Osteoarthritis and Cartilage xxx (2014) 1–8

Osteoarthritis and Cartilage

Utilization rates of hip arthroplasty in OECD countries

C. Pabinger †‡*, A. Geissler §[a]

† EAR (European Arthroplasty Register) Scientific Office, Innsbruck, Austria
‡ Medical University of Graz, Plüddemanngasse 45, 8010 Graz, Austria
§ Department of Health Care Management, WHO Collaborating Centre for Health Systems Research and Management, Berlin University of Technology, Straße des 17. Juni 135, H80 10623 Berlin, Germany

ARTICLE INFO

Article history:
Received 25 January 2014
Accepted 8 April 2014

Keywords:
Hip
Revision
Utilization rate
Public health
Epidemiology
Arthroplasty
Total hip arthroplasty

SUMMARY

Background: Hip arthroplasty and revision surgery is growing exponentially in OECD countries, but rates vary between countries.
Methods: We extracted economic data and utilization rates data about hip arthroplasty done in OECD countries between 1990 and 2011. Absolute number of implantations and compound annual growth rates were computed per 100,000 population and for patients aged 65 years old and over and for patients aged 64 years and younger.
Results: In the majority of OECD countries, there has been a significant increase in the utilization of total hip arthroplasty in the last 10 years, but rates vary to a great extent: In the United States, Switzerland, and Germany the utilization rate exceeds 200/100,000 population whereas in Spain and Mexico rates are 102 and 8, respectively. There is a strong correlation between gross domestic product (GDP) and health care expenditures per capita with utilization rate. Utilization rates in all age groups have continued to rise up to present day. A seven fold higher growth rate was seen in patients aged 64 years and younger as compared to older patients.
Conclusion: We observed a 38-fold variation in the utilization of hip arthroplasty among OECD countries, correlating with GDP and health care expenditures. Over recent years, there has been an increase in the utilization rate in most countries. This was particularly evident in the younger patients. Due to increasing life expectancy and the disproportionally high use of arthroplasty in younger patients we expect an exponential increase of revision rate in the future.

Introduction

Osteoarthritis is one of the 10 most disabling diseases in developed countries and worldwide affects approximately 10% of men and 18% of women aged older than 60 years[1]. The WHO estimates that ageing populations and increasing life expectancy will make osteoarthritis the fourth leading cause of disability in 2020[2,3]. Total hip arthroplasty (THA), can provide effective relief for patients with osteoarthritis of the hip where conservative treatment patterns have failed. Despite worldwide variations in cost[4], arthroplasty does appear to be cost effective in the long term[5]. Arthroplasty is also being used more frequently in the emergency setting with those patients with hip fractures[6,7].

The use of specific endoprostheses with unfavourable results has lead to safety concerns among hip surgeons[8,9], but the establishment of national joint registers has improved knowledge and the quality of hip implants[10].

To our knowledge no study has been performed analysing recent data and the different utilization rates of hip arthroplasty across countries and over time. In addition, it remains unclear why and how much utilization and growth rates of hip arthroplasty differ among countries.

Therefore, the goal of the study is to analyse the historical and epidemiological trend of hip arthroplasty utilization rates across countries using OECD health data by discussing the following questions:

(a) What is the incidence of primary hip arthroplasty in OECD countries according to age and economic parameters?

* Address correspondence and reprint requests to: C. Pabinger, Medical University of Graz, Plüddemanngasse 45, 8010 Graz, Austria. Tel: 43-316-908204-0; Fax: 43-316-908204-20.
E-mail addresses: christof.pabinger@medunigraz.at, M.pabinger@opz.at (C. Pabinger), a.geissler@tu-berlin.de (A. Geissler).
[a] Tel: 49-30-31421020; Fax: 49-30-31428433.

http://dx.doi.org/10.1016/j.joca.2014.04.009

(b) How has utilization rate and population rate changed over time?
(c) Which trends can be derived to predict the future use of hip arthroplasty?

Material and methods

We extracted economic variables and medical data about hip arthroplasty done in OECD countries between 1990 and 2011 from the OECD health data 2013 databases[11]. However, the majority of data were reported later than 2005 and we therefore focused on the time period between 2005 and 2011 or the latest available. We retrieved the following variables for hip replacement which is internationally identified by ICD-9-CM codes 81.51 (total replacement), 81.52 (partial replacement) and 81.53 (revision) from OECD data base: Inpatient cases per 100,000 population and total procedures per 100,000 population (both variables also for patients aged 65 years old and over), total population and population aged 65 years and over, annual gross domestic product (GDP) per capita and annual health care expenditures per capita. Access to essential care was retrieved from United Nations webpage[12].

Data validation for the different variables was done as follows: Economic and population data appeared in multiple OECD databases and were similar. No differences exceeding 5% were found between inpatient cases and total procedures (including in- and outpatient cases). For Australia and Mexico, only total procedures per 100,000 population were reported. Furthermore OECD data were compared with register data, where available and differences did not exceed 5% as well[13].

A Pearson correlation between medical and economic data was done.

In order to compare growth rates across countries and over time we calculated the compound annual growth rate (CAGR) as the *x*th root of the total percentage growth rate, where *x* is the number of observed years:

$$\text{CAGR} = (\text{value last year}/\text{value first year})\hat{}(1/\#\text{years}) - 1$$

We separated the patients into two age groups – for "patients aged 65 years old and over" and for "patients aged 64 years and younger". Numbers and rates per 100,000 population in "patients aged 64 years and younger" were calculated as the total number of hip arthroplasties minus the number of implants in patients aged 65 years and older.

OECD health database reports "rates" in the meaning of "incidence", which equals "inpatient cases per 100,000 total population" for every age group. In this case, the denominator is always the "total population" for all age groups, while the numerator changes according to age group. This definition leads to the phenomenon that total rate is much higher than the rates of the subgroups might suggest (Tables I–III): In 2011 in Austria for example, total utilization rate per 100,000 total population is 273 and rate of patients aged 65 old and over is 154 and rate of patients aged 64 old and under is 119. One would assume at first sight, that total rate would be a value between 119 and 154 and not be 273, but the confusion is due to the fact, that there are 1.5 million people of age 65 and over and 6.9 million people of age 64 and under. According to OECD, the values are always divided by 100,000 of total population, which is 8.4 millions in Austria. We therefore distinguish between "incidence", according to OECD definition and introduced a new parameter, named "mean utilization rate", where numerator and denominator refer to the same group of population. Using this definition, values from the different age groups can be compared and the total "mean utilization rate" ranges between the age-specific "mean utilization rates": In the example of Austria, 12,972 implants in the group of patients aged 65 years and older (1.5 million people) equal an incidence of 154 (12,972 implants/8,400,000 total population × 100,000) or a mean utilization rate of 865 (12,972 implants/1,500,000 population aged 65 and over × 100,000). This is compared to an incidence of 119 (9900 implants/8,400,000 total population × 100,000) and a mean utilization rate of 144 (9900 implants/6,930,000 aged 64 old and less × 100,000) in patients aged 64 old and less. Therefore, patients aged 65 and older present a 30% higher incidence for a hip arthroplasty as compared to younger patients, which means that mean utilization rate in this group of patients is actually six times higher.

Results

The OECD health database contains specific data relating to hip arthroplasty for 32 countries. Canada, Denmark and Finland have continuously reported data since 1990. The majority of countries (27) have reported valid data since 2005 (Table I). Five countries (Chile, Czech Republic, Greece, Iceland and Slovak Republic) had to be excluded due to poor data availability.

The number of hip arthroplasties per 100,000 population vary between individual OECD countries by a factor of 38. The latest available incidence rates show a broad range from 306 hip replacement cases per 100,000 population in Switzerland to eight per 100,000 population in Mexico. Similar differences can be demonstrated in the older group. In Switzerland 180 hip procedures in the population over age of 65 years are performed per 100,000 total population, whereas Korea reports 15 cases for the same population (Table II). Switzerland, Germany and Austria show the highest utilization rates with 286–306 cases per 100,000 population, followed by Belgium, Sweden and Denmark with 225–237, whereas the USA report 204, respectively.

Annual GDP per capita ranged from 18,321 (Mexico) to 88,276 (Luxembourg) and annual health care expenditures per capita ranged from 620 USD (Mexico) to 9121 (Switzerland), which accounted for 3% (Mexico) to 17% (Switzerland) of GDP expenditures. Access to essential care was 100% in all countries, except for Mexico with 46%, respectively.

A strong correlation ($r = .764$, $P < .001$) was found between utilization rate of hip arthroplasty and health care expenditures and a significant and moderate correlation ($r = .642$, $P < .001$) was found between utilization rate and GDP: Countries with a higher GDP per capita and higher health care expenditures had a significantly higher utilization rate of hip arthroplasty (Fig. 4).

There was a 23% rise in the total number of hip arthroplasties performed between 2005 and 2011 in OECD, while population grew only by 4% during the same time frame. This increase is attributed to the increasing use of arthroplasty in younger patients (+35%) (Table III) compared to the older population (+16%) (Table II). This is in stark contrast to population growth during the same time frame, which was 3% and 12%, respectively (Fig. 1). CAGR of "mean utilization rate" is seven times higher in younger patients than in older ones (3.9% vs 0.6%) (Fig. 3). Q4

Korea and Poland show the highest growth rates of hip arthroplasty. In contrast, Ireland shows massive decreasing utilization rates despite the population grows slightly. In Estonia, Finland and New Zealand as well a decline was noted in the use of hip arthroplasty in patients aged 65 or older (Fig. 2).

There was a trend for a higher CAGR in countries with a lower utilization rate as compared to countries with a higher utilization rate that demonstrated lower CAGR values.

The significant increase in total utilizations is attributed to the increasing use of hip arthroplasty in patients aged less than 65 years, where CAGR rates are higher as compared to older patients.

Please cite this article in press as: Pabinger C, Geissler A, Utilization rates of hip arthroplasty in OECD countries, Osteoarthritis and Cartilage (2014), http://dx.doi.org/10.1016/j.joca.2014.04.009