Original article

Acute Myocardial Infarction Trends in the Population of the Nišava District

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SUMMARY

Acute myocardial infarction is the leading cause of premature morbidity and premature death worldwide. The aim of the paper was to determine the trends of acute myocardial infarction in the period between 2006 and 2019 in the population of the Nišava District.

A descriptive study was performed. Data about acute myocardial infarction incidence and mortality were obtained from the population registry for Acute Coronary Syndrome of Serbia. Crude, specific and age-standardized incidence and mortality rates per 100,000 persons were calculated as well as the trend lines.

A total number of 12,142 new cases of acute myocardial infarction (7,595 in males and 4,547 in females) were registered. Men suffered 1.7 times more often than females. An insignificantly decreasing acute myocardial infarction incidence trend $y = 0.4868x + 112.24$, $R^2 = 0.0029$ was recorded. A total of 3,925 persons died (2,260 males and 1,665 females). Men died 1.4 times more often than women and a significant decreasing mortality trend was recorded both males ($y = -1.6112x + 52.563$, $R^2 = 0.7779$) and in females ($y = -0.4956x + 22.81$, $R^2 = 0.3306$). A significant increasing mortality trend of acute myocardial infarction by age was determined $y = 11.152x - 34.519$, $R^2 = 0.7022$.

The trend of incidence tended to decrease however, without statistical significance, but insignificantly. The incidence and mortality rates were higher in men than in women for the whole observed period. Mortality trend significantly decreased both in men and in women and significantly increased with age.

Key words: acute myocardial infarction, incidence, mortality, sex, age

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INTRODUCTION

According to the Global Burden of Disease Study (GBD) 2017, cardiovascular diseases were responsible for 31.8% of all deaths worldwide and about half of all cardiovascular deaths were due to ischemic heart disease (IHD), which also declined by 9.7% during the period 2007 – 2017 (1).

IHD was the leading killer disease during the last decades worldwide (2, 3). In 2012, IHD caused 7.4 million deaths in the world (4) and IHD alone has been the most common cause of death in Europe, accounting for nearly 2 million deaths each year: nearly 22 per cent of all deaths in women and 21 per cent of all deaths in men (5).

In 2013, the number of people who died from IHD worldwide was more than 8.1 million, representing an increase of 41 per cent from 1990: the global increase in deaths was a result of population ageing (52.5% increase from 1990) and population growth (23.6% increase from 1990) (3). In addition, three-fourths of global deaths due to IHD occurred in the low- and middle-income countries (6).

Generally, mortality rates from IHD have been higher in Central and Eastern Europe than in other regions (5, 6). Mediterranean countries (such as Spain, Greece) have been historically considered as those of 'low risk' for IHD (9). Since 1970s, death rates from IHD have been falling rapidly in North America and many Northern and Western European countries but rising rapidly in some Central and Eastern European countries (7). Slovakia was an exception as well as several countries in Latin America, where rates varied very slightly from year to year during the last decades (8). Around two-thirds of the decline in IHD mortality were due to a decline in exposure to cardiovascular risk factors and the remaining one-third was due to improvements in treatment (9).

The etiology of IHD has not been entirely clear yet, but advancing age, smoking, overweight/obesity, high level of blood cholesterol, hypertension and diabetes mellitus were recognized as major risk factors for IHD (10 - 12). There is no direct evidence, but some contemporary risk factors (such as infectious agents, C-reactive protein) have been associated with IHD (12).

Serbia ranks among the countries with intermediate mortality rates for IHD in the world (13).

The aim of the paper was to determine trends of acute myocardial infarction based on incidence and mortality rates between 2006 and 2019 in the population of the Nišava District.

PARTICIPANTS AND METHODS

A descriptive study was done. Data were obtained from the population registry for Acute Coronary Syndrome of Serbia (14). Data were extracted for the population aged from 0 up to 75 years of age, from the territory of the Nišava District. Acute myocardial infarction (AMI) was coded according to the Tenth Revision of International Classification of Diseases-ICD-(codes I21 and I22), (15).

Crude, specific and age-standardized incidence and mortality rates (ASRs) per 100.000 inhabitants were calculated during the period 2006 - 2019 using the direct method according the World Standard population. Data about population were obtained from Censuses 2002 and 2011.

As we have used already published the official data an approval of Ethical Committee was not needed, link:

http://www.batut.org.rs/index.phpcontent=186

Statistical analysis

Statistical analyses were performed using the SPSS version 20. Trend lines were calculated. The p-value below 0.05 (p < 0.05) was considered significant.

RESULTS

A total number of 12,142 new cases (7,595 in males and 4,547 in females) were registered in the period 2006 - 2019. The average number of newly diagnosed cases were 867 and they were 1,7 times more often in men than women.

The number of new and the number of fatal cases, annual standardized incidence and mortality rates are presented in Table 1.

A total number of fatal cases were 3,925 (2,260 in males and 1,665 in females). The average number of fatal cases was 280. Men died 1,4 times more often than women on average.

Annual standardized incidence rates of AMI in men ranged from 76.2/100,000 (2016) up to 270.5/100,000 (2018). In women, annual standardized incidence rates ranged from 38.8/100,00 (2016) to 125.1/

Table1. *Age-standardized incidence and mortality rates (per 100,000 population) of acute myocardial infarction in male and female population of the Nišava District, 2006 - 2019*

Year	Male				Female			
	No of cases	*ASR of Incidence	No of deaths	*ASR of Mortality	No of cases	*ASR of Incidence	No of deaths	*ASR of Mortality
2006	696	196.8	166	46.3	524	116.6	123	23.8
2007	661	167.7	173	45	348	73.3	99	17.6
2008	596	174.4	185	49.4	337	69.9	102	17.2
2009	579	159.4	172	44	392	85.9	139	23.2
2010	421	120.5	206	51.5	256	51.4	147	24.2
2011	543	148.4	187	45.2	319	63.5	121	20.9
2012	551	146.4	180	43.2	292	55.7	111	18.8
2013	375	100.5	190	45.2	195	38.3	126	19.7
2014	427	160.2	166	38.7	285	80.9	135	23.1
2015	657	250.6	151	35.1	434	125.1	102	16.8
2016	275	76.1	80	32	188	38.8	32	14.9
2017	562	153.6	134	31.3	349	65.0	89	13.4
2018	690	270.5	150	33.6	414	78.6	125	19.4
2019	562	150.9	120	26.2	334	62.6	96	14.3
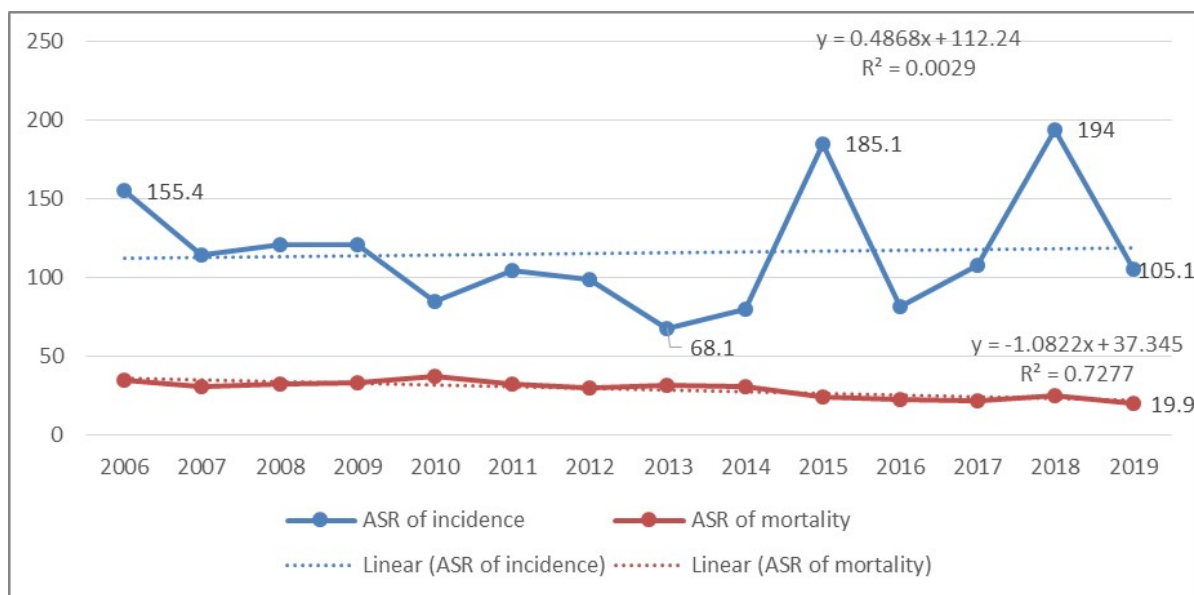
*Age-standardized rates according to the World Standard population

Figure 1. *Incidence and mortality trends of acute myocardial infarction based on standardized incidence and mortality rates from 2006 to 2019 in the population of the Nišava District*

100,000 (2015).

Annual standardized mortality rates of AMI in men ranged from 26.2/100,00 (2019) to 51.5/100,000 (2010) and in women mortality rates ranged from 13.4/100,000 (2017) to 24.2/100,000 (2010). The highest mortality rates both in men and in women was in

2010 (Table 1).

Incidence and mortality trends of AMI from 2006 to 2019 are presented in Figure 1.

An insignificantly decreasing incidence trend $y = 0.4868x + 112.24$, $R^2 = 0.0029$ and significantly decreasing mortality trend $y = -1.0822x + 37.345$, $R^2 =$

0.7277 were determined (Figure 1).

Mortality rates decreased steeply. The highest standardized mortality rate was 37.3/100,000 in 2010 and the lowest one was 19.9/100,000 in 2019 (Table 1 and Figure 1).

Mortality trend of AMI in men and in women is given in Figure 2.

A significantly decreasing mortality trend was determined both in men $Y = -1.611+52.563$, $R^2 = 0.7779$ and in women $y = -0.4956x + 22.81$, $R^2 = 0.3306$ (Figure 2).

Mortality rates of AMI increased with age. The lowest mortality rates were in the age group 20 - 24 (0.32/100,00) and the highest was in those over 75 years of age 59.08/100,00 (Figure 3).

A significantly increasing mortality trend of AMI by age was determined $y = 11.152x - 34.519$, $R^2 = 0.7022$.
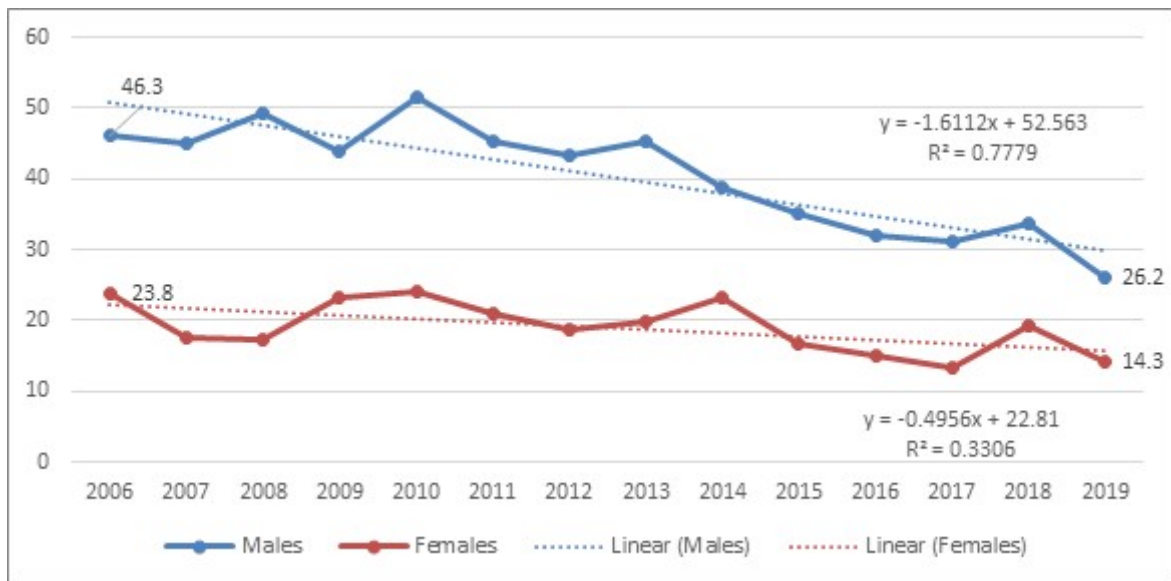

Figure 2. *Mortality trend of AMI based on standardized mortality rates in males and females from 2006 to 2019 in the Nišava District*
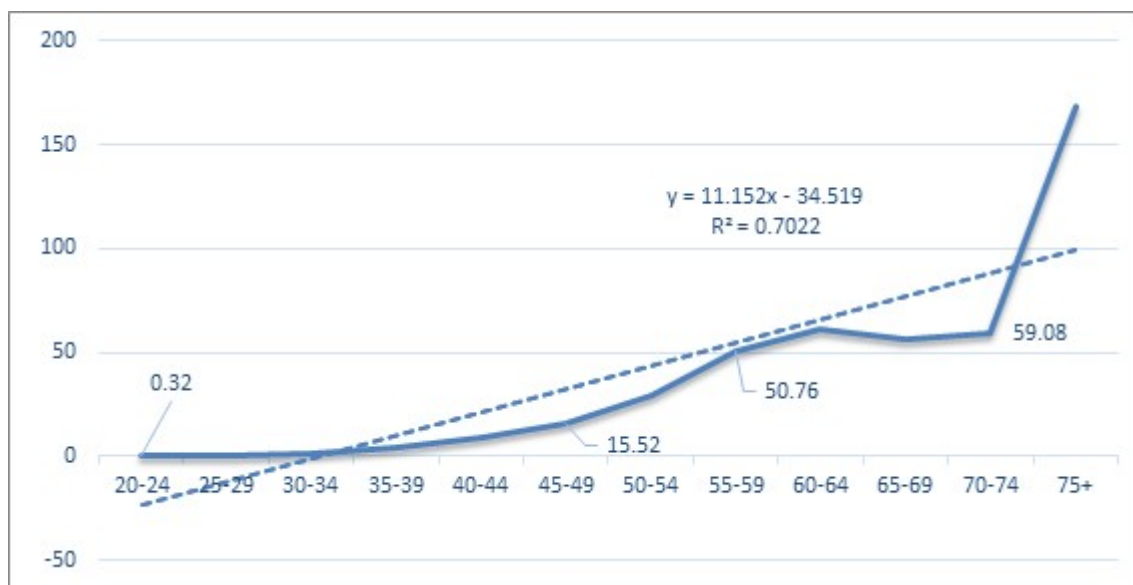

Figure 3. *Mortality trend of acute myocardial infarction by age in the population of the Nišava district, from 2006 to 2019*

DISCUSSION

We determined a significantly decreasing trend of age-standardized mortality rates of acute myocardial infarction in the period 2006 - 2019, both in men and women in the Nišava District. Mortality rates were higher in men than in women in the entire observed period. Men died 1.4 times more often than women. Mortality rates increased with age and were the highest in those older than 75 years of age.

A decrease in AMI mortality was reported in other studies (1, 12, 13, 16). According to the recent available data for the European Region (2010), the highest mortality rates for IHD both in men and women were observed in Eastern and Central Europe (Republic of Moldova - 496.2 per 100,000 persons, Ukraine - 491.9); very high rates were recorded in the Russian Federation - 349.4 and Lithuania - 313.9; high rates were recorded in Slovakia - 260.7 and Croatia - 164.2; intermediate rates were observed in Germany - 80.9 and the United Kingdom - 77.2, and the lowest rates were noticed in France - 30.3 (17).

The highest rates among men were recorded in Ukraine (656.3) and Republic of Moldova (597.0), and the lowest rates were found in France (47.3) and Portugal (55.0). Similarly, the lowest rates in women were recorded in France and Spain (17.5 and 26.8, respectively) while the highest rates were noticed in the Republic of Moldova and Ukraine (424.3 and 391.5, respectively) (18).

With a rate of 86.0 in 2010, Serbia was ranked among the countries with intermediate mortality rates of IHD (13). The highest rates across the countries of the former Eastern Bloc likely reflect the rapid social and economic changes during the transition period since 1980s (19, 20). The main contributor to the high mortality rates of IHD was high smoking prevalence (21).

In 2013, the mortality ASRs of IHD in Serbia were higher than the mortality in Mediterranean countries (Portugal, Spain and Italy) and the mortality of IHD in the Serbian population (94.7/ 100,000) was above the average mortality rates in the European Union (75.9/100,000) in 2013 (13).

During the last decades of the 20th century, IHD has demonstrated a declining trend of deaths in both men and women in Western and Northern European countries (in the United Kingdom, Finland) and worldwide (in the United States of America, Australia), (1, 2, 22 - 24).

At the beginning of the 21st century, the decline was also recorded in Japan (2) and France (2, 8). In contrast, in some countries in Eastern Europe (such as Ukraine, Kyrgyzstan), as well as some other countries (Mexico, Republic of Korea), the increase in mortality from IHD was recorded (2). More than half of the IHD mortality decrease in developed countries was attributed to a favorable population risk factor trend (principally declining smoking prevalence, mean cholesterol concentrations and blood pressure levels), while the remaining minor part was due to improvements in medical and surgical treatment (8, 24).

The mortality rate from IHD began to decline earlier in the countries where the tobacco control started to be implemented earlier (such as the USA, the United Kingdom, Australia). The plateaus in IHD mortality among young population may be partly linked to the increased rates of obesity and diabetes that have occurred over the same period in some of developed countries (25).

However, the recent increasing trends in some Eastern European countries suggest that other factors (including mainly obesity, physical inactivity, diabetes mellitus and dietary factors), besides smoking, may have influenced the IHD mortality (4, 24).

As in other European countries, mortality rates for AMI were substantially higher in males than females in the Nišava District, which could be explained by differences in age, smoking habit, diabetes mellitus and alcohol use among men and women (26).

Similar findings were obtained in Serbia, too (13). The National health surveys (2000, 2006, 2013), (22, 23) showed that the prevalence of major cardiovascular risk factors (such as smoking, obesity, diabetes mellitus, hypertension, hyperlipidaemia) in Serbian population was higher in comparison to the majority of the neighboring countries and other European countries (22 - 24, 27).

CONCLUSION

The trend of incidence rates tended to decrease, but insignificantly. Mortality rates were higher in men compared with women for the whole observed period. Mortality trend of acute myocardial infarction significantly decreased both in men and in women and also increased with age.

References

1. World Health Organization. WHO Mortality Database. Geneva: WHO; 2015.

2. Roth GA, Abate D, Abate KH, Abay SM, Abbafati, C, Abbasi N et al. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980-2017: A systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018; 392:1736-88. https://doi.org/10.1016/S0140-6736(18)32203-7

3. Roth GA, Forouzanfar MH, Moran AE, Barber R, Nguyen G, Feigin VL, et al. Demographic and epidemiologic drivers of global cardiovascular mortality. N Engl J Med 2015;372:1333-41. https://doi.org/10.1056/NEJMoa1406656

4. Menotti A, Puddu PE. Coronary heart disease differences across Europe: A contribution from the seven countries study. J Cardiovasc Med (Hagerstown) 2013;14:767-7. https://doi.org/10.2459/JCM.0b013e3283628dff

5. Cequier A. The MASCARA Registry Reveals the True Nature of Acute Coronary Syndromes Treatment in Spain. Rev Esp Cardiol 2008;61:793-96. https://doi.org/10.1157/13124988

6. De'gano IR, Salomaa V, Veronesi G, et al. Twenty-five-year trends in myocardial infarction attack and mortality rates, and case-fatality in six European populations. Heart.2015; 101; 1413-21. https://doi.org/10.1136/heartjnl-2014-307310

7. Pace M, Cayotte E, Agafitei L, Zupanic T, Wojtyniak B, Gissler M. 2013 Edition Revision of the European Standard Population Report of Eurostat's Task Force; Methodologies and Working papers; Publications Office of the European Union: Luxembourg, 2013. https://op.europa.eu/en/publication-detail/-/publication/69399636-1113-4a38-9ad1-269c33d0dc01/language-en

8. Puymirat E, Battler A, Birkhead J, Bueno H, Clemmensen P, Cottin, Y et al. Euro Heart Survey 2009 Snapshot: Regional variations in presentation and management of patients with AMI in 47 countries. Eur Hear J Acute Cardiovasc Care 2013; 2. 359-70. https://doi.org/10.1177/2048872613497341

9. Townsend N, Wilson L, Bhatnagar P, Wickramasinghe K, Rayner M, Nichols, M. Cardiovascular disease in Europe: Epidemiological update 2016. Eur Heart J 2016; 37: 3232-245. https://doi.org/10.1093/eurheartj/ehw334

10. Rahimi K, Duncan M, Pitcher A, Emdin CA, Goldacre MJ. Mortality from heart failure, acute myocardial infarction and other ischaemic heart disease in England and Oxford: A trend study of multiple-cause-coded death certification. J Epidemiol Community Health 2015; 69: 1000-005. https://doi.org/10.1136/jech-2015-205689

11. Orozco-Beltran D, Cooper RS, Gil-Guillen V, Bertomeu-Martinez V, Pita-Fernandez S Durazo-Arvizu R et al. Trends in Mortality From Myocardial Infarction. A Comparative Study Between Spain and the United States: 1990-2006. Rev. Española Cardiol (Engl. Ed.) 2012, 65, 1079-85. https://doi.org/10.1016/j.rec.2012.02.025

12. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study):Case-control study. Lancet 2004;364:937-52. https://doi.org/10.1016/S0140-6736(04)17018-9

13. Ilić Milena, Ilić I. Ischaemic heart disease mortality in Serbia, 1991-2013; a joinpoint analysis. Indian J Med Res 2017; 146(6): 746-53. doi: 10.4103/ijmr.IJMR_1935_15 https://doi.org/10.4103/ijmr.IJMR_1935_15

14. Incidence and mortality of acute coronary syndrome in Serbia. Institute of Public Health Serbia"Dr Milan Jovanovic Batut", Report No. 14, Belgrade, Serbia, 2020

15. World Health Organisation. International Statistical Classification of Diseases and Related Health Problems, 10 th Revision (ICD-10) Geneva: WHO; 1992.

16. Benjamin E, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R, De Ferranti, SD et al. Heart Disease and Stroke Statistics'2017 Update: A Report from the American Heart Association. Circulation 2017; 135: e146-e603
https://doi.org/10.1161/CIR.0000000000000491

17. World Health Organization. European Health for All Database (HFA-DB) Copenhagen: WHO Regional Office for Europe; 2015

18. Ioacara S, Popescu AC, Tenenbaum J, Dimulescu DR, Popescu MR, Sirbu A et al. Acute Myocardial Infarction Mortality Rates and Trends in Romania between 1994 and 2017. Int. J. Environ. Res. Public Health. 2020; 17: 285. Available at:
https://doi.org/10.3390/ijerph17010285

19. Finegold JA, Asaria P, Francis DP. Mortality from ischaemic heart disease by country, region, and age: Statistics from World Health Organisation and United Nations. Int J Cardiol 2013;168:934-45.
https://doi.org/10.1016/j.ijcard.2012.10.046

20. Falk E, Nakano M, Bentzon JF, Finn AV, Virmani R. Update on acute coronary syndromes: the pathologists' view. Eur Heart J 2013;34:719-28.
https://doi.org/10.1093/eurheartj/ehs411

21. Vujcic IS, Sipetic SB, Dubljanin ES, Vlajinac HD. Trends in mortality rates from coronary heart disease in Belgrade (Serbia) during the period 1990-2010: A joinpoint regression analysis. BMC Cardiovasc Disord 2013;13:112.
https://doi.org/10.1186/1471-2261-13-112

22. Ratkov I, Sipetić S, Vlajinac H, Sekeres B. Mortality from heart attack in Belgrade population during the period 1990-2004. Srp Arh Celok Lek 2008;136:598-602.
https://doi.org/10.2298/SARH0812598R

23. Ministry of Health, Republic of Serbia. Results of the National Health Survey of the Republic of Serbia, 2013. Belgrade: Ministry of Health, Republic of Serbia; 2014.

24. Vlahovic Z, Radojkovic D. Healthcare in Serbia in transition period. EPMA J 2010;1:601-6.
https://doi.org/10.1007/s13167-010-0055-9

25. Nichols M, Townsend N, Scarborough P, Rayner M. Trends in age-specific coronary heart disease mortality in the European union over three decades: 1980-2009. Eur Heart J 2013;34:3017-27.
https://doi.org/10.1093/eurheartj/eht159

26. Hotchkiss JW, Davies CA, Dundas R, Hawkins N, Jhund PS, Scholes S, et al. Explaining trends in Scottish coronary heart disease mortality between 2000 and 2010 using IMPACTSEC model: Retrospective analysis using routine data. BMJ 2014;348:g1088.
https://doi.org/10.1136/bmj.g1088

27. Statistical Office of the Republic of Serbia. Demographic Yearbook, 2015. Belgrade: Statistical Office of the Republic of Serbia; 2016

Trendovi akutnog infarkta miokarda u populaciji Nišavskog okruga

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S A Ž E T A K

Akutni infarkt miokarda je vodeći uzrok obolevanja i prevreme smrti stanovništva širom sveta.

Cilj rada bio je da utvrdi trendove incidencije i mortaliteta akutnog infarkta miokarda od 2006. do 2019. godine u populaciji Nišavskog okruga.

Primenjena je deskriptivna metoda. Podaci o incidenciji i mortalitetu akutnog infarkta miokarda dobijeni su iz populacionog registra za akutni koronarni sindrom Srbije. Izračunavane su nestandardizovane, specifične i standardizovane stope incidencije i mortaliteta na 100.000 stanovnika. Izračunavan je i linearni trend.

Ukupno je registrovano 12142 novoobolelia slučaja od akutnog infarkta miokarda (7595 muškaraca i 4547 žena). Muškarci su obolevali 1,7 puta više od žena. Utvrđen je pad trenda incidencije akutnog infarkta miokarda (y = 0,4868x + 112,24; R^2 = 0.0029), ali pad nije bio statistički značajan. Ukupno je rgistrovano 3925 umrlih (2260 muškaraca i 1665 žena). Muškarci su 1.4 puta više umirali od žena. Zabeležen je statistički značajan pad trenda mortaliteta akutnog infarkta miokarda i kod muškaraca (y = -1.6112x + 52.563, R^2 = 0.7779) i kod žena (y = -0,4956x + 22,81; R^2 = 0,3306). Tvrđen je značajan porast trenda mortaliteta akutnog infarkta miokarda sa starenjem (y = 11,152x – 34,519; R^2 = 0,7022).

Trend incidencije ima tendenciju opadanja, ali utvrđeni pad od 2006. do 2019. godine nije bio statistički značajan. Stope incidencije i mortaliteta bile su više kod muškaraca nego kod žena u celom posmatranom periodu. Trend mortaliteta je i kod muškaraca i kod žena statički značajno opao, a utvrđen je i statistički značajan porast trenda mortaliteta sa starenjem.

Ključne reči: akutni infarkt miokarda, incidencija, mortalitet, pol, starost