The Journal of Arthroplasty 29 (2014) 1911–1914

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Unnecessary Magnetic Resonance Imaging of Hips: An Economic Burden to Patients and the Healthcare System

Kimona Issa, MD, Julio J. Jauregui, MD, Mark McElroy, MS, Samik Banerjee, MD, Bhaveen H. Kapadia, MD, Michael A. Mont, MD

Center for Joint Preservation and Replacement, Rubin Institute for Advanced Orthopedics, Sinai Hospital of Baltimore, Baltimore, Maryland

ARTICLE INFO

Article history:
Received 29 April 2014
Accepted 23 May 2014

Keywords:
unnecessary MRI
hip osteoarthritis
hip arthritis
healthcare costs
economic burden

ABSTRACT

Patients referred to orthopedists for hip pain due to arthritis may already have MRI studies ordered by their referring physicians despite plain radiographs being sufficient in most cases. Hence, we prospectively evaluated every patient referred to our institution during a 36-month period to identify the number of new patients with hip osteoarthritis who had an unnecessary MRI, the additional costs of these MRIs, and the extrapolated cost to the United States healthcare system during the next 10 years. Overall, 15.4% of the patients presented with unnecessary MRIs, approximately, 330 to 440.5 million dollars may be spent on unnecessary hip MRIs in this patient population in America. We believe that referring physicians should not simultaneously order a radiograph and an MRI to evaluate hip pain.

Containing rising healthcare costs continues to be a major priority for United States policymakers [1]. According to the most recent data available from the World Health Organization, from 2000 to 2008, per capita expenditure on healthcare in the United States grew from $4703 to $7164, and the expenditure as a percentage of the gross domestic product (GDP) grew from 13.4% to 15.2%. Both of these values were the highest of any country [2]. For comparison, the United Kingdom spent $2662 per capita in 2008, with total expenditures equaling 8.7% of its GDP [2] which potentially is an underestimate as well. Increasing the urgency for action is the most recent data from the Centers for Medicare and Medicaid Services showing that the percentage of GDP spent on health care rose to 17.9% in 2011 and will continue rising to a projected 19.6% by 2021 [3]. Taken together, these trends have led to increasing pressure from healthcare reformers, hospital administrators, and insurance companies to provide care at lower costs.

The diagnosis and treatment of arthritis is one area with potential for cost reduction. The Centers for Disease Control and Prevention have named arthritis as the leading cause of disability in the United States and estimate that the total costs attributable to arthritis [4] and other rheumatic conditions to be 1.2% of the GDP [5]. A 2010 study by Murphy et al [6] estimated that one out of every four people may experience pain from hip arthritis in their lifetime. Many patients with hip arthritis initially seek care from their primary care physicians (PCP.) These PCPs may simultaneously order plain radiographs and a magnetic resonance imaging (MRI) study despite the plain radiographs being sufficient to formulate a diagnosis and treatment plan in most cases. With the cost of a hip MRI far exceeding that of a standard two-view set of plain hip radiographs ($782 versus $222, respectively, at our institution), reducing the number of these unnecessary MRIs represents one way to decrease healthcare costs. Furthermore, because of the high prevalence of hip arthritis, even small reductions in cost per patient may result in important overall savings.

As a tertiary referral center for joint-related problems, we receive a high number of patients with hip arthritis who presented with both plain radiographs and MRIs ordered by their referring physicians. We aimed to examine the frequency with which this costly, and often unnecessary, practice occurred. We sought to answer the following questions: (1) what percentage of these referred patients for hip pain had received unnecessary hip MRIs; (2) was there a correlation between patient demographics and the likelihood of receiving an MRI study; (3) what were the additional costs incurred to our patients by these unnecessary MRIs; and (4) what was the approximate cost to the United States healthcare system when these results were extrapolated to a national level?

Methods

All 21,837 consecutive patients who were evaluated by one of the three experience orthopedic surgeons at our tertiary care center from July of 2010 and June of 2013 were prospectively and carefully assessed to identify only the number of new patients. This resulted in identifying 4133 new patients who had presented to our institution. All patients who were evaluated for shoulder, knee, ankle, elbow, and

The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2014.05.022.

Reprint requests: Michael A. Mont, MD, Center for Joint Preservation and Replacement, Rubin Institute for Advanced Orthopedics, Sinai Hospital of Baltimore, 2401 West Belvedere Avenue, Baltimore, MD 21215.

http://dx.doi.org/10.1016/j.arth.2014.05.022
0883-5403/

wrist were excluded from this study in order to identify only new patients who had symptomatic hip disease. This resulted in 1135 new patients who were referred for symptomatic hip disease. All patients who had non-osteoarthritis hip diagnoses such as osteonecrosis, rheumatoid arthritis, traumatic arthritis, etc. were excluded (all these are summarized in Table 1). The remaining 383 patients included 156 men and 227 women who had a mean age of 56 years (range, 28 to 90 years) and a mean body mass index of 30 kg/m^2 (range, 20.5 to 54 kg/m^2). The sources of referral were primary care physicians (PCPs) (86%) and sub-specialists (14%) (e.g. rheumatology, emergency medicine, etc.) Approval to conduct the study was obtained from our institutional review board committee.

When patients had both plain hip radiographs and MRI studies at presentation, an experienced, fellowship trained adult joint reconstruction orthopedic surgeons had evaluated all available radiographs and patient records to determine whether the obtained MRI was necessary to diagnosis or to aid in developing a treatment plan. Radiographic evaluations of osteoarthritis were according to the Kellgren–Lawrence classification [7]. According to this classification, Grade I is when the narrowing of the joint space is unlikely. Grade II is when there are small osteophytes with possible narrowing of the joint space. Grade III is when there are multiple, moderately sized osteophytes, definite joint space narrowing, some sclerotic areas, possible deformation of bone ends. Grade IV is an end-stage disease when there are multiple large osteophytes, severe joint space narrowing, marked sclerosis and definite bony end deformity. Our patients had the following Kellgren–Lawrence osteoarthritis grade disease: Grade I (2 patients), Grade II (18 patients), Grade III (114 patients), and Grade IV (128 patients). An MRI was considered to have been inappropriately ordered for patients with osteoarthritis since this condition is visible on plain radiographs [7].

Furthermore all patient demographic data including age, gender, and body mass index for all patients were recorded and the odds ratio of receiving an unnecessary MRI stratified by these demographics were further evaluated.

Since referred patients had received their MRIs at various outside facilities, it was difficult to obtain a summation of actual costs due to variability in insurance compensations. To make a potential estimate, we evaluated the costs of a standard hip MRI at our institution and also attempted to calculate an upper limit value based on our search of cost in a national level. This total cost was $782 in our institution, which is a combination of the $565 test fee and the $217 radiologist fee (CPT 73721, "MRI hip single sequence"). While the cost at a single point in time throughout the year varied, $782 represents the rate as averaged over a year (from 2010 to 2013) and approved for the state of Maryland by the Maryland Health Services Cost Review Commission. Our mean estimated upper limit of cost per each MRI was $1600 [8].

Table 1
Summary of Etiology of Hip Disease in Our Patients.

Etiology of Hip Disease	Number of Patients	Percent
Osteoarthritis	383	33.7
Previous THA at outside institution	221	19.5
Osteonecrosis	203	17.9
Labral pathology	67	5.9
Tendonitis (Piriformis syndrome)	43	3.8
Trocanteric bursitis	42	3.7
Fracture	35	3.1
Congenital dysplasia	29	2.6
Fibro mialgia	21	1.9
Muscle strain	18	1.6
Legg calve Perthes	14	1.2
Fibrous dysplasia	13	1.1
Rheumatoid arthritis	13	1.1
Femoroacetabular impingement	9	0.8
Traumatic	8	0.7
Osteochondritis	7	0.6
Slipped capital femoral epiphysis	5	0.4
Malignancy	2	0.2
Infectious arthritis	2	0.2

We then sought to estimate the total cost of unnecessary hip MRIs at a national level. The current incidence of osteoarthritis in United States was estimated to be approximately between 750,000 to 1,000,000 new cases annually according to the studies by Hootman and Helmick [9] and Center for Disease Control and Prevention reports [10], respectively. These averages were used to estimate the upper and lower approximation of the incidence of osteoarthritis in America. The estimated incidence of symptomatic hip osteoarthritis among all other joint arthritis was estimated to be between 9% and 14% (mean 12%) [11]. We further asked a consecutive cohort of 250 total hip arthroplasty patients in our practice when were they diagnosed with hip osteoarthritis and 31% had responded to be diagnosed the same year as their arthroplasty procedure. Using this percentage, we estimated that approximately 100,000 cases of THA nationwide may be performed within the same year of diagnosis of hip osteoarthritis. To form this extrapolation, we calculated the mean unnecessary cost of MRIs form our cohort per each patient and multiplied that by the estimated incidence of symptomatic hip osteoarthritis during the next 10 years. These means were used to estimate the upper and lower approximation of potential wasted costs.

Data were recorded using an Excel spreadsheet (Version 2007, Microsoft Corporation, Redmond, Washington). Percentages were calculated to determine the proportions of necessary and unnecessary MRIs. Odds ratios were calculated using MedCalc software (Ostend, Belgium). Cost analysis was performed by calculating the average unnecessary expenditure per patient in our study then multiplying this average cost by the estimated incidence of hip osteoarthritis in the United States over the next decade.

Results

In total, 15.4% ($n = 59$ of 383) of the patients presented with MRIs that had been prescribed at a similar time as plain hip radiographs by their refereeing physicians (Figure 1). However, 100% of these MRIs were determined to be unnecessary to diagnose hip osteoarthritis and/or to develop potential treatment plans. The stage of hip osteoarthritis in this patients cohort included 13 patient (22%) with Stage I, 14 (23.7%) with Stage II, 17 (29%) with Stage III, and 15 (25.5%) with Stage IV Kellgren–Lawrence classification.

Patients who had received MRI included 25 men and 34 women who had a mean age of 51.5 years (range, 32 to 87 years) and a mean body mass index of 29 kg/m^2 (range, 21 to 54 kg/m^2). When the cohort of patients who had received MRI was compared to all remaining patients with hip osteoarthritis who had not received MRI, women (OR: 1.5; $P = 0.21$), age younger than 45 (OR:1.3; $P = 0.28$), and a body mass index of greater than 40 kg/m^2 (OR:1.42; $P = 0.25$) were associated with higher odds ratio of receiving an unnecessary MRI.

Using the $782 to $1600 estimated national cost of a hip MRI, the 59 unnecessary MRIs ordered by referring physicians in 383 patients with hip arthritis had cost approximately $46,138 to $94,400. This is approximately $120.5 to $246.5 extra cost (per each patient who had hip osteoarthritis.

Extrapolating the mean $183.5 extra cost per patient, an estimated total of 330 to 440.4 million dollars may be spent on unnecessary hip MRIs in this patient population (not accounting for inflation) for 180,000 to 240,000 estimated new cases of hip arthritis per year in America.

Discussion

Rising healthcare costs continue to be a topic of interest in both the political and medical professions [1]. One potential area for cost reduction is the elimination of unnecessary diagnostic testing that may not change the course of medical management. Specifically, we have noticed that a large number of patients presenting to our