



The incidence of arm, forearm, and hip osteoporotic fractures during early stage of COVID-19 pandemic

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Abstract

Summary The study analyzes whether the COVID-19 pandemic affects the incidence of arm, forearm, and hip fractures. Additionally, the change in the overall cost of those fractures treatment was estimated. During the COVID-19 pandemic, the incidence of arm, forearm, and hip fractures and the cost of fracture management are decreased.

Introduction Purposes of the study were to analyze if COVID-19 pandemic influences the incidence of arm, forearm, and hip osteoporotic fractures and to estimate the changes in costs of their management.

Methods Data on arm, forearm, and hip fracture incidence were collected for inhabitants aged over 50 years in the district of Tarnowskie Góry and the city of Piekary Śląskie, South Poland, in the early stage of COVID-19 pandemic (77 days, from March 16th to May 31st 2020). These results were compared with the number of fractures noted in years 2015–2019 in the same period of the year. The ratio of analyzed fractures per 100,000 inhabitants was calculated.

Results The recorded numbers of fractures of arm, forearm, and hip were 13, 43, and 29, respectively. The respective mean number for fractures reported in corresponding period in 2015–2019 years was 23.6, 52, and 33. The year fracture incidence calculated per 100,000 inhabitants decreased by 45.8%, 18.4%, and 13.4%, respectively. The estimated numbers of avoided fractures extrapolated for the whole country for arm, forearm, and hip were 1722, 1548, and 947, respectively. The total number of avoided fractures was 4217. The expected nationwide cost reduction for the arm, forearm, and hip fracture management was estimated at € 568,260, € 332,820, and € 1,628,840, respectively. The total cost reduction was € 2,529,920 over the period of observation.

Conclusion During COVID-19 pandemic, a decrease of arm, forearm, and hip fracture incidence was observed which may result in decrease of total costs for Polish healthcare system.

Keywords Arm fracture · Costs · COVID-19 pandemic · Forearm fracture · Hip fracture

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Introduction

Hip fractures due to their health consequences are the most significant fractures observed in osteoporotic subjects [1]. Together with spine, arm, and forearm fractures, they are called ‘major osteoporotic fractures’. The role of hip fractures is connected with high mortality and deterioration of functional status. The management of hip fractures, especially surgery, generates high costs. Due to high incidence of hip fractures and high costs for health systems, several authors presented lately data on trends of hip fracture incidence [1–16]. Some authors noted the decrease in hip fracture rate [4–8, 16] and the other ones observed their increase [1–3, 9, 13, 17]. The stable prevalence was reported by other groups in women [3] or both men and women [10, 11]. Some studies revealed also the changing trends: till 2010 [12] or 2003 [14], the increase

was established and afterwards the decreasing trend was observed. However, one should be aware that fragility fractures are underestimated and undertreated, although pharmacological treatment demonstrated to be effective for reducing their incidence, particularly in secondary prevention care [18]. Recently, the hip fracture incidence during COVID-19 pandemic was described and the number of hip fractures did not change in comparison with earlier periods [19].

In regard to forearm fractures, the incidence in Central Norway for period 1999–2012 had a trend to diminish in women over 50 years [20]. In another study, the incidence of forearm fractures increased only in women, while increased incidence of arm fractures was observed for both women and men [21].

In Finnish study, a steep rise in the rate of low-trauma distal humeral fractures in 60-year-old or older women from 1970 till late 1990s was observed, which was followed by a clearly declining fracture rate afterwards [22].

Less data are available on proximal humeral fractures. Although proximal humeral fracture is the third most common non-vertebral fragility fracture, it is often poorly considered in the field of osteoporosis, and its surgical management might be challenging [23].

The primary aim of the current study was to analyze the arm, forearm, and hip osteoporotic fracture incidence during early stage of COVID-19 pandemic when ‘lockdown’ strategy was introduced and to compare it with data from five previous years.

The secondary aim was to establish the influence of noted fracture rate changes on costs for Polish health system. We used the data on fracture incidence and costs of management given by a recent report on osteoporosis published in November 2019 by Polish National Health Service [24].

Methods

Data on arm, forearm, and hip osteoporotic fracture incidence were collected for inhabitants (males and females together) aged over 50 years, living in the district of Tarnowskie Góry and the city of Piekary Śląskie, South of Poland, for the early stage of COVID-19 pandemic when ‘lockdown’ strategy was introduced (77 days, from March 16th to May 31st 2020). The study area comprises both rural and urban territories. The fractures in analyzed period were identified based on medical records from Trauma Surgery Hospital in Piekary Śląskie, Upper Silesia, Poland (the only one orthopedic hospital in the study area), according to respective ICD-10 classification (S42, S52, and S72). Additionally, the ICD-10 codes V00–Y99 which describe the external causes of morbidity were analyzed in order to identify and exclude from further analyses all the traumatic fractures. For comparisons with previous years, the numbers of arm, forearm, and hip fractures were

also collected for the period from March 16th to May 31st in 2015–2019 years. Then, the ratio of analyzed fractures per 100,000 of population aged over 50 years was calculated based on the number of inhabitants at this age category in the whole district, which was in consecutive years between 2015 and 2019 at 75,567, 76,194, 76,740, 77,151, and 77,744, respectively. For the year 2020, as the exact number of inhabitants will be published at the end of the year, the data for 2019 year were used for calculations.

According to previously mentioned report [24] based on the results for years 2013–2018, the mean total annual number of arm, forearm, and hip osteoporotic fractures for the whole country of Poland was 33,500, 17,817, and 39,866, respectively. The precise data on fracture incidence in population with exclusion of subjects below 50 years are not available. However, those fractures were probably not classified as osteoporotic.

In order to establish a potential influence of changes in fracture incidence during COVID-19 pandemic on the healthcare system, data on costs of individual patient management given by this report were utilized. Such costs of management for one arm, forearm, and hip fracture expressed in Euro were € 330, € 215, and € 1720, respectively. To estimate the changes in costs of management during the early pandemic period, the mean number of fractures for years 2015–2019 (for period March 16th through May 31st in each year) and the number of fractures in the current period of observation (March 16th till May 31st 2020) were multiplied by the given costs for each fracture site. All results are presented for males and females together.

Results

The number of fractures during the 77-day period of observation for arm, forearm, and hip was 13, 43, and 29, respectively. The respective mean number for fractures reported in corresponding period in years 2015–2019 was 23.6, 52, and 33. In Table 1, the ratio of arm, forearm, and hip fracture calculated per 100,000 inhabitants and the decrease in fracture incidence noted in 2020 year are shown.

The observation period makes 21.1% of the entire year (77 out of 365 days), and the estimated changes in incidence were calculated taking into account this proportion of the observation period to the full-year data.

Table 2 presents the number of fractures and their management cost estimated for the whole country for the average 77-day period in years 2015–2019 and for our current 77-day period of observation during early pandemic time.

The estimated numbers of avoided fractures extrapolated for the whole country for arm, forearm, and hip were 1,722, 1,548, and 947, respectively. The total number of avoided fractures was 4217.

Table 1 Fracture incidence per 100,000 inhabitants for arm, forearm, and hip, based on data from local cohort and calculated for 77-day period of observation

Fracture site	Fracture incidence in 2020 year	Mean fracture incidence for 2015–2019 years	Fracture incidence reduction rate noted in 2020 year [%]
Arm	16.7	30.8	45.8
Forearm	55.3	67.7	18.4
Hip	37.3	43.08	13.4

The expected nationwide cost reduction for the arm, forearm, and hip fracture management was estimated at € 568,260, € 332,820, and € 1,628,840, respectively. The total cost reduction for all three fracture locations was € 2,529,920 over the 77-day period of observation.

Discussion

The most important finding of the current study is the observation that during early COVID-19 pandemic time, a substantial decrease in the incidence of arm, forearm, and hip osteoporotic fractures was observed. It is also highly probable that the total costs of fracture management based on data reported by National Health System Report [24] were decreased for Polish health system during that time.

It is not easy to interpret obtained results. A similar ‘lockdown’ strategy was never met before and previously established knowledge on fracture risk factors cannot be directly applied to that very specific period. Generally, it may be considered that the lack of outdoor activities leads to lower fall rate. As many falls in elderly happen outdoors during their normal living activity, the ‘staying home’ strategy could have resulted in subsequent lower fracture incidence. However, this can be a short-term effect only. Further observation is necessary because after total lockdown in March, April, and May 2020, probably the human physical activity has not returned to previous level, which can become the reason for general deterioration in physical fitness of older people. The observations in next months of the year will reveal the further trends of fractures. One of the possible hypothesis may

assume that we will see a ‘rebound phenomenon’ in terms of osteoporotic fracture incidence. Therefore, an observation period limited to 77 days may not reflect the full-year picture of fracture incidence changes and overall cost for healthcare system. In an observational study in UK during lockdown, similar results were noted in regard to non-hip fractures but the number of hip fractures did not change [25]. The attendance to Fracture Clinic during lockdown was compared with respective data for the same period as in current study, e.g., years 2015–2019. Unlike in our study, the analysis of trends in costs of fracture management in UK was not performed. The authors of the cited study explain the lack of a decrease in the incidence of hip fractures during the ‘lockdown’ period by the fact that, according to UK data, most hip fractures occur indoors, so their prevalence could have been ‘resistant’ to the ‘lockdown’ strategy. According to our local data [13], a similar outdoor/indoor hip fracture ratio is also expected in Poland. Nevertheless, it is possible that different demographic structure of society, different prevalence of nursing homes, etc. may result in a slight reduction of hip fracture incidence, at least those occurring outdoors, in the area covered by our study during the lockdown. Additionally, it may be important that in the early period of the pandemic, administrative decisions and educational activities in Poland were strongly focused on limiting social contacts and outdoor activity of the elderly. However, the rate of reduction in the incidence of hip fractures in our study is clearly lower than that of arm and forearm fractures, indicating generally similar trends in both our and cited studies. We consider that relatively short period of observation does not allow to fully explain the reasons for general lower fracture incidence, especially that we are not aware of outdoor/

Table 2 The number and management costs for fractures in the whole country calculated over an average 77-day period in years 2015–2019 and projected for the early pandemic time (March 16th till May 31st 2020)

	[A] ‘Background’ mean annual number of fractures in 2015–2019 years	[B] The number of fractures during average 77-day period in 2015–2019 years [B] = [A] × 21.1% ^a	[C] The projected number of fractures during 77-day early pandemic time ^b [C] = [B] × (100-FIRR)% ^c	[D] Total costs for average 77-day period in 2015–2019 years [D] = [B] × MC ^d	[E] The projected costs during 77-day early pandemic time ^b [E] = [C] × MC ^d
Arm	17,817	3759	2037	€ 1,240,470	€ 672,210
Forearm	39,866	8412	6864	€ 1,808,580	€ 1,475,760
Hip	33,500	7068	6121	€ 12,156,960	€ 10,528,120

^a The 77 days of 365 make 21.1% of the year

^b The period between March 16th and May 31st 2020

^c FIRR=fracture incidence reduction rate, based on data from local cohort presented in Table 1

^d MC=management cost for single fracture case, which is € 330, € 215, and € 1720 for arm, forearm, and hip fracture, respectively

indoor ratio for arm and forearm fractures before pandemic. The longitudinal planned observation would be perhaps sufficient to provide more data indicating the reasons for changes in fracture incidence and their diversity for different skeletal sites.

Our current observations should also be compared with the results of our recent work [13] in terms of the hip osteoporotic fracture epidemiology. In this study, the annual increase in hip fractures was 20% for women and 44% for men. Further analyses are necessary in order to reveal factors influencing current results. We consider that prolonged observation for the rest of 2020 year will allow to reveal wider view on trends in hip fracture incidence. We have not performed similar analyses of trends for arm and forearm fractures and a decrease observed in current study cannot be compared with trends in the past.

A study has several limitations. We used a population of one district only and the projection of the results for the whole country made for estimation of management cost reduction may be biased. Due to relatively small number of fractures, separate analyses for females and males were not performed. The incidence of other fractures, especially of spine, was not analyzed, so final costs for health system also may differ from provided simulations. Data given in national report does not present separately the number of fractures in subjects aged over 50 years. Hip fractures rather do not occur in individuals younger than 50 years so prognosis for fractures of that skeletal site seems to be accurate enough. However, arm and especially forearm fractures may occur sometimes in patients below the age of 50 years and presented estimation of changes in management costs may differ from true values. We did not collect data on the trends of use of anti-resorptive therapy or vitamin D supplementation over the prior years and other confounding factors that could impact fracture risk in the current year. It may be also considered as a limitation of the study. Finally, we did not collect data on spine fractures because only some subjects with such fractures undergo hospital therapy and in hospital database sufficient data were not available.

Concluding, during early COVID-19 pandemic period, a decrease of arm, forearm, and hip osteoporotic fracture incidence was observed. It probably resulted in essential reduction of total costs for Polish healthcare system. Further observations analyzing long-lasting consequences of COVID-19 phenomenon will be performed.

Compliance with ethical standards

Conflict of interest None.

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