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ORIGINAL ARTICLE

Impact of geographic location and place of surgery on treatment outcomes of total hip replacement

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ABSTRACT

Aim Environmental factors may influence postoperative outcome and quality of life following total hip replacement (THR). The aim of this study was to investigate the impact of the geographical location of the surgical site, as well as the patient's place of birth and residence, on treatment outcome in individuals with artificial hips.

Methods A prospective study was conducted involving 280 patients (both genders; mean age 62±8.8 years) who underwent THR due to primary or secondary hip osteoarthritis. The patients were divided into two groups: Group A (N=64) included individuals who were not operated in their place of birth and residence, and Group B (N=216) consisted of those who were born, resided, and underwent surgery in the same geographical location. Outcome was assessed using the EQ-5D questionnaire (covering mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), the Visual Analogue Scale (VAS) for pain, and a VAS-based treatment satisfaction scale, administered preoperatively and one year postoperatively. Statistical analysis was performed using Fisher's exact test ($p<0.05$).

Results Only 64 (22.9%) of all patients underwent surgery in their place of birth and residence, mostly for primary hip osteoarthritis. Preoperatively, Group A reported significantly greater limitations in self-care ($p<0.05$). One year postoperatively, Group B showed a significantly higher VAS score for treatment satisfaction ($p<0.05$).

Conclusion Patients who underwent total hip replacement in their place of birth and residence demonstrated a better postoperative outcome compared to those who had relocated.

Keywords: arthroplasty, immigrants, quality of life

INTRODUCTION

The prevalence of degenerative hip disease is steadily rising, with a tendency toward further growth. This condition causes significant disability in patients and markedly reduces their quality of life (1). Due to its numerous benefits, hip arthroplasty has been declared the operation of the 20th century (2). However, some studies have shown that hip-related pain was reported in 28.1% of patients 12 to 18 months after primary total hip replacement (THR), and that 7% of patients were dissatisfied or very dissatisfied one year after THR (3,4).

Surgical approach, implant design, method of fixation, type of implant, femoral head size, hospital size, and fast-track protocols can all influence THR outcome. Additional factors such as age and gender, comorbidities, medication use, alcohol consumption, smoking habits, and activity level may also affect the outcome of THR (5,6).

During the 1990s, Bosnia and Herzegovina (B&H) experienced significant migration and displacement. Regarding the status of immigrants and its impact on THR outcome, we found only studies comparing immigrants and native-born patients within the same countries (7-10).

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The aim of this study was to evaluate whether patients born and undergoing THR surgery in their hometowns in B&H reported comparable clinical outcomes to those born in one city but receiving surgical treatment in another.

PATIENTS AND METHODS

Patients and study design

This study was conducted at two university hospitals in B&H, Tuzla and Banja Luka. Patient data from these two centres were obtained from the EQ-5D health questionnaire form (11) completed by the patients. Data were collected both preoperatively and one year postoperatively.

For the purpose of this study, an immigrant was defined as an individual born in one location but residing and undergoing surgery in another, while still within the territory of B&H. A total of 64 patients (Group A), who underwent surgery in Tuzla and Banja Luka but were born in other cities, were identified and included in the immigrant group.

The main difference between the two comparison groups is the patients' region of origin. Patients treated in Banja Luka generally came from nearby municipalities surrounding the city, whereas those treated in Tuzla were from cities and cantons within the wider Tuzla region (Group B; N=216).

Data collection for all patients undergoing total hip replacement (THR) in Tuzla and Banja Luka was conducted in several stages. The last author of the study coordinated the official translation of the EQ-5D form into all legally recognized languages of B&H by engaging a certified translator.

Subsequently, arthroplasty surgeons in Banja Luka and Tuzla were contacted to coordinate the data collection process, which was conducted from January 2016 to December 2023. Patient-reported outcome measures (PROMs) were collected preoperatively and one year after THA, under the supervision of a dedicated nurse at each hospital, who ensured that the completed forms were accurately entered into a centralized database. Preoperatively, patients completed the forms within four weeks prior to surgery. Data collection and analysis were finalized in 2023. The extended duration of the study was primarily due to interruptions caused by the COVID-19 pandemic.

The inclusion criteria were as follows: provision of written informed consent to participate, patients either from their home cities or born in one city and operated in another, and completion of a preoperative standard-of-care patient-reported outcome measures (PROMs) questionnaire (12). Exclusion criteria included patients with malignancy, those scheduled for one-stage bilateral total THA, patients undergoing reoperations during the study period, and the first hip surgery in patients who received a second THA during the study.

Data from 80 patients were collected between January 2016 and December 2018 in Tuzla, whom 39 (48%) were born in cities other than Tuzla. In Banja Luka, data from 200 patients were collected, with 25 (12.5%) born outside Banja Luka. In total, 280 patients were included, with 64 (22.8%) born in cities or cantons other than their place of surgery (Group A). The remaining 216 patients (87.2%) were operated in their native city (Group B). All patients completed PROMs both preoperatively and at 1-year follow-up.

Data collected from patients in Tuzla and Banja Luka included age, gender, education level, civil status, place of birth, family type, Charnley classification (13), type of implant fixation, and type of surgical incision. Information on hip disease diagnosis was obtained from medical records. Educational level (categorized as low or middle/high) and cohabitation status (YES/NO) were self-reported via questionnaires. The simplified classification of education was based primarily on the International Standard Classification of Education (ISCED) developed by UNESCO (14).

The study received ethical approval from the Regional Ethical Review Board in Banja Luka, Bosnia and Herzegovina (Protocol No.: 116-16-8017/2016), as well as from the Regional Ethical Review Board in Tuzla, Bosnia and Herzegovina (Protocol No.: 02-09/2-4/2016).

Methods

A nurse in both cities contacted patients approximately one month before surgery to inform them about the study and to invite their participation. Patients who consented to participate were provided with the EQ-5D questionnaire (11), along with questions regarding demographic and clinical variables, including age (<60 or ≥60 years), gender (male/female), diagnosis (primary osteoarthritis or secondary osteoarthritis), Charnley classification (class A/B or C) (13), education level (low/middle/high), cohabitation status (YES/NO), type of surgical incision (lateral or posterior), and choice of implant fixation (cemented or uncemented). Patients completed the questionnaires independently, and the nurse subsequently entered the responses into an Excel database.

Each patient was contacted for a follow-up one year postoperatively, at which time all patients were asked to complete the patient-reported outcome measures (PROMs) questionnaire (12). The PROM protocol included the health-related quality of life (HRQoL) measure EQ-5D (11), a visual analogue scale (VAS) for pain (15), the Charnley classification survey (classes A + B, C) (13), and a VAS assessing patient satisfaction after surgery (11). The EQ-5D (11) form used was translated into the official languages of the peoples of Bosnia and Herzegovina.

The EQ-VAS for general health ranges from 0 (worst imaginable health state) to 100 (best imaginable health state). The Pain-VAS ranges from 0 (no pain) to 100 (unbearable pain). The Satisfaction-VAS used at follow-up measures satisfaction with the total hip replacement outcome, where 0 represents complete satisfaction and 100 indicates maximum dissatisfaction. To assess patient-reported comorbidity status, patients completed the Charnley classification survey.

Prior to surgery, patients attended a preoperative visit during which they were examined by an orthopaedic surgeon (typically the surgeon who would perform the operation), an anaesthesiologist, a physiotherapist, and a nurse. During this visit, patients received detailed information about the type of anaesthesia and surgical procedure, expected outcome, potential risks and complications, and the postoperative rehabilitation process.

Each participant was identified using a unique personal identity number. One-year postoperative data collection was conducted during routine follow-up visits at the two hospitals. All data collection in B&H was performed using paper form. Patients were contacted in the clinic preoperatively and again one year postoperatively to complete the survey.

The questionnaire has also been adapted for preoperative use as an internet-based touchscreen application in hospital clinics and is optionally available via the Web.

The three-level EQ-5D form was utilized, defining each di-

mension as no problems, some or moderate problems, or extreme problems. The British tariff (16) was applied to calculate the EQ-5D index score for this population.

Statistical analysis

To assess whether any of the five EQ-5D dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) differed between patients operated outside their home city and those operated within it, responses were dichotomized into "no problems" versus "moderate/severe problems" for each dimension.

Differences between the two groups were tested using Fisher's exact test for dichotomous variables and Fisher's non-parametric permutation test for continuous variables. To evaluate the influence of covariates, binary logistic regression analyses were performed using the dichotomized outcomes for each EQ-5D dimension. The effects of covariates on each EQ-5D dimension were examined by calculating unadjusted and adjusted odds ratios (ORs), with each covariate included separately in the models. Covariates that altered the unadjusted OR by more than 10% were retained in adjusted analyses. Covariates included age, gender (male/female), diagnosis (primary osteoarthritis (OA), secondary OA), Charnley class (A/B or C), education level (low, middle/high), cohabitation status (yes/no), and type of incision (lateral, posterior). At the 1-year follow-up, preoperative values for each dimension were also analysed as potential predictors.

Visual Analog Scales for pain, satisfaction, and general health (EQ-VAS) were analysed using Fisher's non-parametric permutation test and linear or logistic regression models to adjust for covariates. Variables not meeting normality assumptions were dichotomized and analysed via logistic regression.

All statistical tests were two-sided and conducted at a significance level of 0.05.

Table 1. Demographic characteristics of the participants

Variable	Patients operated outside of home city (N=64)	Patients operated in home city (N=216)	p
Age (years)			
Mean±SD	60.2±11.8	60.7 (12.3)	
Median (Min - Max)	59 (29 - 81)	63 (26 - 89)	0.80
	No (%) of patients		
Gender			
Male	23 (35.9)	70 (32.4)	0.70
Female	41 (64.1)	146 (67.6)	
Age group (years)			
<50	11 (17.2)	37 (17.1)	
50-59	23 (35.9)	53 (24.5)	
60-75	20 (31.3)	109 (50.5)	0.64
>75	10 (15.6)	17 (7.9)	
Diagnosis			
Primary OA	10 (15.6)	43 (19.9)	0.57
Secondary OA	54 (84.4)	173 (80.1)	
Charnley class			
A+B	54 (84.4)	186 (86.1)	0.86
C	10 (15.6)	30 (13.9)	
Cohabiting			
NO	4 (6.3)	25 (11.6)	0.32
YES	60 (93.8)	191 (88.4)	
Education			
Low	17 (26.6)	46 (21.3)	0.47
Middle / High	47 (73.4)	170 (78.7)	
Type of fixation			
Uncemented	64 (100.0)	216 (100.0)	0.29
Surgical incision			
Lateral	16 (25.0)	55 (25.5)	1.00
Posterior	48 (75.0)	161 (74.5)	

RESULTS

Out of the total 280, 64 patients underwent hip arthroplasty outside their home city; 23 were male, with a mean age of 59 years (Table 1), and the most common indication for surgery in this group was secondary hip osteoarthritis. Among patients who were operated on in their home city, primary hip osteoarthritis was the predominant reason for total hip replacement.

Table 2. Preoperative and 1-year postoperative data of the pain/satisfaction, EuroQol Visual Analogue Scale (EQVAS)

Parameter	Preoperatively		p	One year postoperatively		p
	Values	Difference		Values	Difference	
Pain VAS						
Mean (SD)						
Home city	41.5 (15.4)	0.72		15.2 (8.8)	0.78	
Outside home city	40.8 (16.4)			16.0 (11.4)		0.58
Median (min-Max)			0.79			
Home city	40 (0-100)	0.79		10 (10-70)	(-2-3.3)	
Outside home city	40 (10- -5.2)			10 (10-60)		
Satisfaction VAS						
Mean (SD)						
Home city	-			12.3 (4.5)	2.5	
Outside home city	-			14.8 (6.9)		
Median (min-Max)						0.0016
Home city	-			10 (10-30)	(1.02-3.9)	
Outside home city	-			10 (10-40)		
EQVAS						
Mean (SD)						
Home city	44.0 (15.7)	0.71		90.5 (10.4)	-0.06	
Outside home city	44.7 (15.7)			90.5 (10.9)		
Median (min-Max)			0.79			0.98
Home city	50 (10-80)	(-37.5 - 5.1)		90 (40-100)	(-3.0 - 3.0)	
Outside home city	50 (10-80)			90 (55-100)		

VAS, Visual Analogue Scale for pain;

Table 3. Preoperative and 1-year postoperative data of the EuroQol 5 Dimension (EQ5D) questions

EQ5D questions Moderate or severe problems	No (%) of patients	95% CI	p	No (%) of patients	95% CI	p
Mobility						
Home city	206 (95.4)	3.10 (-2.1% - 8.2)	0.48	22 (10.2)	-3.90 (-12.1 - 4.2)	0.49
Outside home city	63 (98.4)			4 (6.3)		
Self-care						
Home city	161 (74.5)	-21.40 (-36.0 - -6.9)	0.002	36 (16.7)	-1.00 (-12.2 - 10.2)	1
Outside home city	34 (53.1)			10 (15.6)		
Usual activities						
Home city	189 (87.5)	-7.80 (-19.6 - 4.0)	0.18	29 (13.4)	-4.10 (-13.5 - 5.4)	0.53
Outside home city	51 (79.7)			6 (9.4)		
Pain/discomfort						
Home city	211 (97.7)	-3.90 (-11.2 - 3.3)	0.25	34 (15.7)	-3.20 (-13.7 - 7.2)	0.68
Outside home city	60 (93.8)			8 (12.5)		
Anxiety/Depression						
Home city	114 (52.8)	9.70 (-4.9 -24.3)	0.22	51 (23.6)	-1.70 (-14.4 - 10.9)	0.92
Outside home city	40 (62.5)			14 (21.9)		

Table 4. Odds Ratio (OR) of moderate or severe problems for the five EuroQol Visual Analogue Scale (EQVAS) questions for patients operated outside of home city compared to patients operated in home city

EQ5D questions Moderate or severe problems	Preoperatively OR (95% CI)	p	One year follow-up OR (95% CI)	p
Mobility				
Unadjusted	3.06 (0.38-24.36)	*0.29	0.59 (0.19-1.77)	0.35
Self-care				
Unadjusted	0.39 (0.22-0.69)	*0.0013	0.93 (0.43-1.99)	0.84
Usual activities				
Unadjusted	0.56 (0.27-1.16)	*0.12	0.67 (0.26-1.69)	0.39
Pain/discomfort				
Unadjusted	0.36 (0.09-1.37)	*0.13	0.76 (0.33-1.75)	0.52
Adjusted*	0.32 (0.08-1.27)	*0.11		
Anxiety/Depression				
Unadjusted	1.49 (0.84-2.64)	*0.17	0.91 (0.46-1.77)	0.77

*Adjusted for cohabitation

There was no statistically significant difference between Group A and Group B in terms of education level or living arrangements (living alone or with family) (p=0.32).

Patients who underwent surgery outside their home city reported slightly higher level of anxiety and depression (Table 3) compared to those operated in their hometown (p=0.22). Pain levels, as measured by both the Visual Analogue Scale (VAS) and EQ-VAS, were similar between the two surgical groups (Table 2).

No covariates were found to significantly influence the odds ratios of the preoperative EQ-5D dimensions, except for cohabitation status, which affected the pain/discomfort domain. The odds ratio for pain/discomfort changed after adjusting for cohabitation status (Table 5).

Patients operated outside their home city reported significantly higher average satisfaction score on VAS (p=0.0016) (Table 2). They also had significantly lower odds of reporting a perfect satisfaction score of 10 on VAS (p=0.005). This result remained statistically significant even after adjusting for covariates (p=0.0037) (Table 5).

Postoperatively, no meaningful differences were observed between the groups in Pain VAS or EQ-VAS score. On average, Pain VAS scores were slightly higher in patients operated outside their home city (p=0.58) (Table 2). Nevertheless, the odds of reporting a maximum Pain VAS score of 10 were also slightly higher in this group (p=0.49) (Table 4).

The EQ-5D domains postoperatively did not show significant differences between the groups. A notable preoperative difference in the self-care domain diminished postoperatively, reaching non-significance (p=1.0) (Table 3). Furthermore, no covariates, including undergoing surgery outside the patient's home city compared to surgery in the home city, were found to significantly influence the odds ratios for any of the postoperative EQ-5D dimensions. (Table 5)

Table 5. Mean change and odds ratio of pain-satisfaction and EuroQol Visual Analogue Scale (EQVAS) for patients operated outside of home city compared to patients operated in their home city

Parameter	Preoperatively OR Mean change (95% CI)	p	One year follow-up OR Mean change (95% CI)	p
Pain VAS				
Unadjusted	-0.72 (-5.10 - 3.65)	0.75	1.23† (0.68 - 2.22)	0.49
Adjusted*	-0.12 (-3.89 - 3.66)	0.95	1.26† (0.67 - 2.34)	0.47
Satisfaction VAS				
Unadjusted	-	-	0.43‡ (0.24 - 0.78)	0.0050
Adjusted*	-	-	0.41‡ (0.22 - 0.75)	0.0037
EQVAS				
Unadjusted	0.71 (-3.70 - 5.11)	0.75	1.18¶ (0.67- 2.07)	0.56
Adjusted*	0.78 (-3.64 - 5.20)	0.73	1.16¶ (0.66 -2.05)	0.61

*Adjusted for age, gender, diagnosis, Charnley class, cohabitation and incision. At one year preoperatively values were also adjusted for; †Odds ratio (OR) for scoring 10; ‡OR for scoring 10; ¶OR for scoring 100
The preoperative results for VAS Satisfaction were marked with (-) because all patients are dissatisfied with the condition.
VAS, Visual Analogue Scale for pain;

DISSCUSION

The quality of life in patients with total hip replacement is commonly assessed using various standardized questionnaires, among which the EQ-5D is one of those employed (11). Several studies have investigated the impact of sociodemograph-

ic and socioeconomic factors on the quality of life in patients with hip arthroplasty (17-22).

This study found that a higher proportion of patients operated outside their home city suffered from secondary hip osteoarthritis. One possible explanation for this finding is the necessity for such patients to seek treatment in highly specialized clinics, often located outside their local communities. Additionally, patients with secondary osteoarthritis typically experience long-standing symptoms that may lead to chronic exhaustion and an increased prevalence of anxiety or depression, which could explain the outcome observed in this study. On the other hand, patients who underwent surgery in their hometown may have benefited from greater stability, ranging from emotional and familial support to financial security, since the overall treatment costs are usually lower when managed locally.

There is a lack of studies specifically addressing this topic. One study, published in 2024, demonstrated a significant difference in quality of life among patients who underwent surgery abroad and had migrated from their country of origin, compared to those who were operated on within their local healthcare systems (23).

There is a clear need for more methodologically sound research to further elucidate and explain the influence of sociodemographic factors on quality-of-life outcome in patients following total hip replacement. Studies with more holistic approach to the management of hip osteoarthritis yield important data with particular emphasis on environmental determinants that may impact the quality of life in affected individuals. Such studies are of predictive value, since they also take into account the geographical factor when assessing the chances of a desired outcome of surgery.

In conclusion, our study did not confirm a significant association between the geographic location of treatment and residence and the quality-of-life outcome following total hip replacement. Similar future studies with larger sample sizes may help to further elucidate the outcome and characteristics of this patient group.

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TRANSPARENCY DECLARATION

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