

# CHRONIC DISEASES AND SPONDYLODISCITIS

Róbert Čellár<sup>1</sup>, Erik Dorko<sup>2</sup>, Kvetoslava Rimárová<sup>2</sup>, Dávid Sokol<sup>1</sup>, Ahmad Gharaibeh<sup>1</sup>, István Mitró<sup>1</sup>, Rastislav Šepitka<sup>1</sup>, Viliam Knap<sup>3</sup>

<sup>1</sup>Department of Orthopaedics and Traumatology of Locomotory Apparatus, Faculty of Medicine, Pavol Jozef Šafárik University and Louis Pasteur University Hospital in Košice, Košice, Slovak Republic

<sup>2</sup>Department of Public Health and Hygiene, Faculty of Medicine, Pavol Jozef Šafárik University in Košice, Košice, Slovak Republic

<sup>3</sup>Department of Physiatry, Balneology, and Medical Rehabilitation, Faculty of Medicine, Pavol Jozef Šafárik University in Košice, Košice, Slovak Republic

## SUMMARY

**Objective:** Our research was focused to find a relation between the occurrence of spondylodiscitis and occurrence of chronic diseases. We were trying to discover some new risk factors and relations between chronic disorders in our research group. This analysis was also focused to detect factors that prolong the hospitalization of patients and worsen their prognosis.

**Methods:** A study was carried out involving patients with spondylodiscitis treated between 2013 and 2022. A statistical analysis expressed by several coefficients was calculated in software IBM SPSS 21.

**Results:** The study group comprised 32 (53.3%) females and 28 (46.7%) males. During the period the overall incidence of spondylodiscitis was increasing (except the year 2020 where only 2 patients were treated) with a peak in 2019. The average age of patients was 69.3 ( $\pm 12.3$ ) years, and the highest incidence was in the age group 60–69 years ( $n = 19$ , 31.7%). The most impacted vertebral region was lumbar ( $n = 29$ , 48.3%). The most prevalent associated comorbidity was some cardiovascular disorder ( $n = 39$ , 65%) followed by diabetes mellitus (DM) ( $n = 23$ , 38.3%). Genitourinary system was the most common source of primary infection ( $n = 22$ , 36.7%). Average length of stay was 34.3 ( $\pm 14.5$ ) days and surgery prolonged hospitalization period. Mortality rate was 1.7%.

**Conclusion:** The results of our study are confirmed by the data of other European and non-European studies. We confirmed diabetes mellitus and hypertension as the most common non-infectious risk factors of spondylodiscitis and the presence of pathogens in genitourinary system as the most frequent source of primary infection.

**Key words:** spondylodiscitis, chronic diseases, risk factors, length of stay

**Address for correspondence:** E. Dorko, Department of Public Health and Hygiene, Faculty of Medicine, Pavol Jozef Šafárik University in Košice, Šrobárova 2, 041 80 Košice, Slovak Republic. E-mail: erik.dorko@upjs.sk

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## INTRODUCTION

Spondylodiscitis is a severe and potentially life-threatening infection of the intervertebral disc and adjacent vertebral plates. Spondylodiscitis is typically diagnosed as a recalcitrant back pain unresponsive to conservative treatment. The disease is characteristic by elevated inflammatory markers presented with fever or without fever (1).

Spondylodiscitis (pyogenic osteomyelitis of vertebrae) is the most frequent haematogenous osteomyelitis in adults over the age of 50 (most frequently in 70–79 years old patients). The increasing incidence in the last 15–20 years is associated with the ageing of population and diagnostics development. According to Kramer et al., incidence of spondylodiscitis in Germany between 2005 and 2021 increased from 5.4 to 11 cases per 100,000 individuals (104% increase). Similar results were observed in France in 2010–2019 with increase from 6.1 to 11.3 cases per 100,000 individuals (85% increase). Mortality rate varies in range: from 5.2% in Germany (2), 7.3% in France (3) to 12.2 in Germany (4). Exact epidemiologic data for Slovakia are not available.

Advanced age, diabetes mellitus (DM), hypertension, rheumatologic diseases, HIV infection, previous steroid medication, immunodeficiency, invasive spinal interventions, and spinal osteoarthritis are the most influential risk factors for spondylodiscitis (5, 6). The most common source of infectious nidus is skin, respiratory, genitourinary, or gastrointestinal tract or the oral cavity. In one third of cases it is not possible to identify the primary nidus (7).

Our research was focused to find a relation between the occurrence of spondylodiscitis and occurrence of chronic diseases. We are trying to discover some new risk factors and relations between chronic disorders in our research group. This analysis was also focused to detect factors that prolong the hospitalization of patients and worsen their prognosis.

## MATERIALS AND METHODS

A study was carried out involving patients with spondylodiscitis treated between 2013 and 2022 at the Department of Orthopaedics and Traumatology of the Locomotory Apparatus, Louis

Pasteur University Hospital in Košice. All data of patients with spondylodiscitis (according to ICD-10 classification: diagnosis code M46) in the study period were selected from hospital files. All eligible patients were included in the study.

A statistical analysis was calculated using software IBM SPSS 21. To express the relations between nominal variables a crosstab was used and results defined by Cramer's V ( $\phi_c$ ). The Kolmogorov-Smirnov test was used to determine if an interval data set is well-modelled by a normal distribution and according to the results of this test parametrical or non-parametrical statistic was used. Comparison of median values between two groups is expressed by independent samples t test or Mann-Whitney U test. The effect size of these tests is expressed by Cohen's D (d). The relationship between two interval variables was calculated by Pearson correlation coefficient ( $r_{xy}$ ). Linear prediction of statistical models is expressed by coefficient of determination ( $R^2$ ). Significant difference is considered as a  $p < 0.05$ .

## RESULTS

For one decade period (2013–2022), 60 patients with the spinal region infection were treated. The research group comprised 32 (53.3%) females and 28 (46.7%) males, with female to male ratio 1.14. The youngest, 17 years old patient without any comorbidity was excluded from the study. During the period the overall incidence of spondylodiscitis was increasing (except the year 2020 where only 2 patients were treated) with a peak in 2019 (Fig. 1).

The highest incidence was in the age group 60–69 years ( $n=19$ , 31.7%), followed by the patients older than 80 years ( $n=15$ , 25%), and patients in the age group 70–79 years ( $n=14$ , 23.3%). In the 50–59 years old group we found 7 (11.7%) patients and 5 (8.3%) were younger than 50 years. The average age of patients was  $69.3 (\pm 12.3)$  years in the range from 36 to 89 years. Females were older ( $71.4 \pm 12.9$  years) than males ( $66.9 \pm 11.3$  years), but the difference was not significant ( $p=0.151$ ).

The vertebral regions were impacted as follow: lumbar ( $n=29$ , 48.3%), thoracic ( $n=18$ , 30%), lumbosacral ( $n=7$ , 11.7%), cervical ( $n=3$ , 5%), and thoraco-lumbar ( $n=3$ , 5%).

The most prevalent associated comorbidity was some cardiovascular disorder ( $n=39$ , 65%) followed by diabetes mellitus ( $n=23$ , 38.3%). Other comorbidities in our research group prevail as follows: thyroid gland disorders (TGD) ( $n=11$ , 18.3%), carcinoma ( $n=9$ , 15%), rheumatological disorders ( $n=7$ , 11.7%),

pulmonary disorders ( $n=7$ , 11.7%), liver disorders ( $n=7$ , 11.7%), and renal insufficiency ( $n=6$ , 10%). Eight (13.3%) patients were under immunosuppressive treatment. TGD were significantly more frequent in females ( $n=10$ , 90.9%) than in males ( $n=1$ , 9.1%) ( $\phi_c=0.36$ ,  $p=0.006$ ) and carcinoma was more common in males ( $n=7$ , 77.8%) than in females ( $n=2$ , 22.2%) ( $\phi_c=0.26$ ,  $p=0.042$ ). Liver disorders occur only in patients younger than 69 years ( $\phi_c=0.43$ ,  $p=0.026$ ), and cardiovascular diseases are more common in older patients ( $\phi_c=0.43$ ,  $p=0.024$ ) (Table 1).

In 25 (41.7%) cases, it was not possible to identify the primary source of infection. In others, the most common origin of infection was genitourinary system ( $n=22$ , 36.7%), respiratory system ( $n=7$ , 11.7%), and cardiovascular system ( $n=2$ , 3.3%). In other patients, there was colitis, amputation, or decubitus as a primary source of infection.

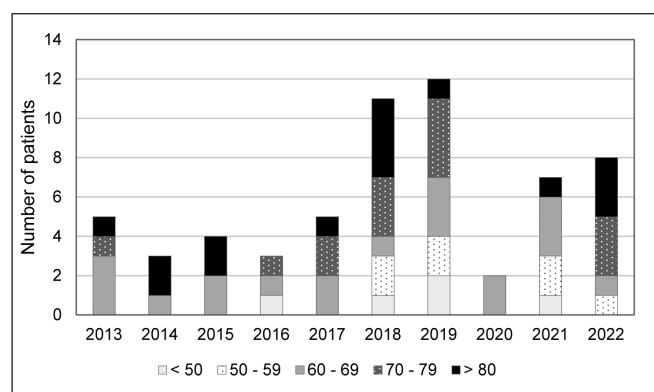
In patients with genitourinary infection there was unknown causative agent in 13 (59.1%) cases. In others, infection of *E. coli* ( $n=4$ , 18.2%), *Klebsiella pneumoniae* ( $n=2$ , 9.1%), *Candida albicans* ( $n=2$ , 9.1%), and *Pseudomonas aeruginosa* ( $n=1$ , 4.5%) was present.

Blood culture test revealed positivity in 11 (18.3%) patients. In 7 (63.6%) cases, *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus* (MRSA) was present in the blood. The blood of other patients was colonized with methicillin-resistant *Staphylococcus epidermidis* ( $n=1$ , 9.1%), methicillin-resistant *Staphylococcus haemolyticus* ( $n=1$ , 9.1%), *Streptococcus pneumoniae* ( $n=1$ , 9.1%), and *Enterobacter faecalis* ( $n=1$ , 9.1%).

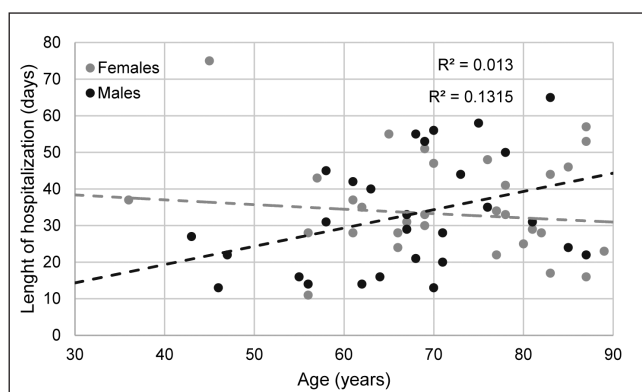
**Table 1.** Average age of patients with and without selected comorbidities

		Age Mean (SD)	d	p-value
Diabetes mellitus	No	71.8 (11)	0.56	0.041
	Yes	65.2 (13.3)		
Liver	No	70.7 (12.2)	0.67	0.017
	Yes	59 (7.2)		
Pulmonary	No	70.9 (11.4)	0.79	0.006
	Yes	57.6 (13.4)		
Cardiovascular	No	63.1 (14.1)	0.86	0.003
	Yes	72.6 (9.8)		

SD – standard deviation; d – effect size;  $p < 0.05$  – significant difference



**Fig. 1.** Number of patients in the last ten years period.



**Fig. 2.** Length of stay in relation to age of patients.

In 7 (11.7%) cases we found some neurological manifestation which was the cause of prolonged hospitalization ( $45.9 \pm 16.3$  days) in contrast to patients without neurological symptoms ( $32.8 \pm 13.7$  days) ( $d=0.63$ ,  $p=0.024$ ). Most patients ( $n=53$ , 88.3%) underwent conservative treatment, 7 (11.7%) patients were selected for surgery. In patients which underwent surgery, longer hospitalization period was observed ( $47.9 \pm 18$  days) in comparison to patients on conservative treatment ( $32.5 \pm 13.2$  days) ( $d=0.77$ ,  $p=0.007$ ).

Average length of stay was  $34.3 (\pm 14.5)$  days and in relation to age, the length of stay for males increased in direct proportion ( $r_{xy}=0.37$ ,  $p=0.050$ ) and in females remains unchanged (Fig. 2).

The average length of stay for patients who were discharged home ( $30.7 \pm 12.3$  days) was significantly shorter compared to patients who were transferred to another department ( $41.6 \pm 9.8$  days) ( $d=0.69$ ,  $p=0.015$ ). A longer period of hospitalization was observed in patients with infection in thoracic, thoraco-lumbar, and lumbar zones when compared to cervical or lumbosacral locations (Table 2). Mortality rate was 1.7%.

## DISCUSSION

Incidence of spondylodiscitis was also increasing in two German studies carried out from 2005 to 2021 or from 2010 to 2020, both with a peak in 2019 as in our study (2, 8). Decreased incidence in 2020 is recognized in most studies (2, 3, 8, 9, 10) and correlates with the COVID-19 pandemic. This observation may be related to decreased hospital attendance and delayed data collection but may be also related to lower infection rates due to public health measures.

These studies also define an age group from 60 to 89 years as a group with the highest incidence which is also confirmed by French study and agrees with this research (2, 3, 8). Average age in Japan study ( $69.2 \pm 13.9$  years) is the same as in our research ( $69.3 \pm 12.3$  years) (9).

The distribution of disease through vertebral region is similar in Brazil (5) and German studies (6, 8).

Cardiovascular disorder followed by DM were the most frequent comorbidities also in the French study (3) and their ratio was similar in the research of Schoof et al. (4). Danda and Castro (5) evaluated hypertension as a leading risk factor occurring in 42% patients. Only a few cases of patients with TGD (hypothyroidism, hyperthyroidism) are found in available publications. None but our study describes the presence of TGD in 18.3% of

patients. We attribute high prevalence of TGD in our study to higher prevalence of TGD in Slovak population (5–10%) than in other countries of Europe (0.2–5.3%) (11, 12). Akiyama et al. (9) indicate the same presence of carcinoma (15.6%) in patients with spondylodiscitis as in this study (15%). Our research indicates higher incidence of rheumatological disorders (11.7%) in patients with spondylodiscitis than Schoof et al. (7.3%) research and Danda and Castro study (4%) (4, 5). Schoof et al. reveal similar incidence of pulmonary (13.8%) and renal (11.6%) disorders. Number of patients with some liver disorder, e.g. liver cirrhosis, (11.7%) is within the range of studies of Akiyama et al. (1.9%), Schoof et al. (5.5%), and Lestin-Bernstein et al. (20%) (4, 9, 13). The ratio of immunosuppressive treatment (13.3%) is similar to ratio (12%) in the research of Danda and Castro (5) and to ratio (11%) of Lestin-Bernstein et al. study (13).

Genitourinary system was the most common source of preexisting infection also in the study of Chang et al. (14); they identify the pneumonia as the second most common (13.9%) comorbidity, which is similar to our results (11.7%).

The occurrence of *E. coli* (15.4%) in patients with spondylodiscitis in the study of Schoof et al. (4) is similar to our results (18.2%), and higher when compared to the Lestin-Bernstein et al. study (11%) (13). Widdrington et al. show almost the same ratio (18.9%) of diagnosed *E. coli* in patients with spondylodiscitis (15).

In the analyses of Stangenberg et al. (16) and Kim (17) is detected *Staphylococcus aureus* followed by *Staphylococcus epidermidis* as the most common blood culture microbial agent. The occurrence of microbial agents agrees with meta-analysis of Rose and Iossifidis (18).

According to Hohenberger et al. (19), any neurological deficit led to longer hospitalization period. Hohenberger et al. also indicate almost the same length of stay in patients with surgical treatment (46.7 days) when compared to our study (47.9 days), and very similar period in patients with conservative treatment (30.3 days) compared to our research (32.5 days) (19).

Meta-analyses of Kramer et al. and Thavarajasingam et al. show the prolonged hospitalization period according to higher age of patients (2, 20). Prolonged length of stay according to affected location has not been confirmed yet by other investigations.

## CONCLUSION

The results of our study are confirmed by the data of other European and non-European studies. We confirmed diabetes mellitus and hypertension as the most common non-infectious risk factors of spondylodiscitis and the presence of pathogens in genitourinary system as the most frequent source of primary infection. We do not assume a direct relationship between higher presence of TGD and spondylodiscitis.

Our study indicates longer period of hospitalization after surgery, but some studies indicate that early surgical management achieves the reduction of this period. We confirmed a directly proportional relationship between the patient's age and length of stay.

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**Table 2.** Average age of patients and length of hospitalization according to affected location

	Age Mean (SD)	Length of hospitalization Mean (SD)
Cervical	65.3 (15.3)	29.3 (13)
Thoracic	66.8 (14.5)	34.8 (14.2)
Thoraco-lumbar	62.7 (18)	40 (31.5)
Lumbar	72.8 (10.6)	35 (13.9)
Lumbosacral	65.6 (7)	29.7 (13)

SD – standard deviation

## Conflicts of Interest

None declared

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