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Effect of Seasonal Changes on Cervical Fractures: Antalya Province

Umut Ogün Mutlucan[1], Ökkeş Zortuk[2], Cihan Bedel[3], Fatih Selvi[3], Cezmi Çağrı Türk[1], and Günay Yıldız[3]

[1]Department of Neurosurgery Health Science University, Antalya Training and Research Hospital, Antalya, Turkey

[2]Department of Emergency Medicine, Defne State Hospital, Hatay, Turkey

[3]Department of Emergency Medicine, Health Science University, Antalya Training and Research Hospital, Antalya, Turkey

Abstract: Aim: Cervical fractures represent a critical type of spinal injury, with the majority occurring in the cervical spine, which is both the most mobile and vulnerable part of the spine. Given the dearth of studies in the literature examining the relationship between cervical fracture and season, our objective was to investigate this relationship and its potential interactions with climate. **Materials and Methods:** The study analysed servical fracture patients who visited the emergency department of a tertiary training and research hospital between 01.01.2023 and 12.31.2023. The data set comprised the following variables: daily average air temperature (, dew point, humidity, weather conditions, wind speed, atmospheric pressure and precipitation. These meteorological parameters were obtained via an application programming interface (API), where historical weather data is stored, and subsequently matched with patient records. **Results:** A total of 82 cases of cervical fractures were followed, of which 40 underwent surgical operations. The average humidity was 55.39 ± 21.6%. These results demonstrate a significantly lower humidity level on days with fractures (p = 0.029). The results of the month-by-month comparison revealed no statistically significant difference in the incidence of fractures, surgically treated fractures, or fractures treated observationally (p=0.774, 0.611, and 0.906). The comparison of the data according to season revealed no statistically significant difference (p=0.650, 0.966, 0.681). **Conclusion:** The incidence of cervical fractures does not appear to be affected by seasonal factors such as weather conditions, temperature, wind, and pressure. However, humidity does seem to exert an influence.

Keywords: Servical Fracture, Seasonality, Prevalanca.

INTRODUCTION

Cervical fractures represent a critical type of spinal injury, with the majority occurring in the cervical spine, which is both the most mobile and vulnerable part of the spine. These injuries can result from various causes, including trauma from accidents and degenerative conditions such as osteoporosis. The management and diagnosis of cervical fractures are of paramount importance due to the potential for severe neurological consequences, including paralysis and death (Segi, N. A.-O). The relationship between cervical fractures and climate, weather, and seasonal changes is complex and multifaceted, and further investigation is warranted. A number of studies have investigated the impact of these factors on the prevalence and risk of cervical and other types of fractures. (Chen, H. J). The findings indicate that specific meteorological conditions, particularly those associated with the winter season, may contribute to an elevated risk of fractures, including those affecting the cervical spine. Such occurrences are frequently attributable to environmental hazards, including snow and ice, which can precipitate falls and other mishaps. (Wilson, R. A.-O). A well-established correlation exists between low temperatures and an elevated risk of bone fractures. In Norway, for instance, a higher prevalence of forearm and hip fractures occurs during the winter months, which is attributed to the effects of cold ambient temperatures. (Dahl, C. A.-O). The occurrence of adverse weather conditions, such as icy road surfaces, has been identified as a potential predictor of fracture epidemics. Such conditions frequently result in an elevated incidence of low-energy fractures, which are typically managed in outpatient settings. (Murray, I. R). The incidence of fractures is higher in the elderly population during the winter months, although specific weather phenomena such as temperature and atmospheric pressure did not demonstrate a statistically significant correlation with fracture incidence. However, a high biotropic index, which considers various weather factors, was significantly related to fracture incidence (Burget, F). In Poland, a decrease in forearm and hip fractures was observed during colder seasons, while an increase in humerus and lumbar fractures was noted. These changes were correlated with mean temperature variations (Jedynasty, K). Given the dearth of studies in the literature examining the relationship between cervical fracture and season, our objective was to investigate this relationship and its potential interactions with climate.

MATERIALS AND METHODS

The study analysed servical fracture patients who visited the emergency department of a tertiary training and research hospital between 01.01.2023 and 12.31.2023, after receiving ethics committee

***Corresponding Author:** Cihan Bedel

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approval and being referred for treatment from the emergency room.

The study included servical Fracture patients who were 18 years or older, while excluding non-fracture patients, those under 18 years of age, and those with missing data.

Meteorological Data

The study documented the meteorological conditions on the days patients were admitted to the hospital. The data set comprised the following variables: daily average air temperature (in Celsius), dew point (in Celsius), humidity (as a percentage), weather conditions (fair, cloudy, windy, or rainy), wind speed (in rpm), atmospheric pressure (in inches), and precipitation (in inches). These meteorological parameters were obtained via an application programming interface (API), where historical weather data is stored, and subsequently matched with patient records. The data source for this study was the WaterGround website (https://www.wunderground.com). The study focused on data from the Murtapaşa region of Antalya (zip code: 07030), where the hospital is situated.

STATISTICAL ANALYSIS

The data for this study were analyzed using IBM SPSS Statistics 27, and the graphics were prepared using GraphPad Prism 8. The database was constructed using data obtained from the hospital information management system and data obtained through the application programming interface (API). Categorical data were analyzed using frequency and percentage values, while numerical data were analyzed using normal distribution analysis. Data that exhibited a normal distribution were presented as mean ± standard deviation, whereas data that did not follow a normal distribution were presented as median (interquartile range).

The analysis of categorical variables was conducted using the Chi-square test, while numerical variables that conformed to a normal distribution were analyzed using the t-test. Nonparametric tests were employed for numerical variables that did not conform to a normal distribution. ROC analysis was performed for numerical values that demonstrated significant results in the comparisons. Results with a p-value below 0.05 were considered significant.

RESULTS

A total of 82 cases of cervical fractures were followed, of which 40 underwent surgical operations. No significant relationship was observed between the need for surgery and gender (p=0.534). The mean age of the surgical group was 42.25±16.34, which was significantly lower compared to those who did not undergo surgery (p=0.036) (Table 1).

The average humidity was 49.52 ± 19.8% on the 72 days when fractures were observed, while on the 293 days without fractures, the average humidity was 55.39 ± 21.6%. These results demonstrate a significantly lower humidity level on days with fractures (p = 0.029). On the 37 days when fractures were treated with observation, the average humidity was 48.51±21.4%, compared to an average of 54.88±21.3% on days without fractures. There was a significantly lower humidity on days with observed fractures (p=0.029). Table 2 presents the relationship between seasonal variations and cervical fractures.

Table 3 presents an analysis of the correlation between fracture days, follow-up or surgery days, and other days with weather conditions.

The results of the month-by-month comparison revealed no statistically significant difference in the incidence of fractures, surgically treated fractures, or fractures treated observationally (p=0.774, 0.611, and 0.906, respectively; Figure 1). The comparison of the data according to season revealed no statistically significant difference (p=0.650, 0.966, 0.681, respectively; Figure 2).

DISCUSSION

Cervical fractures represent a significant concern in the fields of trauma and orthopedics, exhibiting distinct epidemiological patterns influenced by a range of factors, including demographic characteristics, injury mechanisms, and geographical variations (Marcon, R. M). In the United States, the incidence of cervical fractures has been increasing, with a significant rise observed in the elderly population. A study utilizing the National Electronic Injury Surveillance System (NEISS) reported an overall incidence rate of 5.2 per 100,000 person-years, with a notable increase observed in the elderly population, particularly those over 80 years of age. In individuals under the age of 0 years, an incidence rate of 47.9 per 100,000 person-years was observed (Turner, T. *et al.*, 2022). In cases of unstable or displaced fractures, surgical intervention is often indicated. The most common surgical procedures include anterior decompression and fusion. The implementation of

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clinical decision rules, such as the Canadian C-Spine Rule, enables the categorization of patients for imaging and the identification of the most appropriate management pathway (Beeharry, M. W).

The relationship between cervical fractures and climate-related injuries is complex and influenced by various meteorological factors. Climate change, with its associated extreme weather conditions, has been shown to impact the incidence of injuries, including fractures (Dahl, C. *et al*., 2021). Cervical fractures, a subset of these injuries, are particularly influenced by seasonal and weather-related factors, which can exacerbate the risk of falls and other trauma leading to such injuries (Eng, S. F. *et al*., 2022). Temperature variations: Research suggests that colder climates and lower temperatures are associated with an increased risk of fractures. For example, one study found that each 1°C increase in temperature was associated with a 3.0% decrease in fracture risk, suggesting that colder conditions increase the risk of fractures, including cervical fractures (Shi, T). Similarly, colder climates have been associated with higher rates of fall-related deaths and fractures in certain populations, such as white women (Hemenway, D. *et al*., 1990). Specific meteorological conditions, including snow and freezing rain, have been identified as significant risk factors for fractures. These conditions increase the probability of falls, which can result in cervical spine injuries. In particular, snow has been identified as a risk factor for cervical spine injuries resulting from severe falls, especially during the heating season in Northern China. (Hasler, R. M. *et al*., 2014). The incidence of cervical spine injuries tends to increase during the winter months. This is attributed to the increased prevalence of snow and icy conditions, which contribute to falls and subsequent injuries. The study conducted in northern China highlighted that snow during the heating season significantly increased the risk of cervical spine injury due to falls. Heating season: In regions with a distinct heating season, such as northern China, the prevalence of cervical spine injuries is significantly higher. This period is characterised by frequent snow and fog, which contribute to hazardous conditions leading to falls and injuries (Yang, S. *et al*., 2013). In our study, we observed that factors other than humidity had no effect on cervical fractures, while we found that decreased humidity had a significant effect on the occurrence of fractures and fractures that could be treated with follow-up. Although the link between climate and cervical fractures is evident, it is essential to adopt a more comprehensive perspective. Climate change not only influences the prevalence of injuries but also presents significant challenges for health systems and policy-making. The necessity for sustainable practices and adaptation strategies in healthcare is paramount to mitigate the impact of climate-related injuries.

It should be noted that our study was not without limitations. Firstly, it should be noted that the data were analyzed retrospectively from the program, which may have introduced inaccuracies between the data and the conditions under which they were collected. Furthermore, the variability in climate conditions across different time periods represents another significant limitation. As prospective, multicenter studies are conducted, the value of this study will become more apparent.

TABLES

Table 1: Demographic data

	Surgery (n=40)	**Observation (n=42)**	**p-Value**
Gender (Male (%))	27 (67.5%)	29 (69.9%)	0.534
Age (Mean±SD)	42,25±16,34	51,26±21,58	0.036

Table 2: Seasonal changes on servical fracture

		Fracture Day			**Observational**			**Surgery**		
		Day (n)	Estimate	p-Value	Day (n)	Estimate	p-Value	Day (n)	Estimate	p-Value
Temperature	No	293	22,01±7,99	0,498	328	22,08±7,94	0,56	327	22,15±7,98	0,955
	Yes	72	22,77±7,83		37	22,89±8,20		38	22,23±7,88	
Dew Point	No	293	11,27±7,48	0,388	328	11,23±7,42	0,364	327	11,20±7,47	0,474
	Yes	72	10,43±7,45		37	10,05±7,91		38	10,28±7,51	

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Humidity(%)	No	293	55,39±21,6	**0,029**	328	54,88±21,3	**0,029**	327	54,74±21,7	0,189
	Yes	72	49,52±19,8		37	48,51±21,4		38	49,92±17,9	
Wind Speed(km/h)	No	293	13,44±7,98	0,788	328	13,35±7,96	0,086	327	13,57±8,00	0,578
	Yes	72	13,72±7,88		37	14,72±7,89		38	12,81±7,62	
Wind Gust	No	293	0 (0)	0,79	328	0 (0)	0,323	327	0 (0)	0,494
	Yes	72	0 (0)		37	0 (0)		38	0 (0)	
Pressure(hPa)	No	293	1007,±5,94	0,393	328	1007,±5,97	0,257	327	1007,±5,88	0,64
	Yes	72	1006,±6,09		37	1006,±5,94		38	1007,±6,74	

Table 3: Condition compare

	Fracture Day	**Observatiyon**	**Surgery**
Fair	39 (54,2)	18 (48,6)	23 (60,5)
Windy	3 (4,2)	1 (2,7)	2 (5,3)
Rainy	4 (5,6)	2 (5,4)	2 (5,3)
Cloudy	26 (36,1)	16 (43,2)	11 (28,9)
p-Value	0,876	0,952	0,48

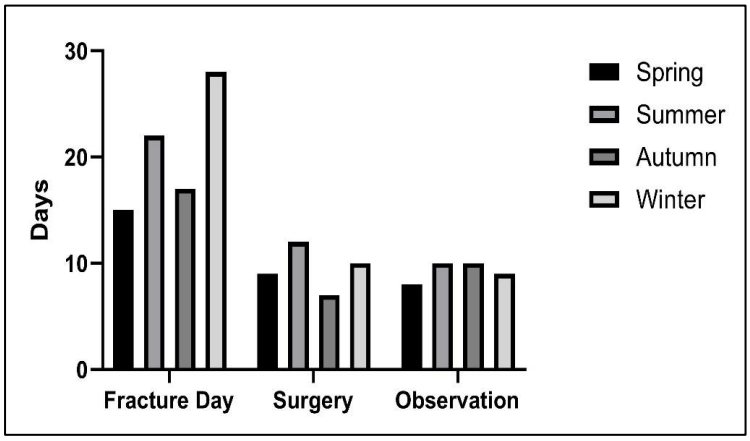

Figure 1: Number of days with cervical fractures according to seasons

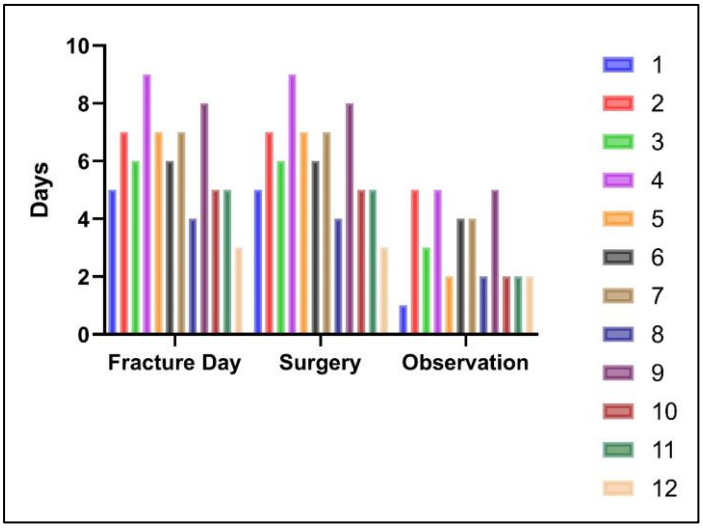

Figure 2: Number of days with cervical fractures by month

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CONCLUSSIONS

The incidence of cervical fractures does not appear to be affected by seasonal factors such as weather conditions, temperature, wind, and pressure. However, humidity does seem to exert an influence.

ETHICAL APPROVAL

The study was conducted with the approval of the SBU Antalya Training and Research Hospital Non-Interventional Clinical Studies Ethics Committee and was designed in accordance with the principles set forth in the Declaration of Helsinki.

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