

# Incidence of Spinal Disability Amongst IAF Pilots — Follow up of 38 Cases

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## Abstract

**T**HIRTY EIGHT cases of spinal disability evaluated at IAM Bangalore have been presented. These include 26 cases of spinal fractures suffered due to ejections, crash landings, ejection testing trials and road accidents. Eleven cases were detected during routine medical examination. The pattern of vertebral fractures suffered due to various causes has been analysed. The disposal of these cases for fitness for flying duties has been discussed giving reasons for such disposal.

## Introduction

The human spine is subjected to undue stress and strain during flying. In transport flying the long flying hours itself may be the source of backache — if the spine is already disabled. In fighter flying repeated exposure to +Gz accelerations or to ejection forces may subject the disabled spine to excessive dynamic overloads and worsen the damage. Therefore spinal disability must be considered a liability to flying and assessment of spine in medical evaluation be given its due importance. Ejection is the most serious threat to spine, leading to spinal fractures in 25% of the ejectees. According to Henzel<sup>2</sup>, the presently accepted ejection acceleration levels generally exceed the structural breaking levels of the vertebral end-plates. And long term follow up of the ejectees will speak about the delayed effects of such undetected injuries. Crooks<sup>1</sup> in his follow up study of long term effects of ejection reported a number of cases of spinal disabilities arising even upto 5 years after ejection. He quotes cervical spondylosis rate amongst ejectees as 70% as against 25% amongst civilians of the same age group. Hirsch<sup>3</sup>, on the other hand in his study of Swedish Air Force Pilots quotes 14 cases with pre-

existing spinal disability which were not aggravated by ejection. All the 55 ejectees of Swedish Air Force were returned to flying within two months on the average as against 3-6 months for US Navy and RAF quoted by Walton et al<sup>6</sup>. In IAF present policy lays down 3 months as the minimum period of rest to fractured spine before an aircrew can be returned to active flying provided of course the recovery has been complete.

## Material and Method

38 cases of spinal disability evaluated at Institute of Aviation Medicine between 1968 to 1976 forms the material of the present study.

In all these cases, flying history, past history of ejection, ejection test rig, crash landing and road traffic accidents were recorded. All cases were subjected to detailed clinical examination of the spine and X-rays of spine were taken periodically during the period of follow up. Whenever necessary special tests like human centrifuge trials were carried out and complaints of the pilots were meticulously recorded. Scoliosis of the spine was accurately measured on the X-ray by Cobb or Risser Ferguson method.

## Findings

Table I shows the types of spinal disabilities. Amongst the two cases of congenital abnormalities of the spine, a case of spina bifida occulta was detected on X-ray after he complained of severe backache during a high G manoeuvre, and a case of hemi vertebra was detected on X-ray spine during routine medical examination. A total of 26 cases suffered vertebral fractures, 16 from ejection, 6 from crash

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landing, 2 from road accidents and 2 on ejection test rig trials. One case has been considered under two causes. This case sustained vertebral fracture from ejection and soon after discharge from hospital met with a road accident sustaining multiple vertebral fractures. 11 cases were found to have spinal deformity on routine medical examination. Thus 39 spinal disabilities have been considered for 38 cases. The cases quoted in brackets are secondary effects to primary disability of vertebral fractures.

Table II shows the distribution of fracture spine related to different causes. The largest number of vertebral fractures in ejection and crash landing falls at the dorso lumbar hinge over T<sub>11</sub>-L<sub>1</sub> and T<sub>12</sub>-L<sub>2</sub> respectively. The vulnerability of this part of spine to ejection and crash forces has been established by many workers like Lathan<sup>4</sup> and Stech<sup>5</sup>.

Of these 26 cases, 13 suffered multiple fractures. Of these 8 sustained fracture of 2 vertebrae and remaining 5 sustained fracture of 3 or 4 vertebrae. Amongst 16 ejectees who suffered fracture vertebrae, 8 had multiple fractures.

Table III gives the breakdown of cases of scoliosis. Amongst a total of 15 cases of lateral deviation of spine only 6 showed scoliosis of less than 10°, remaining 9 showed more than 10° angulation.

Table IV gives the precipitating factor and duration of backache of a total of 8 cases. In 4 out of these 8 cases backache was precipitated during high G manoeuvres. All these 4 cases had past history of ejection, crash landing or road traffic accidents, 2-3 years earlier.

Table V considers the disposal of 38 cases of spinal disability. It may be appreciated that not one case amongst them was found totally unfit for flying duties. Whilst 17 cases were returned to fighter flying duties, 21 others were found unfit to fly aircraft fitted with ejection seats. The guide lines adopted by us in the disposal of spinal disability cases are as follows:

(i) *Attenuation of ejection forces*: The normal spinal curvature helps in attenuating ejection forces. Any distortion of these curves will transmit the ejection forces unattenuated, thus accentuating the forces and exposing the vertebrae to increasing chances of damage. Spinal disabilities such as scoliosis of more than 10°,

TABLE I  
Causes and type of disability

Reasons for reporting	Fracture	Disabilities detected			
		Scoliosis	Kyphosis	Congenital	Osteoarthritic
+ Gz n = 1				1	
Ejection n = 17	16	(4)			1 (1)
Crash landing n = 6	6	(3)			
Road accident n = 2	2		(1)		
Ejection test rig trials n = 2	2		(1)		
Routine medical examination n = 11		7 (1)		1	2 (2)
Total	39	26	7 (8)	2	4 (3)

(figures in brackets-associated findings)

TABLE II  
Location of fracture spine

Cause of disability	Sl. No.	Fractures of vertebrae
Ejection	1	L1
	2	T1, T9, T12 & L1
	3	L4
	4	T11
	5	T8 & L1
	6	C5
	7	T11 & T12
	8	T11, T12 & L1
	9	T11 & T12
	10	C5
	11	L1
	12	C2 & L2
	13	T8
	14	T8 & T12
	15	T11
	16	T12 & L1
Crash landing	17	T5, T6 & T8
	18	T12
	19	T12
	20	L2
	21	T12
	22	L2
Road accident	23	T7, T8 & T9
	24	T11, T12 & L1
Ejection test rig trials	25	L1 & L2
	26	T4 & T5

TABLE III  
Cause and Degree of Scoliosis

Cause of Disability		Mild	Moderate	Severe
		0-10°	10-25°	More than 25°
Ejection	n = 5	3	1	1
Ejection test rig trial	n = 0	—	—	—
Crash landing	n = 7	1	2	—
Unknown	n = 8	2	3	2
Total	n = 15	6	6	3

TABLE IV  
Backache Duration Precipitating Factors

Precipitating Factor for Backache		0-2 yrs.	2-3 yrs.	3 yrs.
		Walking on uneven surface	n = 2	—
+ Gz	n = 4	—	1	3
Prolonged sitting and standing	n = 1	1	—	—
Occasional with movements	n = 1	—	—	1
Total	n = 8	1	2	5

TABLE V  
Disposal and disabilities considered

Sl. No.	Disabilities	Fit for full flying	Fit for transport a/c & helicopters	Unfit for flying
<b>1. Poor Ejection Risk</b>				
(i)	Spina bifida occulta	—	1	—
(ii)	Hemivertebra	—	1	—
(iii)	Moderate/severe scoliosis	—	8 (1)	—
(iv)	Kyphosis	—	2	—
(v)	Shift of vertebra	—	— (1)	—
(vi)	Multiple fractures with gross damage	—	1 (2)	—
(vii)	Wedging more than 30%	—	1 (1)	—
(viii)	Neurological complications of fractures	—	2	—
(ix)	Gross osteo arthritic changes	—	1 (5)	—
<b>2. Severe backache of long duration</b>				
	Cause unexplained precipitated, by + Gz	—	4	—
<b>3. Complete recovery without residual damage</b>				
		17	—	—
	Total n = 38	17	21 (10)	—

Figures in brackets indicate cases considered twice. One of them was considered thrice.

moderate degree of kyphosis, wedge compression fracture with compression more than 30% of vertebral body height, congenital abnormalities associated with poorly developed ligamental and muscular support and gross arthritic changes are some of the conditions which interfere with attenuation and shock absorbing qualities of human spine. Hence these spinal disabilities disqualify for fighter flying. This is in agreement with policy of disposal followed by USAF.

(ii) *Severe backache*: It is a symptom which itself precludes effective fighter flying where +Gz acceleration is routine and which aggravates backache.

(iii) *Neurological complications*: Such complications from the previous accident should be considered serious. A further damage to the same part of the spine in a future ejection is likely to cause irreparable damage to the spine and the neurological system.

(iv) *Multiple fractures*: Apart from involving many more vertebral end plates, multiple fractures are usually associated with other disabilities such as scoliosis, kyphosis etc. Such cases are cause for concern at a later date or in case of another ejection.

#### Recommendations

(i) Basal X-ray of the spine should be taken for all cadets before their entry into Air Force. Such

X-rays would form an excellent base line for comparison at a later date when spinal disability is detected.

(ii) Long term follow-up of all spinal disability cases should be undertaken especially for ejectees and cases of backache. Progress and incidence of various spinal disabilities among aircrew can be gauged.

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