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RESEARCH ARTICLE

Longer cumulative flight time is associated with an increased likelihood of surgical treatment for cervical and lumbar disc herniation in civil aviation personnel

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ABSTRACT

Objective: The aim of this study was to evaluate the occupational characteristics of civil aviation cabin crew and pilots who received medical or surgical treatment for lumbar or cervical disc herniation and to compare these characteristics with those of healthy controls, with a particular emphasis on age, sex, and cumulative flight time.

Method: In this retrospective study, civil aviation cabin crew members and pilots presenting with low back and/or neck pain were compared with healthy controls matched for age and sex. Sociodemographic characteristics (age and sex), occupational characteristics (years of service, cumulative flight time, and type of flight duty), treatments modalities, and magnetic resonance imaging (MRI) findings were recorded and analyzed.

Results: The mean age of affected personnel was 42.37±10.3 years (pilots: n=8, cabin crew: n=11), with the highest proportion of cases occurring in the 40–55-year age group. Males accounted for 73.7% of the surgical treatment group compared with 28.8% of the non-surgical treatment group. The rate of surgical treatment was significantly higher among personnel with cumulative flight times exceeding 15,000 hours, particularly among male pilots. Regression analyses demonstrated that male sex, age greater than 45 years, and cumulative flight time exceeding 15,000 hours were independently associated with an increased likelihood of requiring surgical intervention.

Conclusion: Our findings indicate that male sex, advancing age (particularly >45 years), and longer cumulative flight time are the primary risk factors associated with surgical treatment for lumbar and cervical disc herniation among civil aviation personnel. These results highlight the importance of early monitoring and preventive strategies for individuals at increased risk.

Keywords: Intervertebral disc displacement, vibration, aviation, flight hours

INTRODUCTION

Spinal disc herniation is an important public health problem that may lead to various neurological sequelae, including motor deficits and urinary incontinence, if not appropriately treated. Lumbar and cervical herniations can substantially impair quality of life, cause physical disability, and limit daily activities. They have been reported to represent the second leading cause of healthcare expenditure and loss of

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workforce productivity after cancer-related pain (1). Common clinical manifestations include radicular pain, restricted mobility, paresthesia, and muscle weakness (2). Spinal disc herniations most commonly affect middle-aged men and occur predominantly in the lumbar (90%) and cervical (10%) regions, whereas thoracic herniations are relatively rare (3–5). Cervical disc herniations most frequently occur at the C5–C6 level (approximately 55%), while lumbar disc herniations are most commonly observed at the L4–L5 and L5–S1 levels (3, 4). The choice between conservative and surgical treatment depends primarily on the degree of neural compression and the severity of symptoms.

Personal risk factors associated with spinal disc herniation include advanced age, male sex, White race, genetic predisposition, obesity, greater height, poor posture, limited spinal range of motion, muscle weakness, and poor physical fitness or low exercise capacity. Occupational risk factors include heavy lifting, repetitive pushing or twisting movements, prolonged sitting, poor working posture, exposure to vibration, and extended working hours (6–8). Previous studies involving aviation personnel exposed to multiple risk factors for spinal disorders have shown that whole-body vibration contributes to back and neck pain associated with degenerative spinal conditions (9–11). Several studies have reported an increased risk of cervical lordosis abnormalities, pain, lumbar disc herniation, and degenerative cervical spine changes among helicopter and military aircraft pilots. Furthermore, surgical treatment rates for lumbar disc herniation have been reported to be elevated in these populations (12–15). However, no studies have specifically investigated cervical and lumbar disc herniation among fixed-wing commercial airline pilots and cabin crew members. Therefore, evaluating the occurrence and treatment of these conditions in civil aviation personnel is of considerable clinical and occupational importance.

The aim of this study was to evaluate cervical and lumbar disc herniation and the associated medical and surgical treatment outcomes among pilots and cabin crew members employed in commercial aviation.

METHODS

Study Population

This retrospective study included civil aviation flight personnel who presented to the Flight Health Center in Istanbul, Turkiye, between January 2014 and December 2018. All data were obtained from institutional medical records. The study population consisted of individuals diagnosed with cervical or lumbar disc herniation based on clinical evaluation and radiological imaging, including magnetic resonance imaging (MRI) and/or computed tomography (CT). A total of 85 patients were identified and categorized into two groups according to treatment modality: a conservative treatment group (n=66) and a surgical treatment group (n=19). In addition, a control group consisting of 83 healthy airline personnel was included. Ethical approval was obtained from the institutional ethics committee.

Inclusion Criteria

- Civil aviation flight personnel (e.g., pilots and cabin crew members) presenting to the Flight Health Center during the study period.
- Age between 18 and 65 years.
- Diagnosis of cervical or lumbar disc herniation confirmed by MRI or CT findings with corresponding clinical symptoms.
- For the control group, healthy airline personnel with no history of spinal pathology, matched for age and sex.

Exclusion Criteria

- Previous cervical or lumbar spinal surgery.
- Presence of other spinal disorders or systemic diseases that could explain the symptoms, including but not limited to spinal tumors, infections, inflammatory diseases, fractures, or congenital abnormalities.
- Neurological disorders unrelated to disc herniation.
- Incomplete medical records or missing imaging data.
- Refusal to participate or withdrawal from the study.

Treatment Modalities

Surgical treatment was performed in patients with motor deficits or persistent symptoms despite conservative management and physical therapy. Patients who did not meet these criteria received conservative treatment, including nonsteroidal anti-inflammatory drugs, opioids, muscle relaxants, and physical therapy.

Statistical Analysis

Statistical analyses were performed using SPSS for Windows (version 20.0; IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for all variables and are presented as percentages and means ± standard deviations. Comparisons of normally

Table 1: Baseline characteristics of patients treated conservatively or surgically and healthy controls

	Conservative treatment (n=66)	Surgical treatment (n=19)	Healthy controls (n=83)	Total (n=168)	p
Age	32.5 (24.0–59.0)	40.0 (25.0–65.0)	34.0 (25.0–64.0)	34.0 (24.0–65.0)	**<0.01**[a]
Sex					**<0.01**[b]
Male	19 (28.8)	14 (73.7)	33 (39.8)	66 (39.3)	
Female	47 (71.2)	5 (26.3)	50 (60.2)	102 (60.7)	
Occupation					**<0.01**[b]
Cabin crew	60 (90.9)	11 (57.9)	69 (83.1)	140 (83.3)	
Pilot	6 (9.1)	8 (42.1)	14 (16.9)	28 (16.7)	
Duration of employment (years)	8.0 (1.0–30.0)	16.0 (2.0–36.0)	9.0 (1.0–35.0)	9.0 (1.0–36.0)	**<0.01**[a]
Cumulative flight time (hours)					**<0.01**[b]
<15,000	54 (81.8)	7 (36.8)	62 (74.7)	123 (73.2)	
≥15,000	12 (18.2)	12 (63.2)	21 (25.3)	45 (26.8)	
Cumulative flight time (×1,000 h)	9.6 (0.8–30)	16.8 (2.6–31.2)	10.4 (0.8–26.6)	10.6 (0.8–31.6)	**<0.01**[a]

a: Values are presented as median (minimum–maximum). Group comparisons were performed using the Kruskal–Wallis test. b: Values are presented as n (%). Group comparisons were performed using Pearson's Chi-Square test. Bold values indicate statistical significance (p<0.05).

Table 2: Distribution of treatment modalities according to disc herniation type

	Conservative treatment (n=66)	Surgical treatment (n=19)	Total (n=85)	p
Herniation type				0.23[a]
Lumbar	44 (66.7)	15 (78.9)	59 (69.4)	
Cervical	13 (19.7)	4 (21.1)	17 (20.0)	
Cervical + lumbar	9 (13.6)	0 (0.0)	9 (10.6)	

a: Values are presented as n (%). Group comparisons were performed using Pearson's Chi-Square test.

distributed continuous variables were performed using the independent-samples t-test. When the assumption of normality was not met, group comparisons were conducted using the Kruskal–Wallis test. Correlations between normally distributed variables were evaluated using Pearson's correlation coefficient. No adjustments were made for multiple comparisons and p-value <0.05 was considered statistically significant.

RESULTS

A total of 168 individuals were included in the study: 66 (39.3%) males and 102 (60.7%) females. The mean age of the study population was 35.4±8.4 years.

The median age (p=0.002) and duration of employment (p=0.002) were significantly higher in patients who underwent surgical treatment than in those who received conservative treatment and healthy controls. The sex distribution was similar between the conservative treatment and control groups. However, the proportion of males was significantly higher in the surgical treatment group than in the other two groups (p<0.01). Similarly, the distribution of occupational roles was comparable between the conservative treatment and control groups, whereas the proportion of pilots was significantly higher in the surgical treatment group (p<0.01). In addition, the proportion of personnel with cumulative flight times ≥15,000 hours was significantly greater in the surgical treatment group than in the conservative treatment and control groups. The distributions of cumulative flight time were similar between the conservative treatment and control groups (Table 1).

Among patients with disc herniation, 66.7% had lumbar disc herniation, 19.7% had cervical disc herniation, and 13.6% had combined cervical and lumbar disc herniation. Overall, 22.4% of patients required surgical treatment. No statistically significant association was found between herniation type and treatment modality (p=0.23) (Table 2).

Univariate logistic regression analysis identified increasing age (p<0.01), male sex (p=0.01), being a pilot (p<0.01), cumulative flight time ≥15,000 hours (p<0.01), and longer duration of employment

Table 3: Logistic regression analysis of factors associated with surgical treatment

	B	SE	Wald	Exp (B)	p
Male sex	1.983	0.651	9.283	7.267	**<0.01**
Cumulative flight time ≥15,000 h	2.091	0.638	10.757	8.093	**<0.01**
Constant	-3.083	0.622	24.58	0.046	

SE: Standard error. Bold values indicate statistical significance (p<0.05).

(p<0.01) as factors associated with surgical treatment. In the multivariable logistic regression model, sex and cumulative flight time remained significant independent predictors of surgical treatment. Males had a 7.267-fold higher likelihood of undergoing surgical treatment than females (p<0.01). Personnel with cumulative flight times ≥15,000 hours had an 8.903-fold higher likelihood of surgical treatment compared with those with fewer flight hours (p<0.01) (Table 3). Other variables included in the model, including being a pilot (p=0.58), age (p=0.71), and duration of employment (p=0.23), were not associated with surgical treatment.

DISCUSSION

Intervertebral disc herniation has been reported more frequently among aviation personnel operating helicopters and military aircraft than in the general population (2–4). In the present study, we evaluated the occupational characteristics and treatment outcomes of airline personnel diagnosed with lumbar and/or cervical disc herniation. Our findings demonstrated that personnel with cumulative flight times of 15,000 hours or more were significantly more likely to require surgical treatment.

Consistent with our findings, Ahsan et al. (16) reported an increased risk of lumbar disc herniation in occupations involving prolonged standing and heavy lifting. The authors suggested that poor posture, prolonged standing, heavy lifting, and physically demanding working conditions contributed to this increased risk. Several occupational factors associated with spinal disc herniation in other professions are also relevant to aviation personnel. For cabin crew members, prolonged standing and working in a constantly moving environment may contribute to spinal strain, whereas prolonged sitting and suboptimal posture may increase risk among pilots. In recent years, numerous studies have demonstrated a higher prevalence of low back and neck pain among aviation personnel compared with the general population. In a cross-sectional study of military pilots, 50% reported spinal pain during or after flights (17). Personnel working in airborne early warning and control systems have also been shown to be at increased risk of cervical pain and cervical lordotic abnormalities (15). Similarly, low back pain has been identified as a major occupational health problem among helicopter pilots (18).

Although these studies demonstrate an increased prevalence of neck and back pain among aviation personnel, the underlying pathological causes have not always been clearly defined. Neck and back pain may arise from various conditions, including disc herniation, spondylolisthesis, and muscular strain. Previous research has suggested that degenerative spinal changes typically associated with aging may develop earlier in military high-performance aircraft pilots (14). Furthermore, helicopter pilots have been reported to have a significantly increased risk of lumbar disc herniation compared with non-pilots (12). In a study of military pilots, it was reported that 7.4% of helicopter pilots with lumbar disc herniation were unable to continue flying duties because of complications related to their condition (13).

The increased risk of spinal pathology in aviation personnel has been attributed to poor posture and prolonged exposure to whole-body vibration (18, 19). Bongers et al. (20) reported that chronic back pain in helicopter pilots was associated with both vibration exposure and cumulative flight time. Similarly, Byeon et al. (9) demonstrated an association between increased flight time and degenerative changes in the cervical and lumbar spine among helicopter pilots. Aircraft generate whole-body vibration (WBV), which affects both crew members and passengers. WBV refers to low-frequency vibrations transmitted through contact surfaces, such as vehicle seats or workplace floors, to the entire body. Exposure to WBV has been associated with adverse effects on health, well-being, and occupational performance among pilots (21). Consistent with these findings, we observed that the likelihood of surgical treatment for disc herniation increased with cumulative flight time. No previous study in the literature has identified a specific flight-time threshold associated with a higher risk of surgically treated disc herniation. In the present

study, cumulative flight time was analyzed both as a continuous variable and using a threshold of 15,000 hours. In both analyses, as well as in the multivariable model, increased flight time was significantly associated with surgical treatment. Because of the retrospective nature of the study, we were unable to directly assess vibration exposure. One possible explanation for this finding is that increased flight time among airline personnel results in greater cumulative exposure to vibration, which may contribute to disease progression and more severe clinical manifestations.

In the present study, lumbar disc herniation accounted for 66.7% of cases, cervical disc herniation for 19.7%, and combined cervical-lumbar disc herniation for 13.6%. No association was observed between herniation type and the need for surgical treatment. Similarly, Mason et al. (13) reported that 74.2% of cases involved lumbar herniation and 25.8% involved cervical herniation, with no significant relationship between herniation type and surgical intervention. However, the rate of surgical treatment observed in our study (22.4%) was lower than the 66.6% reported by Mason et al. (13). Regression analysis further demonstrated that male sex was associated with surgical treatment for disc herniation. In contrast, Kelley et al. (11) found no sex-related differences in the prevalence of back pain among helicopter crew members.

One of the main limitations of this study is its retrospective design, which limited the availability of comprehensive data. In addition, long-term follow-up information was unavailable, preventing assessment of treatment outcomes and symptom resolution. Consequently, we were unable to determine the effectiveness of different treatment approaches. Several potential confounding factors associated with spinal disc herniation, including body mass index (BMI), genetic predisposition, height, postural characteristics, spinal range of motion, muscle strength, physical fitness, and exercise capacity, could not be evaluated. These variables may have influenced the observed associations. Another limitation is that cervical and lumbar disc herniations were analyzed together rather than as separate disease entities. Future studies examining these conditions independently may provide more clinically meaningful findings. Despite these limitations, to the best of our knowledge, this is the first study to provide detailed data on cervical and lumbar disc herniation and their treatment among fixed-wing commercial airline pilots and cabin crew members.

CONCLUSION

In conclusion, male sex and cumulative flight time exceeding 15,000 hours were the principal factors associated with surgical treatment for cervical and/or lumbar disc herniation among civil aviation personnel. Improved understanding of the mechanisms underlying spinal disc herniation in aviation personnel may facilitate the development of preventive strategies and assist in identifying individuals at increased risk of requiring surgical intervention. Nevertheless, the relatively small sample size of the present study should be considered when interpreting the results. Further studies with larger cohorts are needed to confirm and extend these findings.

Ethical Approval: The Ethics Committee for Science, Social Sciences and Non-Interventional Health Sciences Research at Istanbul Yeni Yuzyıl University granted approval for this study (Date: 07.01.2020, number: 2020/01).

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	Data acquisition	I.S.
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REFERENCES

1. Engels JA, Landeweerd JA, Kant Y. An OWAS-based analysis of nurses' working postures. Ergonomics 1994; 37:909-919. [CrossRef]
2. Chun SW, Lim CY, Kim K, Hwang J, Chung SG. The relationships between low back pain and lumbar lordosis: a systematic review and meta-analysis. Spine J 2017; 17:1180-1191. [CrossRef]
3. Camp CL, Conti MS, Sgroi T, Cammisa FP, Dines JS. Epidemiology, treatment, and prevention of lumbar spine ınjuries ın major league baseball players. Am J Orthop 2016; 45:137-143.

4. Kuijper B, Tans JT, Schimsheimer RJ, van der Kallen BF, Beelen A, Nollet F, et al. Degenerative cervical radiculopathy: diagnosis and conservative treatment. A review. Eur J Neurol 2009; 16:15-20. [CrossRef]

5. Roh JS, Teng AL, Yoo JU, Davis J, Furey C, Bohlman HH. Degenerative disorders of the lumbar and cervical spine. Orthop Clin North Am 2005; 36:255-262. [CrossRef]

6. Deyo RA, Rainville J, Kent DL. What can the history and physical examination tell us about low back pain? JAMA 1992; 268:760-765. [CrossRef]

7. Rihn JA, Kurd M, Hilibrand AS, Lurie J, Zhao W, Albert T, et al. The influence of obesity on the outcome of treatment of lumbar disc herniation: analysis of the Spine Patient Outcomes Research Trial (SPORT). J Bone Joint Surg Am 2013; 95:1-8. [CrossRef]

8. van Tulder MW, Assendelft WJ, Koes BW, Bouter LM. Spinal radiographic findings and nonspecific low back pain. A systematic review of observational studies. Spine (Phila Pa 1976) 1997;22:427-434. [CrossRef]

9. Byeon JH, Kim JW, Jeong HJ, Sim YJ, Kim DK, Choi JK, et al. Degenerative changes of spine in helicopter pilots. Ann Rehabil Med 2013; 37:706-712. [CrossRef]

10. Hansen OB, Wagstaff AS. Low back pain in Norwegian helicopter aircrew. Aviat Space Environ Med 2001; 72:161-164.

11. Kelley AM, MacDonnell J, Grigley D, Campbell J, Gaydos SJ. Reported back pain in army aircrew in relation to airframe, gender, age, and experience. Aerosp Med Hum Perform 2017; 88:96-103. [CrossRef]

12. Knox JB, Deal JB Jr, Knox JA. Lumbar disc herniation in military helicopter pilots vs. matched controls. Aerosp Med Hum Perform 2018; 89:442-445. [CrossRef]

13. Mason KT, Harper JP, Shannon SG. Herniated nucleus pulposus: rates and outcomes among U.S. Army aviators. Aviat Space Environ Med 1996; 67:338-340.

14. Petrén-Mallmin M, Linder J. Cervical spine degeneration in fighter pilots and controls: a 5-yr follow-up study. Aviat Space Environ Med 2001; 72:443-446.

15. Shin YH, Yun C, Han AH. Cervical spine status of pilots and air-controllers of airborne early warning and control aircraft. Aerosp Med Hum Perform 2017; 88:476-480. [CrossRef]

16. Ahsan MK, Matin T, Ali MI, Ali MY, Awwal MA, Sakeb N. Relationship between physical work load and lumbar disc herniation. Mymensingh Med J 2013; 22:533-540.

17. Jones JA, Hart SF, Baskin DS, Effenhauser R, Johnson SL, Novas MA, et al Human and behavioral factors contributing to spine-based neurological cockpit injuries in pilots of high-performance aircraft: recommendations for management and prevention. Mil Med 2000; 165:6-12. [CrossRef]

18. Kåsin JI, Mansfield N, Wagstaff A. Whole body vibration in helicopters: risk assessment in relation to low back pain. Aviat Space Environ Med 2011;82:790-796. [CrossRef]

19. Hill TE, Desmoulin GT, Hunter CJ. Is vibration truly an injurious stimulus in the human spine? J Biomech 2009; 42:2631-2635. [CrossRef]

20. Bongers PM, Hulshof CT, Dijkstra L, Boshuizen HC, Groenhout HJ, Valken E. Back pain and exposure to whole body vibration in helicopter pilots. Ergonomics. 1990; 33:1007-1026. [CrossRef]

21. Yépez V, Arcentales I, León M, Caiza P. Vibration effects of the fixed-wing aircraft of the army aviation from Ecuador on the human body. In: Developments and Advances in Defense and Security: Proceedings of MICRADS 2020. Cham: Springer; 2020. p. 353-362. [CrossRef]