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Abstract

Background: age-related issues are expected to rise in the coming decades. Osteoporosis, falls and fractures are major public health issues among elderly. Pelvic fractures are associated with a serious morbidity and hospitalisation rate. We therefore performed a study to determine trends in incidence and age-specific rates of pelvic fracture-related hospitalisations among elderly (≥65 years).


Results: the total number of hospitalisations due to a pelvic fracture increased from 887 in 1986 to 2,013 admissions in 2011 (127% increase). The overall age-adjusted incidence rate increased from 5.19 in 1986 to 7.14 per 10,000 population in 2011 (37.5% increase). The incidence rate increased with age and was higher for females. The Percentual Annual Change was 1.2% (95% CI: 0.9;1.5) for older males, and 1.0% (95% CI: 0.9;1.2) for females, respectively. The mean length of hospital stay decreased between 1991 and 2011 to 12.0 days (53.4% decrease). The total number of hospital-bed-days decreased from 29,002 days in 1991 to 17,283 days in 2011 (40.4% decrease), despite an increase in absolute number of admissions.

Conclusion: absolute numbers and incidence rates of pelvic fractures are increasing among the older Dutch population. Considering the fact the general population is growing older, an increasing number of elderly suffer from pelvic fractures. Attention on osteoporosis screening and prevention of falls in elderly remains important, in order to limit-related healthcare costs in the future.

Keywords: trends, falls, pelvic fractures, The Netherlands, older adults, older people
Increasing rates of pelvic fractures among older adults

Introduction

The population of older adults, aged 65 years and over, is increasing rapidly worldwide [1]. The increase of the older population is partly caused by a rising number of older adults, but also due to an increasing life expectancy. Consequently, age-related problems are rising, including osteoporosis and falls [2, 3]. Falls are the main cause of injuries among older adults, and leading to a high healthcare demand. One-third of the persons aged 65 years and older fall on average once a year [4, 5]. The majority of fall-related injuries among older adults, presenting at an Emergency Department, are fractures (60%) and superficial injuries (21%) [6]. It might be expected that rates of pelvic fractures will increase in the near future [7, 8]. Fractures of the pelvic bones are associated with high rates of hospitalisation and mortality [9]. Worldwide, osteoporosis is a growing public health issue in developed countries [10]. People with osteoporosis, characterised by low bone mass and micro-architectural deterioration of bone tissue, have an increased risk of fractures [11]. Over 60% of the pelvic fractures are associated with osteoporosis. For patients aged 60 years and older the percentage increases to 94% [12].

Accurate numbers and trends over time are needed to assign the limited healthcare resources in ageing populations. The Netherlands is an ideal country for such trend analysis, because of the extensive and long-term registration of all hospitalisations. Therefore, the aim of the current study was to provide secular trend analysis of numbers, incidences and age-specific rates of pelvic fractures hospitalisations among the older Dutch population.

Patients and methods

For this study, all hospitalisations due to a pelvic fracture among older adults were obtained from 1986 throughout 2011. During the study period, a pelvic fracture has been defined using the International Classification for Diseases, 9th revision (ICD 9) of the World Health Organization, code 808 [13]. Persons aged 65 years and older were defined as ‘the older population’. The method used in this study has been used previously [14, 15].

Data were obtained from National Medical Registration (LMR, Dutch Hospital Database, Utrecht), which is operated by the Consumer and Safety Institute, Amsterdam, The Netherlands [16]. In the LMR database information is stored of nearly all hospital admissions in The Netherlands with a uniform classification system, and with a high national coverage (missing values <5%, except in 2007 when 12% was missing). Data were extrapolated to full national coverage by the Consumer and Safety Institute. The extrapolation factor was based on the adherence population of the registering hospitals and the national Dutch population in each year of the study [16]. Information regarding hospital admissions, admission diagnosis, age, gender and length of hospital stay (LOS) in days is stored in this database. For each individual patient only one injury code, the primary diagnosis, was used. The primary diagnosis is based upon the medical record of the treating physician (in general the most severe injury). During the study period the uniform classification and coding system for all hospitals used by the LMR did not change.

Numbers of hospitalisations due to a pelvic fracture were specified for age and gender. Demographic numbers were obtained from the Statistics Netherlands using the mid-year population numbers [17]. Incidence (crude- and age-adjusted) rates were calculated in 5-year age groups, for both males and females and expressed per 10,000 persons in the specified age groups. Age-adjusted incidence rates enabled us to compare the incidence rate for a standardised population during the study period. Demographic changes throughout the study period were corrected by ‘Direct Standardization’. Numbers of hospital admissions and LOS in the period 1986 throughout 2011 were expressed as percentages compared with the index year 1986.

The medical ethical review board of the Erasmus MC, University Medical Center, Rotterdam, approved the study method (MEC-2010-402) and provided a waiver for ‘informed consent’, because the data were retrieved from a large public accessible database, containing anonymous data on admissions, which cannot be traced to individuals.

A linear regression model with Poisson error and log link (log was mid-year population size in each year of the study) as an offset factor was used to model the trend in hospitalisations. The parameter for calendar year, corrected for gender and age group, was transformed into Percentual Annual Change (PAC). The Statistical Package for the Social Sciences software (version 16.1.1) was used to perform all statistical analyses. A P-value <0.05 was considered statistically significant.

Results

During the study period from 1986 until 2011 a total number of 34,307 patients, aged 65 years and older, had a pelvic fracture requiring hospitalisation in the Netherlands. The annual number hospitalisations due to a pelvic fracture increased with 127% (from 887 admissions in 1986 to 2,013 admissions in 2011), Figure 1. The male–female ratio remained stable throughout the study period to ~1:4 (Table 1). During that same period, the population aged 65 years and older, increased from 1.77 million in 1986 to 2.595 million in 2011 (46.7% increase).

Gender- and age-specific incidence rates for pelvic fractures are shown in Table 2. The incidence rates for females are higher than those for males, and increased with age for both genders. The overall age-adjusted incidence rate of hospitalisations related to a pelvic fracture increased from 5.19 per 10,000 population in 1986 to 7.14 per 10,000 population in 2011 (37.5% increase). For males, the age-adjusted incidence rate increased from 2.83 per 10,000 persons in 1986 to 3.68 per 10,000 persons in 2011 (30.0% increase).
females an increase was observed from 6.82 to 9.53 (39.7% increase) during the same period (Figure 1).

Age-specific hospitalisation rates increased during the study period for both genders, in all age-categories (Table 2). The strongest rise in age-specific incidence was seen among persons aged ≥85 years (Figure 2). The PAC was 1.2% (95% CI: 0.9; 1.5) for the older male population. For females the PAC was 1.0% (95% CI: 0.9; 1.2) during the study period. The PAC for the age-specific groups is shown in Table 2.

There was a shift in the distribution of the different age groups. The proportion of oldest old, persons aged 85 years and older, increased during the study period (Figure 3).

The mean admission duration among older adults admitted because of a pelvic fracture decreased over the last 20 years for all age groups, from 25.8 days in 1991 to 12.0 days admission in 2011 (Table 1). Despite an increase in the total number of pelvic fracture-related hospitalisations, the total number of hospital-bed-days decreased from 29,002 days in 1991 to 17,283 days in 2011 (40.4% decrease), due to the decrease in the mean admission duration. In older males, it decreased from 7,857 days in 1991 to 4,745 in 2011 (decrease 39.6%). For females a decrease was seen from 21,145 days in 1991 to 12,537 hospital-bed-days in 2011 (decrease 40.7%) (Figure 4).

Discussion

In the current study, secular trends of pelvic fracture-related hospitalisations in the older Dutch population are shown. Both absolute numbers and incidence rates are increasing. However, the total number of required hospital-bed-days decreased during the study period due to a reduced LOS per admission.

Melton et al. [18] reported an exponentially increase in the incidence of pelvic fractures in the USA in both elderly men and women. Kannus et al. [19] reported similar results in Finland over the period 1970–97. These findings are in concordance with our results. Pelvic fractures comprise <5% of all fractures in patients aged 80 years and older. However, these fractures constitute up to 23% of admissions to level 1 trauma centres in the USA. [20] Also, Matityahu et al. [21] reported an increased rate of severe complications (e.g. renal failure, acute respiratory distress syndrome or pulmonary embolism) and mortality among the oldest old (80 years and older) with pelvic fractures.

Because the population of older adults is increasing and the life expectancy is increasing, the proportion of older adults will increase in the next decades. The incidence of fragility fractures might be predicted to show a similar increase [1]. Related healthcare demands and healthcare costs are expected to show a comparable rise in the coming decades, on top of the rising incidence rates.

One of the most important factors of the related healthcare resources and costs is the LOS per admission. Over the last decades, the admission duration has been reduced by over 50%. The reduction in LOS may, at least partly, be explained by better pain management and better care during hospital stay with early mobilisation under supervision of the physiotherapist. Also, early discharge to designated rehabilitation places and skilled nursing homes have contributed to this reduction in LOS [22]. The mean admission duration related to pelvic fractures was longer for patients who were not self-sufficient prior to the fracture. Furthermore, the high LOS can be attributed to complications associated with immobility. These complications are decreased muscle strength, deep venous thrombosis and pulmonary embolism, postural hypotension, decreased cardiac function, urinary retention and calculus formation, constipation, pressure ulcers,

### Table 1. The number of people aged 65 years and older and pelvic fracture-related hospitalisations in The netherlands, 1986–2011

<table>
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<tbody>
<tr>
<td>Population (1,000)²</td>
<td>1,769</td>
<td>1,934</td>
<td>2,061</td>
<td>2,175</td>
<td>2,330</td>
<td>2,595</td>
</tr>
<tr>
<td>No. of admissions</td>
<td>887</td>
<td>1,125</td>
<td>1,387</td>
<td>1,184</td>
<td>1,464</td>
<td>2,013</td>
</tr>
<tr>
<td>Incidence rate²</td>
<td>5.0</td>
<td>5.8</td>
<td>6.6</td>
<td>5.4</td>
<td>6.3</td>
<td>6.9</td>
</tr>
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²Crude incidence rate per 10,000 population aged 65 years and older; d, days; n.a., not available.
In the Netherlands, all inhabitants enjoy a full healthcare insurance and full accessibility to the Dutch healthcare system without financial barriers. Bone resorption with increasing osteoporosis and impaired pulmonary function resulting in pneumonia, and...
system. This system has been applicable during the whole study period. The study has been based on data retrieved from the electronic national population-based in-hospital data from 1986 until 2011. This highly accurate electronic database records with nearly complete national coverage all pelvic fractures related hospital admissions as well as hospital-bed-days in all hospitals in the Netherlands. It is important to mention that during the study period no changes in the coding system of the National Medical Registry occurred, nor were there major policy changes introduced affecting the increase in admission rates.

However, this study has a few notable limitations. First of all, linked administrative databases are prone to variation and coding errors [23]. A quality survey performed in 2002 by Paas [24] showed a high accuracy of coded injury data of the LMR database (correctly coded in 91% of cases and in 9% incomplete). These data are comparable of a similar database used in New Zealand (period 1996–98) [25]. The true number of pelvic fractures might be higher, because only the primary admission diagnosis was used. So in patients with multiple, more severe injuries were missed in this study. Furthermore, the database used does not contain clinical data regarding underlying diagnosis and co-morbidities. Also no data were available as far as injury severity, lifestyle or medication of patients. Therefore, the interpretation of causal mechanisms behind observed trends is limited. Possible explanations for the observed trends might be that the population is ageing, individuals are longer living independently and with more comorbidities. Consequently, these people remain more mobile and the fall risk increases. Retrieved data only relate to patients in the Netherlands, the results may not be directly translated to other countries, as other healthcare system and different demographics may exist. Furthermore, readmissions were not excluded and some ‘double registration’ could have occurred. However, it is unlikely that readmissions influenced our results, because readmissions constitute only 2.6% in the Netherlands, as was found in a study by Polinder et al. [26].

In conclusion, absolute numbers and incidence rates of pelvic fractures increased in the Netherlands. During the study period incidence rates increased with almost 50% in patients aged 65 years and older. However, the total number of hospital-bed-days was almost halved in the same period. As the general population is ageing, an increasing number of older patients suffer from pelvic fractures. To limit related healthcare costs in the future, it remains important to keep attention on the prevention of falls and osteoporosis among older adults.

Key points

- Trend analysis of hospitalisations due to pelvic fractures.
- Pelvic fractures are associated with serious comorbidity.
- Osteoporosis screening and fall prevention in elderly remains important.

References


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Understanding NHS hospital admissions in England: linkage of Hospital Episode Statistics to the Hertfordshire Cohort Study

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Abstract

Background: concern over the sustainability of the National Health Service (NHS) is often focussed on rising numbers of hospital admissions, particularly among older people. Hospital admissions are enumerated routinely by the Hospital Episode Statistics (HES) Service, but published data do not allow individual-level service use to be explored. This study linked information on Hertfordshire Cohort Study (HCS) participants with HES inpatient data, with the objective of describing patterns and predictors of admissions among individuals.

Methods: 2,997 community-dwelling men and women aged 59–73 years completed a baseline HCS assessment between 1998 and 2004; HES and mortality data to 31 March 2010 were linked with the HCS database. This paper describes patterns of hospital use among the cohort at both the admission and individual person level.

Results: the cohort experienced 8,741 admissions; rates were 391 per 1,000 person-years among men (95% CI: 380, 402) and 327 among women (95% CI: 316, 338), P < 0.0001 for gender difference. A total of 1,187 men (75%) and 981 women (69%) were admitted to hospital at least once; among these, median numbers of admissions were 3 in men (inter-quartile range, (IQR): 1, 6) and 2 in women (IQR: 1, 5). Forty-eight percent of those ever admitted had experienced an emergency admission and 70% had been admitted overnight.