THE CROATIAN HEALTH INSURANCE FUND DOES NOT RECOGNIZE DIFFERENCES IN THE COST OF DIFFERENT TREATMENTS FOR REVISION TOTAL HIP ARTHROPLASTY

Srećko Sabalić1,2, Dinko Vidović1,3, Slaven Babić1, Tomislav Ćuti1, Domagoj Gajski1,4,6, Krešimir Rotim1,4,5,6 and Dejan Blažević1,4

1Department of Traumatology, Sestre milosrdnice University Hospital Centre, Zagreb, Croatia; 2School of Medicine, University of Split, Split, Croatia; 3School of Dental Medicine, University of Zagreb, Zagreb, Croatia; 4University of Applied Health Sciences, Zagreb, Croatia; 5School of Medicine, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia; 6Department of Neurosurgery, Sestre milosrdnice University Hospital Centre, Zagreb, Croatia

SUMMARY – In recent years, there has been increased interest in the cost of treatment for revision interventions for hip and knee prostheses. In all publications so far, the authors note the high cost of treatment for revision interventions, especially if infection is present. The aim of this study was to compare the cost of treatment and health insurance reimbursements between revision total hip arthroplasty (THA) for infection and revision for aseptic indications (aseptic instability and periprosthetic fracture). Hospital data on 168 patients having undergone revision THA between 2010 and 2018 at the Department of Traumatology, Sestre milosrdnice University Hospital Centre from Zagreb were analyzed. Financial data were collected from the Hospital Information System. Financial analysis included total cost per patient, Croatian Health Insurance Fund reimbursements, cost of implants, and length of hospital stay. The difference between the mean total cost per patient and the mean Croatian Health Insurance Fund reimbursements was -262.83 € (-6.08%) for aseptic instability, -1694.94 € (-17.25%) for infection and -916.49 € (-17.33%) for periprosthetic fracture. The Croatian Health Insurance Fund does not recognize differences in the cost of revision THA for aseptic instability, infection and periprosthetic fracture. Health insurance reimbursement is inadequate for centers that offer revision hip surgery.

Key words: Revision total hip arthroplasty; Infection; Periprosthetic fracture; Aseptic instability; Financial analysis

Introduction

The most common reasons for revision total joint arthroplasty published in the literature are instability with or without aseptic loosening, infection and periprosthetic fracture1-3. In recent years, due to the high cost of treatment for revision prosthetic surgery, there has been increased interest in this issue4-7, especially as health insurance institutions are not considered to cover treatment costs8. In Croatia, the cost of treatment for revision surgery of hip prosthesis has not been analyzed so far, which also holds for payment of the Croatian health insurance for revision hip surgery, including aseptic or septic instability, which needs revision after total hip prostheses and/or periprosthetic hip fractures.
Methods

We analyzed hospital data on 168 patients having undergone revision total hip arthroplasty (THA) between 2010 and 2018 at the Department of Traumatology, Sestre milosrdnice University Hospital Centre from Zagreb. Financial data were collected from the Hospital Information System. Financial analysis included total cost per patient, Croatian Health Insurance Fund reimbursements, cost of implants, and length of hospital stay. Patients were divided into three groups according to indications for revision THA, as follows: aseptic instability, infection and periprosthetic fracture (which requires treatment with some kind of revision type of hip prosthesis). On statistical analysis, Student’s t-test at 95% confidence level (p<0.05) was used. The cost of treatment, reimbursement and cost of implants were expressed in €.

Results

During the 2010-2018 period, 168 patients underwent revision THA. Their mean age was 70.82 (range 47-92, SD 9.73) years. There were 73 (43.5%) male and 95 (56.5%) female patients. Indications for surgery were aseptic loosening and instability in 89 (52.9%), infection in 35 (20.8%) and periprosthetic fracture in 44 (26.1%) cases (Fig. 1).

Total cost of treatment for aseptic loosening and instability, infection and periprosthetic fracture is shown in Table 1. Health insurance reimbursements for aseptic loosening and instability, infection and periprosthetic fracture is shown in Table 2. The cost of implants for aseptic loosening and instability, infection and periprosthetic fracture is shown in Table 3. The mean total cost was significantly higher for those undergoing revision for infection (9825.47 €; SD 5913.29) than in the aseptic loosening and instability group (4324.86 €; SD 1266.25; p<0.001, unpaired t-test). The mean total cost was significantly higher for those undergoing revision for infection (9825.47 €;
The CHIF does not recognize differences in the cost for revision THA (5289.25 €; SD 1836.67; p<0.004, unpaired t-test). The mean total cost was significantly higher for those undergoing revision for periprosthetic fracture (5289.25 €; SD 1836.67) than in the aseptic loosening and instability group (4324.86 €; SD 1266.25; p<0.013, unpaired t-test). The length of hospital stay (in days) for aseptic loosening and instability, infection and periprosthetic fracture is shown in Table 4. Financial analysis of revision hip arthroplasty for aseptic loosening and instability, infection and periprosthetic fracture is shown in Table 5.

### Discussion

In the USA, an estimated 2.5 million people are living with hip replacement9. Revision THA is a complex procedure that is associated with a greater risk for patients and greater cost for the treating hospital when compared with primary THA. Revised procedures for periprosthetic joint infection (PJI) are associated with a significantly higher number of hospitalizations, hospital days and number of operations, as well as longer operating time, more blood loss, prolonged antibiotic therapy, higher number of radiographic examinations, and more total outpatient visits during 12-month period following the index procedure. Complications will become an accruing burden to the health care system in the next two decades10-13. The economic impact of PJI is significant. The overall cost to the American health care system to treat PJI was 566 million dollars in 2009, a number that is projected to reach 1.62 billion dollars in 202014.

In some national health insurance systems, institutions do not recognize this problem. For example, a study undertaken in Germany8 found that reimbursement was inadequate. In this study, a total of 281 patients were treated in 2015 due to infection of the

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### Table 3. Cost of implants for aseptic loosening and instability, infection and periprosthetic fracture

| Cost of implants (€)                  | Aseptic loosening and instability | Infection | Periprosthetic fracture |
|---------------------------------------|----------------------------------|-----------|-------------------------|
| Mean                                  | 1771.20                          | 2283.49   | 1711.43                 |
| Standard deviation                    | 739.89                           | 990.19    | 675.03                  |
| Minimum                               | 182.00                           | 686.00    | 1008.00                 |
| Maximum                               | 4108.00                          | 4318.37   | 3225.60                 |

### Table 4. Length of hospital stay for aseptic loosening and instability, infection and periprosthetic fracture

| Length of hospital stay (days) | Aseptic loosening and instability | Infection | Periprosthetic fracture |
|--------------------------------|----------------------------------|-----------|-------------------------|
| Mean                           | 19.46                            | 64.16     | 26.10                   |
| Standard deviation             | 8.68                             | 57.64     | 13.29                   |
| Minimum                        | 6.00                             | 12.00     | 14.00                   |
| Maximum                        | 52.00                            | 228.00    | 70.00                   |

### Table 5. Financial analysis of revision hip arthroplasty for aseptic loosening and instability, infection and periprosthetic fracture

|                                       | Mean total cost (€) | Mean health insurance reimbursement (€) | Deficit (€)       |
|---------------------------------------|---------------------|-----------------------------------------|-------------------|
| Aseptic loosening and instability     | 4324.86             | 4062.03                                 | -262.83 (-6.08%)  |
| Infection                             | 9825.47             | 8130.53                                 | -1694.94 (-17.25%)|
| Periprosthetic fracture               | 5289.25             | 4372.76                                 | -916.49 (-17.33%) |
musculoskeletal system. Of these, 144 patients had periprosthetic infection of the knee or hip joint. Total cost of these 281 treatments was 3.3 million € but only 2.7 million were covered by the diagnosis-related groups (DRG) revenues (underpaid by approximately 20%). This corresponded to a deficit of 633,000 €, with a mean deficit per treatment case of 2300 €. The deficit for infected THA was about 8500 € on average and was five times greater than for infected total knee arthroplasty (TKA) with ~1600 €. The main reasons for the high treatment costs were the length of hospital stay, multiple surgical interventions, and isolation treatment.

In our study, we aimed to evaluate the economic burden of the cost of revision THAs and health insurance reimbursements, with special emphasis on the cost of treating patients with revision THA for PJIs at a university hospital in a middle-income EU country. We found that the mean total cost was significantly higher for those undergoing revision for infection as compared with the aseptic loosening and instability group (p<0.001) and the periprosthetic fracture group (p<0.004). In addition, the mean total cost was significantly higher for those undergoing revision for periprosthetic fracture than in the aseptic loosening and instability group (p<0.013).

Also, the mean cost of implants was about 1800 € for aseptic loosening and instability, 2300 € for infection and 1700 € for fracture. The mean length of hospital stay (in days) was 20, 64 and 26 days for aseptic loosening and instability, infection and fracture, respectively. All hospitalizations and rehospitalizations were included in the study.

We compared the mean total cost and the mean Croatian Health Insurance Fund reimbursements and found the mean deficit of 260 € for aseptic loosening and instability, 1700 € for infections, and 900 € for periprosthetic fracture. Patients with PJI require repetitive hospitalization, more days of hospitalization, more surgical procedures and antibiotic therapy, which increases the cost of treatment as opposed to revision for aseptic instability or periprosthetic fracture. The Croatian Health Insurance Fund reimburses the same amount through the DRG system for different indications and treatment modalities in revision hip surgery and therefore the highest deficit is generated in the case of infection.

Kallala et al. examined inpatient hospital data on 168 revision TKAs. They found that revision surgery for infection was associated with a mean length of stay more than double that in aseptic cases. The mean cost of revision for infection was more than three times that of aseptic revision. Total reimbursement was 1.9 million £, yielding an average loss of 4.5 thousand £ per case in 168 cases.

Our study had several limitations. These were retrospective design and data on the costs were obtained using the hospital accounting system. Therefore, we could not obtain and differentiate (other costs) all cost data for economic analyses. We can expect that the overall cost of treatment is much higher, especially in case of infection and if the patient is active because these is only the cost of treatment at the hospital, without the cost of treatment outside hospitals, as well as the possible loss of income for the patient.

Croatia is a country with a significant share of public social health and small share of private sector. The cost of treatment in hospitals is arbitrary and is determined by the Croatian Health Insurance Directorate. So far, hospital institutions have not commented on the cost of treatment for revision interventions after THA and reimbursements from the Croatian Health Insurance Fund.

In the Croatian health system, we do not have a system where patients with these conditions are transferred to centers of excellence, to reduce treatment costs. There is no broader social understanding of the length and cost of treating hip revision interventions, especially for infection. Organized education of all medical professionals on the prevention of surgical infections should be introduced in the Croatian health system, as well as raising awareness of the cost of treating bone infections.

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Sažetak

HRVATSKI FOND ZA ZDRAVSTVENO OSIGURANJE NE PREPOZNAJE RAZLIKE U TROŠKOVIMA RAZLIČITIH MODALITETA REVIZIJE TOTALNE ARTROPLASTIKE KUKA

S. Sabalić, D. Vidović, S. Babić, T. Ćuti, D. Gajski, K. Rotim i D. Blažević

Posljednjih godina sve je veći interes za troškove liječenja revizijskih intervencija kod endoproteza kuka i koljena. U svim dosadašnjim publikacijama autori bilježe visoke troškove liječenja revizijskih intervencija, osobito ako je prisutna infekcija. Cilj ove studije bio je usporediti troškove liječenja i naknade hrvatskog zdravstvenog osiguranja između revizije totalne artroplastike kuka za infekciju i revizije za aseptične indikacije (aseptična nestabilnost i periprotetski prijelom). Analizirani su bolnički podaci 168 bolesnika koji su bili podvrgnuti reviziji totalne artroplastike kuka u razdoblju od 2010. do 2018. godine na Klinici za traumatologiju Kliničkog bolničkog centra Sestre milosrdnice u Zagrebu. Financijski podaci prikupljeni su iz bolničkog informacijskog sustava. Financijska analiza uključivala je ukupni trošak po bolniku, troškove hrvatskog zdravstvenog osiguranja, troškove implantata i duljinu boravka u bolnici. Razlika između srednje vrijednosti ukupnog troška po bolesniku i srednje vrijednosti povrata hrvatskog zdravstvenog osiguranja bila je -262,83 € (-6,08%) za aseptičnu nestabilnost, -1694,94 € (-17,25%) za infekciju i -916,49 € (-17,33%) za periprotetski prijelom. Hrvatski fond za zdravstveno osiguranje ne prepoznaje razlike u troškovima revizije totalne endoprotese kuka za aseptičnu nestabilnost, infekciju i periprotetski prijelom. Naknada za zdravstveno osiguranje nije odgovarajuća za centre koji obavljaju reviziju kuka.

Ključne riječi: Revizija totalne artroplastike kuka; Infekcija; Periprotetski prijelom; Aseptična nestabilnost; Financijska analiza