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REVİZE ETMEK VEYA ETMEMEK! İŞTE BÜTÜN MESELE BU

TO REVISE OR NOT TO REVISE! THAT IS THE QUESTION

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ÖZ

AMAÇ: Bir kamu hastanesinin ortopedi ve travmatoloji kliniğinde kalça revizyon artroplasti ameliyatı yapılan hastaların yatarak tedavi gördüğü süreçte, kurumca katlanılan maliyetlerinin araştırılması ve fatura edilen miktar ile karşılaştırılması amaçlanmıştır.

GEREÇ VE YÖNTEM: 01.01.2016 ile 30.09.2017 tarihleri arasında bir kamu hastanesinde total kalça revizyon artroplastisi ameliyatı yapılan 60 hastanın demografik bilgileri ve revizyon nedenleri tespit edilmiştir. Hastalar septik ve aseptik olarak iki gruba ayrılmıştır. Hastaların, yatarak tedavi gördüğü sürece katlanılan tıbbi sarf, ilaç/serum, tedavi, ameliyat, anestezi, görüntüleme, laboratuvar, kan ve kan ürünleri, yemek, refakatçı maliyetleri, cihaz amortisman giderleri, konsültasyon, kontrol muayenesi, ameliyat öncesi hasta hazırlık aşaması, vizit ve diğer maliyetleri her bir hasta için ayrı ayrı hesaplanmıştır.

BULGULAR: Bir hastanın toplam maliyeti ortalama 21.956,00 ₺ iken fatura tutarı ortalama 17.220,00 ₺ tespit edilmiş olup arada 4.736,00 ₺ fark bulunmaktadır. Bu fark septik gruptaki hastalarda 9.876,00 ₺, aseptik gruptaki hastalarda 2.534,00 ₺ olarak tespit edilmiştir. SGK'nın kuruma yaptığı fatura ödemesi, revizyon kalça artroplastisi maliyetinin% 78,4'ünü kapsıyor. Septik grupta yatış süresi, tıbbi sarf, ilaç, tedavi, ameliyat, anestezi, laboratuvar, görüntüleme, kan merkezi, konsültasyon, vizit, yemek maliyeti, toplam maliyet ve fatura tutarı aseptik gruptan anlamlı ($p< 0.05$) olarak daha yüksek bulunmuştur.

SONUÇ: Kamu hastanesinin mali sürdürebilirliğinin sağlanması için SGK tarafından düzenlemelerin yapılmasına ihtiyaç bulunmaktadır. Ayrıca, revizyon cerrahisinde medikal ve teknik protokolleri takip edilmesi maliyetin azalmasına yardımcı olabilir.

ANAHTAR KELİMELER: Hastane maliyetleri, Revizyon, Artroplasti, Kalça, Maliyet analizi

ABSTRACT

OBJECTIVE: The aim of this study was to investigate the costs covered by the hospital during the inpatient treatment process of the patients who underwent hip revision arthroplasty surgery in orthopedics and traumatology clinics of a public hospital and compare with the invoiced amount.

MATERIAL AND METHODS: The demographic information and revision reasons of 60 patients who underwent total hip revision arthroplasty operation in a public hospital between 01.01.2016 and 30.09.2017 were determined through Hospital Information Management System records. The patients were categorized under two groups including septic and aseptic. For each patient, the costs of medical consumables, medicine/serum, medical treatment, surgery, anesthesia, imaging services, laboratory procedures, blood and blood products, meal and companion costs, device depreciation expenses, consultation, control examination, preoperative patient preparation stage, surgery, visit and other costs were calculated separately during the inpatient treatment.

RESULTS: The total cost of an average patient was 21,956.00 ₺, while the average amount of invoice was 17,220.00 ₺, with a difference of 4,736.00 ₺. This difference was found to be 9,876.00 ₺ in the septic group and 2.534,00 ₺ in the aseptic group. The bill payment made by the Social Security Institution (SGK) to the institution covers 78.4% of the cost of revision hip arthroplasty. In the septic group, the duration of hospital stay, medical expenditure, medication, treatment, surgery, anesthesia, laboratory, imaging, blood center, consultation, visit, meal cost, total cost and invoice amount were found to be significantly higher than the aseptic group ($p< 0.05$).

CONCLUSIONS: Regulations by the Social Security Institution are needed to ensure the fiscal sustainability of public hospitals. In addition, following the medical and technical treatment protocols in revision surgery can help reduce the costs.

KEYWORDS: Hospital costs, Revision, Arthroplasty, Hip, Cost analysis

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INTRODUCTION

More than 1 million arthroplasties are done every year worldwide, and this number is projected to double within the next two decades (1).

The Nationwide Inpatient Sample (United States) surveys of hospital discharge records projected the demand for primary total hip arthroplasty to increase by 174%, from 208,600 in 2005 to 572,000 by 2030. Total hip arthroplasty revisions were projected to grow from 40,800 in 2005 to 96,700 in 2030 (an increase of 137%) (2). Revision total hip arthroplasty requires significantly more work and risk on the part of the surgeon, high postoperative complication rate and significantly more hospital resources (3).

For an economical operation and sustainability of a hospital, the costs of complex cases requiring higher budgets should cover the variable costs per patient, which enables to cover the hospital's total fixed costs by the income from other more common procedures (4).

Calculation of the costs of the services in hospitals is a very difficult tough and sore issue, because overhead costs are common in hospitals, and the diversity of health services provided and the complexity of service units causes some difficulties in cost estimations.

Public hospitals delivered most of their services free of charge, and there is often no direct relationship between the income from service provision and the cost of services. It is only possible to determine whether a hospital gains or losses from an operation by identifying the expenses in a real or real-like way. Diagnostic and treatment methods of health services financed by the Social Security Institution (SGK) in our country are indicated in the Health Practice Notifications (SUT) and the annexes lists and SUT scores are determined comparingly in line with the opinions of experts according to the difficulty of the procedures (5, 6).

In this study, it is aimed to investigate the costs covered by the hospital during the inpatient treatment process of the patients who underwent hip revision arthroplasty surgery in orthopedics and traumatology clinics of a public hospital and compare with the invoiced amount.

MATERIALS AND METHODS

Demographic information and revision reasons of 60 patients who underwent total hip revision arthroplasty operation in a public hospital between January 01, 2016 and September 30, 2017, were determined through Hospital Information Management System (HBYS) records.

All total revision procedures due to infection, component loosening, and instability were included in the study. The patients were categorized into two groups as septic and aseptic.

The treatment costs of patients in public hospitals in Turkey were maintained according to the lists in the SUT and the annexes in the appendix announced by the SGK. In these lists, a code has been determined for each surgical procedure and the amount to be paid to the institution is indicated by the codes. The physician enters the code of each surgical procedure applied to the patient. The data of the patients for whom the code for the total hip revision arthroplasty was used were included in the study but those for whom partial revision arthroplasty code was used were excluded from the study **(Figure 1a, Figure 1b)**.

Two-stage revision arthroplasty operations in patients with septic origin were included in the study **(Figure 2a, Figure 2b, Figure 2c)**. The duration and cost of hospitalization for each stage were added to the data set for each patient and included in the study.

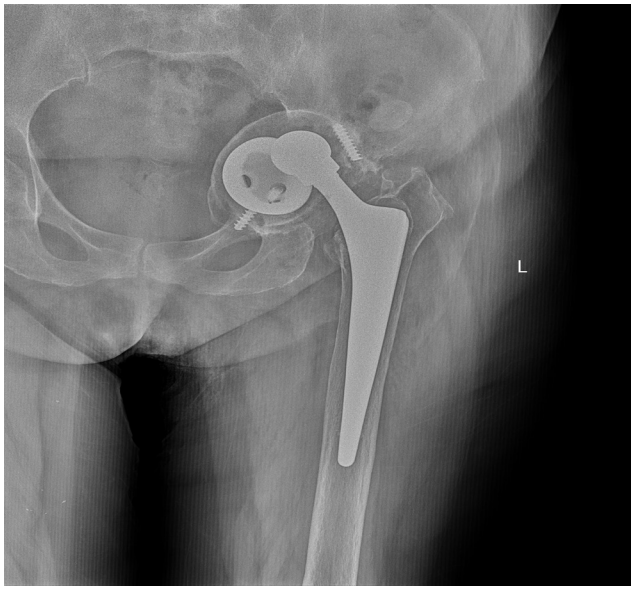

Figure 1a: Left hip AP radiography of 67-year-old patient with left hip total hip arthroplasty aseptic loosening.

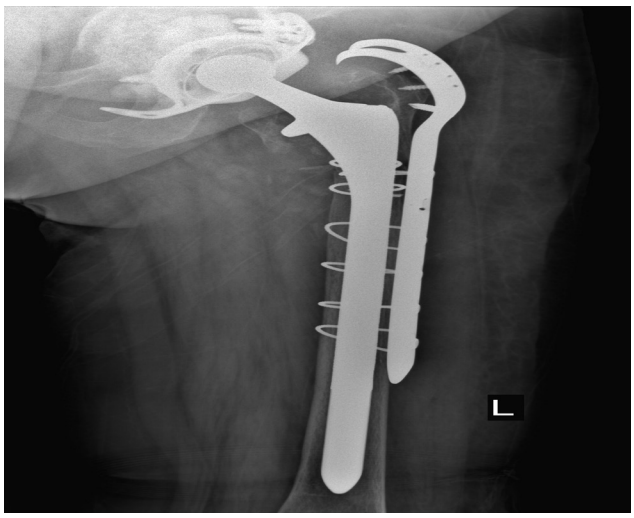

Figure 1b: Postoperative left hip AP radiography of patient revision total hip arthroplasty operation with acetabular allograft, Burch Schneider ring, cemented polietilen acetabular cup, revision type femoral stem, metalhead, trochanteric grip plate and Dall-Miles cable.

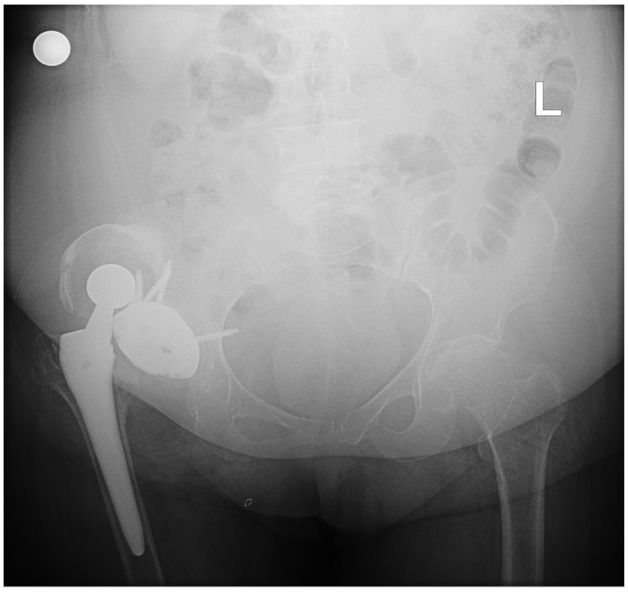

Figure 2a: Pelvis AP radiography of 65-year-old patient with right total hip arthroplasty septic loosening, and chronic luxation.

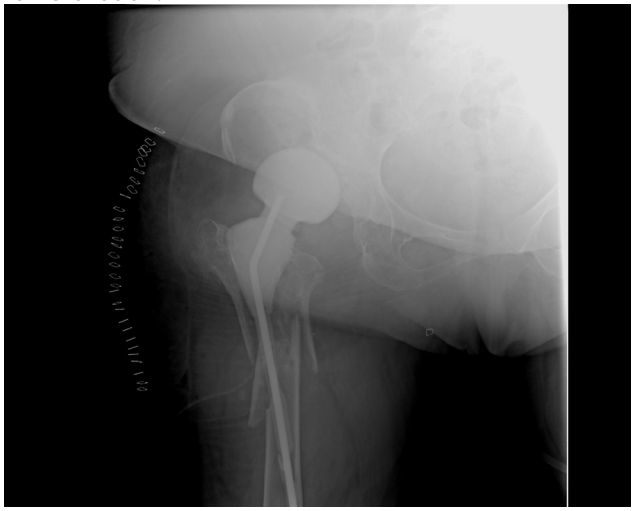

Figure 2b: Postoperative pelvis AP radiography after debridement and spacer implantation.

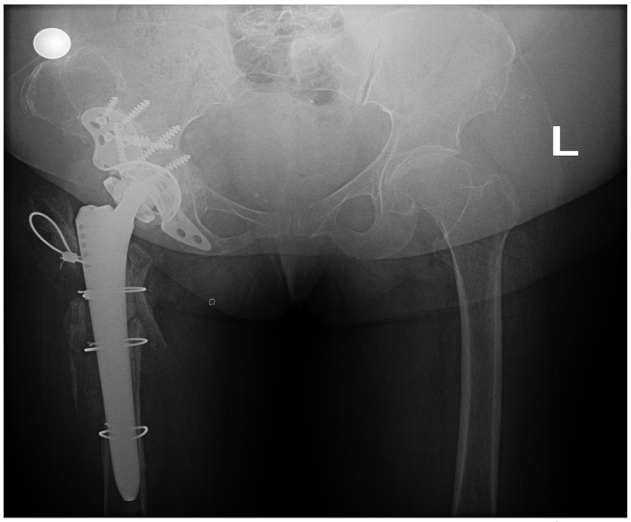

Figure 2c: Postoperative pelvis AP radiography after second stage revision total hip arthroplasty operation with acetabular allograft, Burch Schneider ring, cemented constraint polietilen acetabular cup, revision type femoral stem, ceramic head, and Dall-Miles cable.

For each patient, the costs of medical consumables (femoral revision stem, acetabular cup, screw, glove, suture, etc.), medicine/serum costs, medical treatment costs (injection, transfusion, arterial catheterization, wound debridement, enema, vascular access, etc.), costs of surgery and anesthesia procedures (revision hip arthroplasty, joint debridement, implant removal, spacer application, anesthesia, epidural block, etc.), expenses of imaging services (direct graph, length graph, MR, CT, reporting, etc.), costs of laboratory procedures (biochemistry, microbiology, etc.), expenses of blood and blood products (erythrocyte suspension, FFP, etc.), patient meal and companion costs, device depreciation expenses, consultation, control examination, preoperative patient preparation stage, surgery, visit and other costs were calculated separately during the inpatient treatment, and the expenses of each patient covered by the hospital were determined after calculating the sum of all the above-mentioned costs.

While making these calculations, after the amounts of all the goods and services covered for each patient during inpatient treatment were determined through HBYS, the average purchasing unit prices of the goods and services used for these patients from the hospital purchasing unit, the goods and services procurement contracts, the point multiples determined by the laboratory and imaging service procurements, the billings paid to the Red Crescent

Blood Center, the main scores and coefficients (0,593) to be paid for the processes in the SUT annex lists, data of the salary trust department, warehouse records, data from other related units and the expense determination tables in the cost analysis studies published by the Ministry of Health were used (6).

Under the applicable legislation, the invoices according to the SUT and annex lists have been determined for each patient from the hospital records. The total costs covered, and the SGK bill amounts were compared to determine the difference.

In 2016-2017, when the study was conducted, the average exchange rates were 1US Dolar -3.02 ₺, 1 Euro-3.34 ₺ for 2016, 1 Dolar- 3.65 ₺ and 1 Euro-4.12 ₺ for 2017.

ETHICS COMMITTEE

Approval was obtained from the Metin Sabancı Baltalimanı Bone Diseases Training and Research Hospital Ethics Committee and numbered, Institutional review board approval (IRB No: 16.10.2017-16)

STATISTICAL ANALYSIS

Mean, standard deviation, median lowest, highest, frequency and ratio values were used in the descriptive statistics of the data. The distribution of the variables was measured by the Kolmogorov Simirnov test. Mann-Whitney u test was used in the analysis of quantitative independent data, a chi-square test was used in the analysis of qualitative independent data. SPSS 22.0 program (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) was used to analyze the datas.

RESULTS

Of the 60 patients, 40 were female and 20 were male, with an average age of 55. The number of patients in the aseptic group was 42 and 18 in the septic group. The data of patients undergoing hip revision arthroplasty and their costs are given in **(Table 1)**. The total cost of an average patient was 21,956.00 Turkish Liras (₺), while the average amount of invoice was 17,220.00 ₺, with a difference of 4,736.00 ₺. When comparing patients who underwent surgeries for septic and aseptic reasons, the average cost of the surgery (two-stage) for septic reasons was 32,329.00 ₺, while the invoice amount was 22,453,00 ₺, with a difference of 9,876.00 ₺. The average cost of patients who underwent surgeries for aseptic reasons was 17.511,00 ₺ while the amount of invoice was 14.977,00 ₺, with a difference of 2.534,00 ₺. The bill payment made by SGK to the institution covers 78.4% of the cost of revision hip arthroplasty, in which the invoice amount covers 69.4% of the expenses in the septic group, while the invoice amount in the aseptic revision group covers 85.4% of the cost.

Table 1: Descriptive statistics of the data.

		Min.-Max.	Median	Average.±s.s./n-%
Age		18,0 - 87,0	57,5	55,3 ± 15,3
Gender	Female			40 66,7%
	Male			20 33,3%
Surgery Time (min)		90,0 - 600,0	210,0	222,5 ± 90,6
Length of Stay (days)		4,0 - 235,0	17,0	30,7 ± 43,6
Medical Consumption Expenses (TL)		2253 - 29720	9025	10282 ± 5722
Drug Expenditures (TL)		0,2 - 6349,5	251,2	852,4 ± 1427,0
Treatment Expenses (TL)		130,0 - 3801,2	694,5	819,5 ± 643,3
Operation, Anesthesia Expenses (TL)		1319,0 - 8475,5	2327,6	2609,6 ± 1232,2
Laboratory Expenses (TL)		19,8 - 543,4	112,5	130,0 ± 102,8
Imaging Expenses (TL)		6,7 - 260,9	27,0	41,4 ± 43,4
Blood and Blood Product Expenses (TL)		28,8 - 6311,6	1387,6	1641,9 ± 1057,4
Consulting Expenses (TL)		24,1 - 1711,1	168,7	264,3 ± 301,3
Patient Admission Expenses (TL)		113,0 - 113,0	113,0	113,0 ± 0,0
Surgical Team Expenses (TL)		530,3 - 3535,4	1237,4	1311,0 ± 533,7
Device Depreciation Expenses (TL)		22,1 - 145,3	51,1	54,1 ± 21,9
Visit Team and Other Expenses (TL)		108,4 - 25471,7	1842,6	3322,2 ± 4727,5
Patient Meal Expenses (TL)		15,2 - 3560,3	257,6	464,3 ± 660,8
Companion Expenditures (TL)		0,0 - 548,6	13,4	49,7 ± 89,2
Total Cost (TL)		**7842 - 75620**	**17830**	**21956 ± 13563**
Invoice Amount (TL)		**5781 - 54984**	**15173**	**17220 ± 8645**

There are 26 patients under the age of 55 (cost mean=19732,33 ₺, invoice mean=15890,65 ₺). 10 out of 26 patients under the age of 55 are in the septic group (cost mean=21947,85 ₺, invoice mean=16627,42 ₺). 16 out of 26 patients under the age of 55 are in the aseptic group (cost mean=18347,6 ₺, invoice mean=15430,17 ₺). There are 34 patients over 55 years (cost mean=23656,65 ₺, invoice mean=18235,99 ₺). 8 out of 34 patients over the age of 55 are in the septic group (cost mean=23656,65 ₺, invoice mean=18235,99 ₺). 26 out of 34 patients over the age of 55 are in the aseptic group (cost mean=16995,53₺, invoice mean=14697,67 ₺).

The cost of septic group patients over the age of 55 was about 1708.15 ₺ more than the septic group patients under the age of 55 years.

The age and gender distribution of the patients in the aseptic and septic group of hip revision

arthroplasty operations did not differ significantly (p>0.05). In the aseptic and septic group, the duration of operation did not differ significantly (p>0.05).

In the septic group, the duration of hospital stay, medical expenditure, medication, treatment, surgery, anesthesia, laboratory, imaging, blood center, consultation, visit, meal cost, total cost and invoice amount were found to be significantly higher than the aseptic group (p< 0.05). In the aseptic and septic group, patient acceptance, operation team, device depreciation, companion expenses did not differ significantly (p>0.05) **(Table 2)**.

Table 2: Comparison of septic and aseptic revision hip arthroplasty data.

		Aseptic			Septic			
		Avr.±s.s./n-%	Median	Avr.±s.s./n-%	Median	p	
Age		57,2 ± 15,6	60,5	50,7 ± 13,7	53,5	0,093	m
Gender	Female	33 78,6%		10 55,6%		0,070	X^2
	Male	9 21,4%		8 44,4%			
Surgery Time (min)		215,7 ± 89,1	210,0	238,3 ± 94,6	240,0	0,342	m
Length of Stay (days)		16,2 ± 12,4	11,5	64,4 ± 67,2	36,0	***0,000***	m
Medical Consumption Expenses (TL)		9094 ± 4811	8324	13054 ± 6797	10611	***0,011***	m
Drug Expenditures (TL)		373,7 ± 561,6	192,9	1969,5 ± 2102,3	1110,3	***0,000***	m
Treatment Expenses (TL)		633,3 ± 454,0	484,6	1254,2 ± 808,4	1002,9	***0,000***	m
Operation, Anesthesia Expenses (TL)		2366,4 ± 941,3	2156,7	3177,2 ± 1626,6	2692,9	***0,011***	m
Laboratory Expenses (TL)		89,8 ± 54,1	68,4	223,8 ± 127,8	179,6	***0,000***	m
Imaging Expenses (TL)		27,4 ± 20,7	20,6	74,1 ± 62,2	58,5	***0,000***	m
Blood and Blood Product Expenses (TL)		1291,1 ± 691,3	1182,4	2460,6 ± 1309,3	2339,0	***0,000***	m
Consulting Expenses (TL)		150,3 ± 143,8	96,4	530,2 ± 397,8	421,8	***0,000***	m
Patient Admission Expenses (TL)		113,0 ± 0,0	113,0	113,0 ± 0,0	113,0	1,000	m
Surgical Team Expenses (TL)		1271,1 ± 525,0	1237,4	1404,3 ± 557,3	1414,2	0,342	m
Device Depreciation Expenses (TL)		52,5 ± 21,5	51,1	58,0 ± 22,9	58,4	0,342	m
Visit Team and Other Expenses (TL)		1754,9 ± 1341,3	1246,5	6979,1 ± 7279,9	3902,0	***0,000***	m
Patient Meal Expenses (TL)		245,3 ± 187,5	174,2	975,5 ± 1017,5	545,4	***0,000***	m
Companion Expenditures (TL)		47,5 ± 66,9	13,4	55,0 ± 129,6	0,0	0,401	m
Total Cost (TL)		17511 ± 7160	16185	32329 ± 18764	24598	***0,000***	m
Invoice Amount (TL)		14977 ± 5715	13602	22453 ± 11796	19171	***0,004***	m

m Mann-Whitney u test/ X^2 Chi-square test

There is no complication developed in the period in which the patients included in the study received inpatient treatment. In addition, since the complications after discharge were not included in the study, the effects on cost were not calculated.

DISCUSSION

The main purpose of the studies on the total cost of patients during inpatient treatment is to find possible ways to reduce the costs based on health care without compromising the quality of the health care services (8, 9). However, the cost analysis work is difficult and time-consuming. Administrative, financial, and medical data should be very reliable to establish the direct cost (10). In this study, it was determined that the payment of the patients who underwent the revision hip arthroplasty during inpatient treatment based on SUT prices by the SGK was made below the cost of hospitalization. The bill payment made by SGK to the institution covers 78.4% of the cost of revision hip arthroplasty, in which the invoice amount covers 69.4% of the expenses in the septic group, while the invoice amount in the aseptic revision group covers 85.4% of the cost.

In the literature, hip revision arthroplasty cost analysis studies in other countries are examined; In France, the cost of aseptic hip revisions is 12.049 euros, the invoice amount is 14.062 euros, the repayment covers 116.7% of the cost, the cost in septic revisions is 23.757 euros, the invoice amount is 15.081 euro, and the reimbursement only covers 63.4% of the cost (11).

In Germany, hip arthroplasty cost in septic revisions is 29.322 euros, the invoice amount is 16.645 euros, and the reimbursement covers only 56.7% of the cost (12). In the UK, the cost for aseptic hip revisions is 11.897 GBP, the invoice amount is 8.152 GBP, the reimbursement covers only 68.5% of the cost, the cost for septic revisions is 21.937 GBP, the invoice amount is 8.152 GBP, and the reimbursement covers only 37.1% of the cost. (13) In a study conducted in a hospital in a small settlement in England where early rehabilitation processes were performed on the same hospitalization, the aseptic-based revision cost was 31.370 GBP, the invoice amount was 8.152 GBP, and the reimbursement only covered 25.9% of the cost (14).

High reimbursements only partially cover the higher cost of revision joint replacement (15).

As the number of patients with revision hip arthroplasty surgery is expected to increase in the future (2), we believe that SGK needs to make corrective actions such as revision of SUT prices in revision hip arthroplasty operations to ensure the sustainability of financial resources in public hospitals. In similar studies, it has been reported that septic hip revision arthroplasty is significantly more costly than aseptic hip revision arthroplasty (16, 17). In our study, the cost of inpatient treatment of septic-based revision hip arthroplasty of the patients was approximately 14,818.00 TL more for one patient with aseptic

reasons. The cost of septic group patients over the age of 55 was about 1708.15 TL more than the septic group patients under the age of 55 years. There is a danger here that specialized centers will no longer be able to bear the financial burden of septic-based revision hip arthroplasty in the future (18).

This study is significant as all costs during inpatient treatment covered by the hospital are calculated and the duration of hospitalization, medical expenditure, medicine, treatment, surgery, anesthesia, laboratory, imaging, blood center, consultation, visit, meal costs, total costs and billing costs in the septic group were found to be significantly higher than the aseptic group ($p<0.05$).

It is necessary to reduce the incidence of septic revision to reduce the financial deficit caused by septic revisions of the hospital. In this case, patient-related factors and hospital-related factors need to be addressed.

Several modifiable and non-modifiable factors are associated with the risk of revision for PJI after primary hip replacement; sex, high body-mass index (BMI), steroid use, diabetes, rheumatoid arthritis, congestive heart failure, depression, and smoking and alcohol intake also recently younger age, chronic pulmonary disease, liver disease, and dementia added as factors each associated with an increased risk of PJI. Identification of modifiable factors, the use of targeted interventions, and beneficial modulation of some of these factors could be effective in reducing the incidence of PJI (19, 20).

Patient admission for a THA should be avoided before the day of surgery, patients have an increased risk for developing PJI if their hospitalization was prolonged. Higher infection rates have been associated with low institution volume of THA procedures. It is likely that high-volume institutions strictly adhere to measures for prevention and early detection of infections. Additionally, low surgeon volume is another variable identified as a risk factor for SGK after THA (21). Studies conducted to shorten the length of hospital stay may be an appropriate attempt to reduce the cost of inpatient treatment. Although there is no difference in the clinical follow-up of the patients, it is stated that, the length of hospitalization in hip arthroplasty in centers with higher surgical experience is shorter by half than the centers with less surgical experience (22). Increasing surgeon volume was associated with a shorter length of stay, lower costs and lower dislocation rates (23).

In the literature, the mean length of hospitalization of hip arthroplasty surgeries is reported to be shorter (24). We can explain the long duration of hospitalization in our study with the lack of adequate home care services after discharge in our country, thus the pain control and rehabilitation process of the patients in the early postoperative period are carried out in the hospitals. In addition, the reasons for the longer hospitalization period in patients undergoing septic revision hip surgery include the inclusion of two-stage revision arthroplasty operations in the study, the inclusion of the cost and duration of each step and process of hospitalization for spacer and spacer revision to the data set of each patient, the use of some of the antibiotics parenterally used in two-stage revision applications (Aztreonam, Vancomycin, Imipenem, Meropenem, Linezolid, Ertapenem, Doripenem, Sulbactam, Kolistimetat, Cefuroxime Sodium, and Daptomycin) being possible only during hospitalization according to the SUT (5), and inability to discharge the patient until antibiotic treatment is completed. PJI requiring multiple revisions or for which there is no possibility of continuing intravenous antibiotic therapy orally in the outpatient sector, which necessarily – regardless of the use of reserve anti-infectives – lead to a sizable increase in costs (18).

In the literature, it is stated that blood products and drug expenditures are significantly higher in the inpatient treatment of septic-based revision surgery and while analyzing the costs covered by the hospital in the cost analysis of septic total hip revision operations (25).

Blood-saving protocols can help to reduce the cost of allogeneic transfusion efforts to maintain preoperative Hb levels at 13 g/dL or greater is recommended for reducing postoperative transfusion (26). Pre-operative autologous blood donation, acute normovolemic haemodilution, hypotensive anesthesia, tranexamic

acid administration, epsilon-aminocaproic acid administration, subcutaneous placement of a vacuum drain, strict application of postoperative hemorrhagic management, and the administration of parenteral iron and erythropoietin (27, 28, 29). Inclusion of a fibrin sealant may significantly reduce post-operative blood transfusions and induce a faster recovery for patients undergoing complete RHA, allowing early discharge from the hospital. These advantages provide significant cost savings for both the hospital and the healthcare system (30).

The limitations of the study include the study being single-centered, the inability to evaluate the clinical results of the patients and the low number of patients.

Strengths of the study include regulation of SUT and its annexes to ensure the financial sustainability of public hospitals, and it's potential to contribute to further studies towards cost reduction through a detailed description of each cost item for revision hip arthroplasty operation.

CONCLUSION

As a result, to ensure the financial sustainability of the public hospital in the inpatient treatment process of the patients who have undergone this surgery, there is a need for arrangements by SGK such as increasing the SUT prices. In addition, following the medical and technical protocols in revision surgery can help reduce the costs.

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