

## GUIDELINES FOR FLIGHT SURGEONS

### NEPHROLITHIASIS IN AIRCREW

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#### GENERAL

1. Nephrolithiasis is no more prevalent in aircrew than in the general population (1:1000 adult Americans annually). However, given its significant potential for incapacitation and/or mission compromise, its occurrence in aircrew merits special consideration. In particular it is imperative that subsequent investigation and search for cause be thorough and intensive such that cure or more commonly control, may be achieved. This is important not only for flight safety, but also allows the aircrew to return to productive employment with the minimum of restrictions and delay.

2. Regardless of stone type, certain predisposing factors are clearly recognized. Such factors either increase the urinary concentration or decrease the urinary solubility of the chemical constituents of the stone. Fortunately, many predisposing conditions are treatable.

3. Increased urinary concentration of chemical constituents may be caused by either low urine volume (dehydration, arid climates) or by increased urinary excretion (hypercalcuria, hyperoxaluria, hyperuricosuria, cystinuria). Decreased urinary solubility, on the other hand, can be induced by an abnormal urine pH (uric acid and phosphate-containing calculi being predisposed by relatively acidic, and alkaline, urine respectively). Hyperuricosuria, furthermore, not only predisposes to uric acid stones, but also to those of calcium oxalate.

#### INVESTIGATION

4. Accurate diagnosis, therapy, control and categorization require stone collection and analysis.

5. Where the stone is lacking, presumptive diagnosis may be provided by X-ray appearance (or non-appearance) and by urine and serum analysis. The protocol at Annex A is recommended as a standard investigation for all aircrew suspected of nephrolithiasis with or without stone recovery.

6. If the stone type is known the protocol can be simplified to critical tests in search of a treatable cause. Regardless of stone composition a Renal Stone Metabolic Work-up (Annex A) to evaluate renal function and rule out complicating infection, should be completed.

#### TREATMENT

7. It is appreciated that recent trends in stone management are towards a less aggressive approach to pre-predisposing factors – such as hypercalcuria and/or hyperuricosuria in calcium-oxalate stone formation. In this instance, for example, long-term therapy (thiazides and/or allopurinol) would not be advocated unless the disease were considered metabolically active (i.e. x-ray evidence, during the follow-up year, of new stones and/or unpassed stone growth or documented passage of gravel). This approach is not necessarily ideal for aircrew and an aggressive, therapeutic approach within the confines of sound clinical management is

recommended. The newer treatment modalities also allow for a quicker return to normal duties following stone removal

8. It is recommended that in all instances:
  - a. a large urine volume be maintained (2-3 litres per day including patient-monitoring with reagent strip to keep urinary specific gravity between 1.005 and 1.010 to guarantee a daily urine volume in excess of 2 litres);
  - b. diet be restricted as indicated (i.e. calcium where intake is excessive, oxalate where intestinal absorption is increased and purines where hyperuricosuria or gout is a factor) (NOTE: Blind dietary calcium reduction is rarely helpful and may be counter-productive);
  - c. urinary pH be controlled when solubility is considered a factor; and
  - d. salt be restricted to approximately 6g/day – particularly for hypercalcaemia.

#### AEROMEDICAL DISPOSITION

9. With an acute episode aircrew should be grounded pending initial treatment, investigation and institution of long-term management.

10. Upon resolution of the acute episode and radiographic evidence that there are no retained calculi, and if there is no requirement for long term medication, aircrew may be returned to unrestricted flying duties after the following periods (with the non-pharmacologic treatment modalities outlined in para 8):

- a. two weeks following spontaneous passage of a stone;
- b. four weeks after basket extraction or utereroscopic manipulation;
- c. four weeks after the last passage of fragments or “gravel” following extracorporeal shock-wave lithotripsy (ESWL);
- d. six weeks after percutaneous nephrolithotripsy; or
- e. twelve weeks following open surgery.

11. If pharmacological treatment is instituted (e.g. with a thiazide for hypercalcaemia) aircrew should not be returned to flying duties until such time as the medication is deemed to be efficacious (e.g. normal urine calcium excretion on 24 hr collection) and free from adverse side effects.

12. Aircrew with retained calculi or who have a recurrence of renal colic must be grounded and will be assessed on an individual basis. Referral to a urologist must be arranged, and case discussion with CMB is recommended from the outset. In the case of retained calculi, a return to flying status will depend on the location of the retained stone(s) and the probability of recurrence of renal colic. Aircrew with recurrent renal colic, or with retained calculi with a high probability of stone movement and risk of recurrent colic are likely to be permanently grounded. Return to flying status of aircrew with retained calculi will depend on the aircrew position, the estimated risk of recurrence and the potential impact on flight safety and mission effectiveness.

13. Applicants for aircrew duty with a history of renal calculi will be considered only if the metabolic work-up is negative, there are no retained calculi and a year has passed since stone passage.

**ANNEX A  
To Flight Surgeon's Guidelines  
Nephrolithiasis in Aircrew**

**RENAL STONE METABOLIC WORK-UP**

**Date** : \_\_\_\_\_  
**Name & Init:** \_\_\_\_\_  
**SN:** \_\_\_\_\_ **Rank:** \_\_\_\_\_  
**DOB** : \_\_\_\_\_

<b>Urinalysis</b>	Microscopic:	
	Protein/Sugar:	
	PH:	
	Culture & Sensitivity:	_____

<b>CBC</b>	HCT:	
	HGB:	
	WBC:	
	DIFF:	_____

<b>Blood Chemistries</b>	<b>Normal Values</b>	<b>Sample # 1</b>	<b>Sample # 2</b>
Calcium:	2.20-2.60 mmol/l		
<b>Creatinine:</b>	<110 µmol/l		
Electrolytes:	Normal limits		
Alk-Phosphate:	0.7-1.3 mmol/l		
Uric Acid:	<450 umol/l		
Urea:			

- Compile two sets of blood/urine chemistries drawn at weekly intervals while the patient is asymptomatic.
- Blood, urine collections should be done on customary diet

<b>24 Hrs Urine Chemistries</b>	<b>Normal Values</b>	<b>Sample # 1</b>	<b>Sample # 2</b>
Calcium:	2.5-7.5 mmol/24hr		
<b>Creatinine:</b>	M > 8.8 mmol/24hr		
Phosphate:	29-77 mmol/24hr		
Uric Acid:	1-3 mmol/24hr		
Total Volume:	1 litre minimum		
Oxalate :			
Citrate:			
Cystine:			
Creatinine Clearance:			

**IVP/Ultrasound Results:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Stone Analysis:** \_\_\_\_\_ **Date:** \_\_\_\_\_