIA	7	28
RECURRENT U.T.I.	7	28

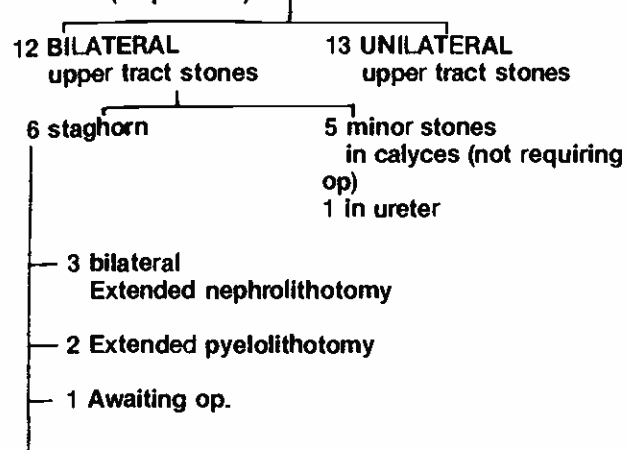
Table II: COMPOUND STAGHORN STONES
(25 patients)

TABLE III BACTERIOLOGY

NO GROWTH	5
KLEBSIELLA	7
PROTEUS	5
PSEUDOMONAS	5
E COLI	3
CITROBACTER	2
STAPH	2
ACINETOBACTER	1
ENTEROBACTER	1

TABLE IV
Incidence of Residual Stones over the years

Year	No of kidneys	Residual stones	%
1979	6	4	66.6
1980	11	7	63.6
1981	7	2	28.6
1982	4	1	25
TOTAL	28	14	50

MATERIALS AND METHODS

At the University Department of Surgery, Singapore General Hospital, we started using this modified technique of extended nephrolithotomy with regional renal hypothermia since January 1979, and up to April 1982 we have operated on 28 kidneys in 25 patients. Whenever possible, the simple staghorn calculi are removed by extended pyelolithotomy (Gil-vernet operation) and these cases are excluded from our analysis. Extended

nephrolithotomy is done only for the compound staghorn stones which are considered difficult to remove via the renal-pelvic approach.

Briefly, the technique now involves complete mobilisation of the kidney, 100ml of 25% manitol is infused intravenously before the renal pedicle is clamped en mass with a Satensky vascular clamp. The kidney is cooled for 10 minutes with ice-saline slush. Extended nephrotomy incision is made on the posterior aspect of the kidney along a line, about 1 cm away from the lateral curvature for about 3/5 of the way extending towards the upper and lower poles, and deep into the calyceal systems. Multiple daughter stones when present are removed and flushed out from the calyces first, before removing the large obstructing pelvic stone to prevent the daughter stones from dropping down into the ureter. Nephroscopy is done when indicated. Any narrowed infundibula are incised and widened repairing with 5-zero dextron.

When all the stones are deemed to have been removed, intra-operative contact kidney X-ray film is done to detect any residual stones, 2 nephrostomy tubes are placed for continuous post-operative irrigation with normal saline. The renal capsule is closed with 4-zero dextron. Irrigation is stopped after about 2 days and the nephrostomy tubes are removed about the 10th post operative day.

RESULTS AND FOLLOW-UP

Patients characteristics and symptomatology. Of 25 patients, 14 were males and 11 were females, their age ranged from 27 to 68 years old, the majority being in the 40 to 60 years age group. (Figure 1)

2 patients (8%) were asymptomatic 18 (72%) had loin pain and 7(28%) presented with gross haematuria, while another 7(28%) presented, with recurrent urinary tract infections. (Table I)

12(48%) patients had bilateral involvement of the upper urinary tract by stone disease. (Table II) Of these 6 had bilateral staghorn stones, 3 of whom had bilateral extended nephrolithotomy done, while 2 patients had extended pyelolithotomy for the other kidneys and one patient is awaiting operation. Of the other 6 patients, 5 have minor stones in the calyces with no obstruction or symptoms and they are being treated expectantly. One patient had a ureteric stone removed. Of the 28 kidneys operated on 14(50%) had multiple stones in the calyces and the incidence of residual stones is much higher in this group of patient (71.4%). The other 14 (50%) had single large branched staghorn stones.

2 kidneys were operated on for recurrence, one had an extended pyelolithotomy and the other a lower pole nephrectomy 5 year previously.

Operation

The total operating time range from 55 to 240 minutes averaging, 150 minutes.

The cold inchaemic time range from 25 to 85 minutes averaging 57 minutes.

Post operative results

There were no post-operative death and no kidneys were lost. Average post op stay was 14 days. Post operative renal functions assessed by urea and creatinine levels and intravenous urogram had shown no significant deterioration of renal functions, with the majority of patients relieved of their symptoms. (Figure 2)

There were two major complications. One patient had continued haemorrhage postoperatively, developing clots retention. His kidney was re-explored 2 weeks post-operatively under regional hypothermia and a bleeding

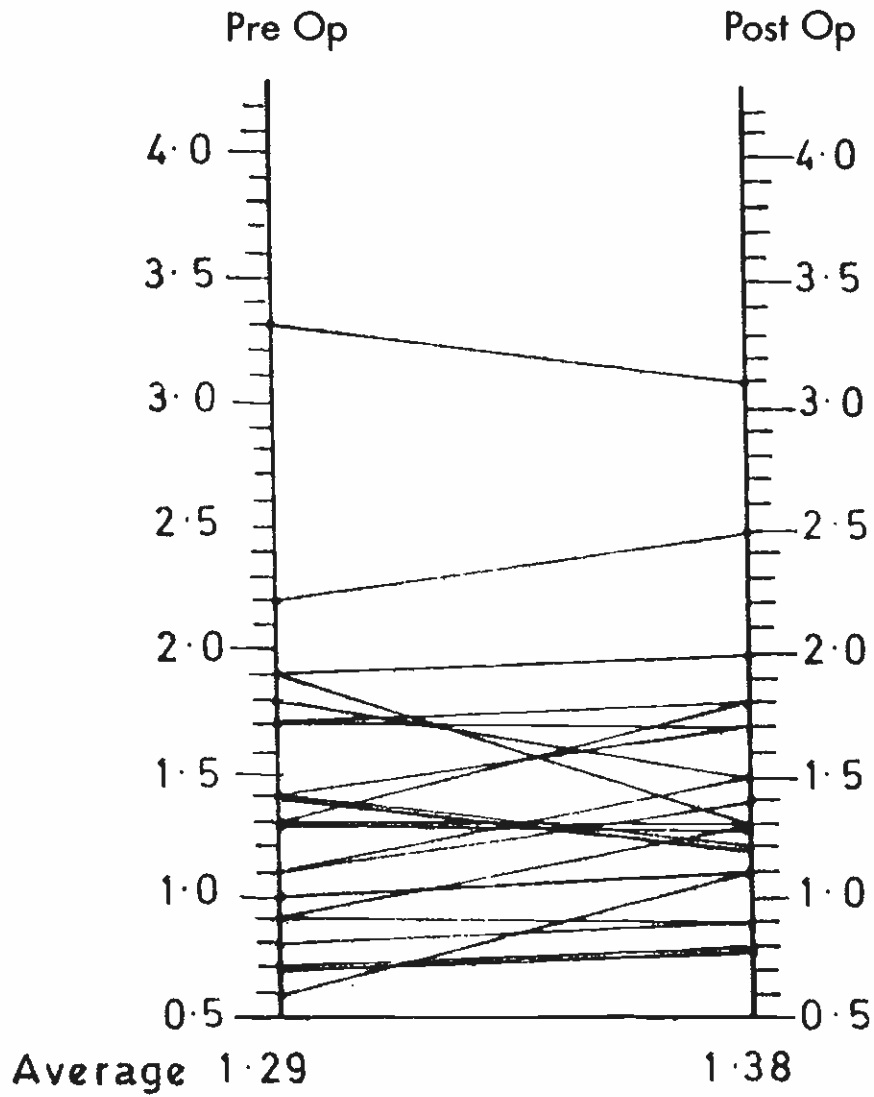
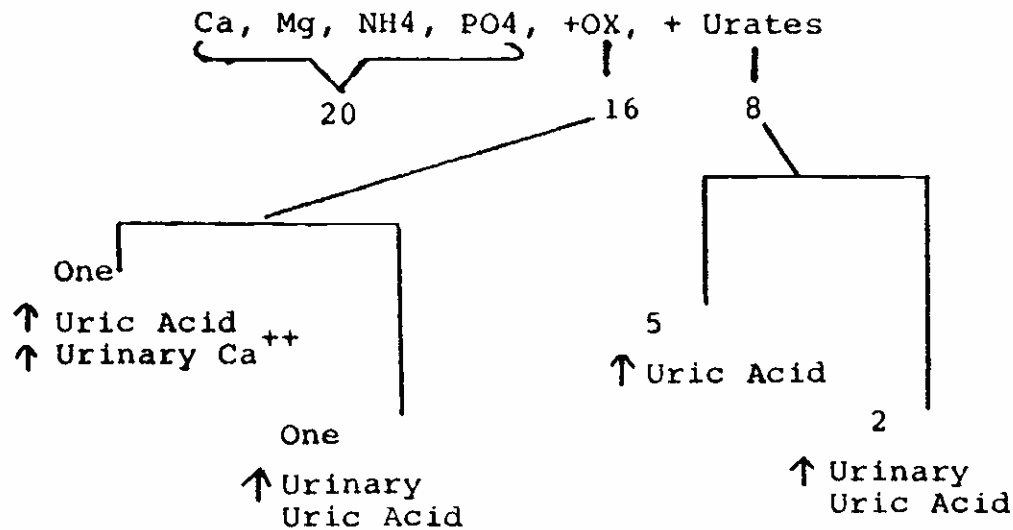


Fig. 2 : CREATININE LEVEL PRE & POST OP
IN 22 PATIENTS

TABLE V: STONE ANALYSIS (20 CASES)



venule was ligated and he recovered uneventfully. Another patient developed septicaemia and shock in the immediate post-operative period, however, he recovered with appropriate antibiotics and supportive treatment and was discharged well on the 12th post-operative day.

2 patients had urinary tract infections giving rise to post operative fever, one was associated with a temporary obstruction of the ureter by old blood clots, while another developed secondary haemorrhage which was successfully managed by further continuous irrigation of the kidney and appropriate antibiotics.

6 patients had wound infections 2 of which were severe with wound dehiscence and requiring prolonged hospitalisation.

The organisms cultured were mainly klesiella, proteus and pseudomonas species. (Table III)

Residual stones

14 kidneys (50%) had residual stones. (all except one were less than 1 square cm in area). The incidence of residual stones was 66.6% in 1979 and had shown a steady decrease to 25% in 1982 (Table IV).

Of the 14 kidneys with residual stones 2 were passed spontaneously.

2 caused obstruction, one patients had to have 2 ureterolithotomies to clear the obstruction, the other developed acute retention of urine due to the residual stone causing obstruction at the posterior urethra. This stone was removed endoscopically.

8 kidneys had residual stones which remained inactive and 2 were lost to follow up.

Recurrent stones

Over a follow up period of 3 months to 3 years, there were 3 patients with recurrence of stones, at 6 months, 7 months and 18 months. One was due to high urinary uric acid, another had pseudomonas infection which was difficult to eradicate. The third patient had no obvious cause, but probably has active metabolic disease which is not detected at present as he had lower pole nephrectomy done for renal stones 5 years previously and was re-operated on for recurrent stones.

All the recurrent stones are small at the present moment and not causing obstruction. They do not require re-operation so far.

Stone analysis and metabolic studies.

Of 20 stones available for analysis all were shown to contain calcium, magnesium Ammonium phosphates. 16 contained oxalate and 8 (40%) contained urates as well. (Table V) Of these 8 patients with urates in the stones all except one had either hyperuricaemia (5 patients) or hyperuricosuria (2 patients). Of the patients with infective calcium oxalate stones, one was found to have hyperuricosuria while another has hyperuricaemia as well as hypercalciuria.

None of our patients were found to have hypercalcaemia.

DISCUSSION

Though our post-operative results with regards to renal functions, morbidity, relieve of symptoms are satisfactory, the incidence of residual stones at 50% is high compared to other series of about 22% (3, 4, 5). This is partly due to the nature of the cases we dealt with, 50% of the kidneys had multiple small stones and these were more difficult to clear, however, the main reason was our relative inexperience at the beginning with this new operative procedure. We did not realise the limitation of the nephrotomy incision to expose all the calyces and also we were in too much of a hurry, fearing the consequences of a prolonged renal ischaemia with the renal pedicle clamped, and no proper intra-operative contact kidney x-ray films were done. With better experience and hind sight, we now explore every calyces, some may have only a small opening exposed, using nephroscopy when necessary, and even then, when all stones are deemed to have been removed, a good intra operative contact kidney film is essential. Often, the x-ray film will show up small stones hidden in one of the calyces. It is encouraging to note that our incidence of residual stones have decreased from a high of 66.6% in 1979 to 25% in 1982 and we hope that this will decrease further as more experience is gained (Table IV).

Though the incidence of recurrent stones is higher in incompletely cleared kidneys, many of the residual stones remain inactive, as is shown in this series and in other

series with longer follow up period (4, 5). Other factors causing recurrence of stones must be looked out for such as urinary tract infection and metabolic disorders. It is interesting to note that in this series, there is a high incidence (40%) of urates present in the stones and this is supported by metabolic studies. In other series by Redman et al (3), only one out of 49 stones analysed contained uric acid, and Sleight and Wickham (6) found no uric acid component in 72 renal stones analysed.

Apart from controlling urinary tract infections, the use of allopurinol to lower uric acid level may help in preventing stone recurrence in patients with abnormally high uric acid and urates stones.

Because our follow up period has been short the incidence of recurrent stones is low (10.7%) with long term follow up, up to 10 years the reported incidence of recurrent stones is from 16.8% (4) to 22% (7).

CONCLUSION

1. Extended nephrolithotomy under regional hypothermia for compound staghorn stones is a relatively safe technique giving uniformly good results.
2. The incidence of residual stones is still high but with better experience and good intra-operative X-rays, the incidence can be reduced to an acceptable level.
3. With longer follow up, the incidence of recurrent stones is expected to increase. However, with proper

control of urinary tract infections, and metabolic studies to identify those with abnormality especially that of uric acid in our local population, and instituting treatment accordingly, the recurrence rate can probably be kept low.

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