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ANALYSIS OF RENAL DISORDERS AMONG AIRCREW

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*Aircrew are susceptible to urinary diseases as any other population. It has, however, been reported that urinary lithiasis is more frequent among aircrew than among general population (3% vs 1%). The aetiopathological factors are possibly urinary stasis due to effects of acceleration during flight, sedentariness, postponed urination and dietary constraints involved in prolonged flight and oliguria resulting from exposure to hot humid cockpit environment. Transport aircrew are more susceptible to renal stones than fighter aircrew.*

*This study analyses the incidence of renal diseases among Indian military aircrew evaluated at the Institute of Aviation Medicine, IAF during the ten year period from 1976 to 1985. Renal diseases formed 0.4% of all medical evaluations carried out at the Centre during this period. Among the aircrew evaluated for renal disorders, 58.5% had urinary lithiasis.*

*Keywords: urinary system and aviation; urolithiasis in aircrew; aircrew fitness.*

AIRCREW are required to have anatomically and functionally sound genito-urinary system as part of the medical requirements for aviation duties. The seriousness of the numerous anomalies and diseases of the kidneys, urinary passages and genital organs leaves one

in no doubt about the justification for an assessment of unfitness when found in the candidates for service or in serving personnel. Aircrew are susceptible to urinary diseases just like any other population. No study has been reported on the problem of urinary

system disorders among the military aircrew in India.

The present study was carried out to identify the magnitude of the problem of urinary diseases among our aircrew. An effort has also been made to review the medical standards in vogue both in Indian Air Force (IAF) and in some other Air Forces.

#### Medical Requirements

In the IAF (8), during initial selection of aircrew, a detailed history of urinary disorders, enuresis, renal pain, haematuria, nephritis, cystitis, urethral discharge and venereal diseases is elicited. Clinical evaluation is carried out to exclude any detectable abnormalities of the genitourinary system. Chemical and microscopic examination of a freshly voided concentrated sample of urine is also a mandatory requirement. Radiological examination carried out to assess the spine helps to rule out any radio-opaque shadow in the kidney-ureter-bladder area. During the periodic medical examination of those already in service, apart from a clinical examination of the genitourinary system, urinalysis to exclude the presence of protein, sugar and microscopic abnormalities is also carried out.

Any abnormality of the urogenital system is a cause for temporary or permanent unfitness for aircrew duties. Proteinuria, unless orthostatic, is a cause for rejection. Glycosuria will require detailed investigations and disposal as per the results. Renal glycosuria is not a cause for rejection.

History of evidence of urinary infection or haematuria will require full investigations before a person can be considered fit. Cases of acute nephritis who made complete recovery and have no proteinuria may be considered fit for aircrew duties after a minimum surveillance of one year following recovery. Cases of chronic nephritis and those who had nephrectomy will be rejected. Cases of renal colic and calculi will require detailed urographic investigations; those with calculi are rejected.

Methods of assessment of fitness for military aviation duties in various NATO countries (1) are similar to those of IAF. Orthostatic proteinuria is a cause of unfitness for aircrew duties in the three services of the US and in the Norwegian Air Force. However, this condition is considered compatible with fitness in the Air Forces of Belgium, Canada, France, UK and West Germany. Persistent glycosuria, regardless of cause including renal glycosuria, is disqualifying at the initial examination for military aviation duties in all the NATO countries. The French regulations require estimation of post-prandial blood glucose levels as a routine whereas the German Air Force carries out an oral glucose tolerance test on all applicants for aircrew duties. In trained aircrew, only the Belgian regulations consider renal glycosuria compatible with fitness for flying duties. French and UK regulations consider reversible alimentary or intermittent glycosuria compatible with flying after sufficient observation in a hospital or after the use of an appropriate diet.

While the presence of a calculus in the pelvis of the kidney, the ureter or

the bladder is a cause for rejection at the initial medical examination in all the NATO countries, all except UK accept candidates with a history of unilateral renal calculus or who have had a single attack of renal or ureteral colic provided the calculus has been passed and detailed investigations do not show any anatomical or functional anomaly. The UK regulations reject candidates who have a history of renal colic or renal calculi. The US regulations consider a history of bilateral renal calculi as a cause for rejection both at initial and periodic examinations. All the NATO countries agree that past history of urinary lithiasis in a trained aircrew may be compatible with fitness if the calculus has been passed and if the urinary tract is anatomically and functionally normal. The US, Norwegian, Canadian, French and German regulations consider nephrectomy, for whatever reason, cause for permanent unfitness both at initial examination and periodic examination. The German regulations state that a history of pyelotomy is acceptable for fitness for flying. The Belgian and UK regulations accept a history of nephrectomy after trauma provided the other kidney is healthy.

Renal ptosis is a cause for rejection in the regulations of all NATO countries. While chronic diseases of the genitourinary tract are causes for rejection, acute or chronic urethritis if without complications and not of gonococcal origin is compatible with fitness for flying duties. According to German regulations, in periodic examinations, minor chronic prostatitis, slight hypertrophy of prostate and minor urethral strictures with only minor urinary troubles are compatible

with fitness. In these regulations, varicocele and hydrocele are causes for rejection if large or painful.

#### Flying Environment and Urinary System

Diseases of the urinary system can result in acute illness capable of causing sudden incapacitation or chronic state of general ill health. Thus, there is universal agreement on the principle that most of these diseases render a flyer medically unfit to handle an aircraft safely either temporarily or permanently.

There is some evidence to suggest that flying environment per se may cause some changes in the urinary system of a healthy aircrew. Didier et al (6) have found that urinary lithiasis was detected in 3% of aircrew whereas its incidence was 1% in the general population. Bellanger (2) has reported more frequent incidence of symptoms of renal lithiasis in aircrew than in ground personnel. Among the aircrew, transport pilots seem to be more prone to calculus diseases (7) and proteinuria (10) as compared to fighter pilots. In a study of 146 military flight personnel who underwent intravenous urography, 37% had nephritic colic and among these 48% showed abnormal urograms in the form of lithiasis (46%) and congenital anomalies (52%). Lithiasis was also found in about 40% of the patients presenting with haematuria and 22% presenting with pyuria. Galban (7) has reported that 1.7% of French Air Force personnel experienced one or more episodes of nephritic colic associated with probable lithiasis in 50% of them. In his study, lithiasis was found to be more common in older subjects, in

personnel stationed overseas and less common in fighter pilots than in transport pilots regardless of age. Delahaye et al (4) found more than 50% of cases of urinary lithiasis in aircrew above the age of 30 years.

Various aetiological factors have been considered for the increased incidence of lithiasis and proteinuria among the aircrew. Sedentariness, diet, prolonged immobility, increased cockpit temperature, oliguria and postponed urination are some of the factors suggested by various authors (5,6) as possible mechanisms leading to stasis in urinary tract resulting in inflammatory episodes and calculosis. Acceleration forces during flight may cause the descent of kidney during +Gz leading to proteinuria and stasis in urinary tract favouring lithiasis (9). Anton and Nastoiu (2), in a study during 6 hours of supersonic flight, reported increased urinary pH, drug residue, calcium content and concentrations of sodium chloride, phosphorus and oxalate as well as decreased urinary density, potassium content, creatine and urea. Lower age groups had higher output than older group. Output was higher during cool seasons. Nayar (11) has reported urinary disorders to be the cause of 0.6% of permanent unfitness and 4.8% of temporary unfitness among civil aircrew in India.

#### Material and Method

The limited objective of this study was to assess the incidence of urinary disorders among the aircrew evaluated at Institute of Aviation Medicine, IAF. Data of medical evaluations conducted between January, 1976 and December,

1985 were analysed and medical documents of aircrew who were evaluated for urinary diseases examined in detail.

#### Results and Discussion

Analysis of a total of 11,740 medical evaluations held during the 10 years period shows that only 47 evaluations (0.4%) were carried out for assessment of fitness of aircrew with various urinary disorders. These 47 medical boards were held on 17 aircrew - 15 pilots and 1 flight navigator from IAF and one pilot from the Navy. As the medical documents of five subjects were not locally available, detailed study of only 12 cases is reported here.

Table 1  
Age Distribution (N=12)

Age (Yrs)	No.	%age
< 25	3	25.0
25.1 - 30	2	16.6
30.1 - 35	2	16.6
35.1 - 40	3	25.0
40.1 - 45	1	8.3
> 45	1	8.3
Total	12	99.8

The age-wise distribution of the 12 aircrew is given in Table I. 41.6% of the subjects were below 30 years of age, 41.6% between 30 and 40 years and 16.6% above 40 years.

Table II indicates the flying experience of the affected aircrew. 33.3%

Table II  
Total Flying Experience (N=12)

Flying Hours	No. of aircrew	%age
< 1000	4	33.3
1000 - 2000	3	25.0
2001 - 3000	0	0
3001 - 4000	3	25.0
4001 - 5000	1	8.3
> 5000	1	8.3
Total	12	99.8

of the pilots had less than 1000 hours of flying. 58.3% had between 1000 and 5000 hours and 8.3% had over 5000 hours of flying experience.

The 12 subjects included five fighter pilots (41.7%), six transport/helicopter pilots (50%) and one flight navigator (8.3%). Two pilots had predominant experience in helicopter flying.

The diagnoses of the renal diseases in the 17 aircrew are given in Table III. Medical documents of four cases of urolithiasis and one case of urinary tract infection were not available for detailed study.

#### Urolithiasis

Analysing the mode of presentation, it is seen that five out of the six cases whose documents were studied had developed acute colicky pain and microscopic/trank haematuria. The sixth case was asymptomatic and on routine radiological examination of the spine for

Table III  
Urinary Disorders

Diagnosis	No of aircrew	%age
Urolithiasis	10	58.8
Contusion Kidney	1	5.9
Horse-shoe Kidney *	1	5.9
Renal Tuberculosis	1	5.9
Ureteric Stricture	1	5.9
Acute Nephritis	1	5.9
Acute UTI	1	5.9
Renal Cyst	1	5.9
Carcinoma Bladder	1	5.9

Note : \* Had renal calculus also.

high performance medical evaluation, he was detected to have a horse-shoe kidney with multiple renal calculi. Radiological examination including contrast studies demonstrated the calculi in all the six cases even though in one case where the colicky pain was on the left side the stone was visualised on the right side. The pain on the left side was probably due to crystalluria. There was a second case in this series, who demonstrated bilateral calculi. He developed a left sided ureteric calculus which was removed by cystoscopic basketting; but after 22 months he showed a calculus on the right side which was later removed by ureterolithotomy. In two cases the stones were passed spontaneously, in one case it was removed endoscopically and in two others ureterolithotomy was required. In two cases the stones were silent and in the substance of renal parenchyma, and as such left in situ.

Five of the six cases of urinary lithiasis were returned to flying. The young pilot with the horse-shoe kidney with multiple calculi was declared permanently unfit for flying duties. The average time taken to return to restricted flying duties was 4.25 months. All the five cases were given their final medical categories after an average time of 10.1 months from the onset of illness. Four of them were given full medical category of A1C1 whereas one case who had a silent calculus was awarded medical category A2G2 with the proviso to fly transport aircraft and helicopters only.

#### Conclusion

The present study shows that urinary system disorders are occasionally encountered among our aircrew most of the cases being of urinary lithiasis. The affected aircrew are being returned to flying duties after a reasonably minimum period of medical surveillance. Newer non-invasive methods of treating urinary lithiasis may further help to reduce the period of unfitness for aviation duties.

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