



Arthroplasty in patients with rare conditions

## Joint replacement surgery in homeless veterans

Chase G. Bennett, MD <sup>a, b</sup>, Laura Y. Lu, BS <sup>b</sup>, Kathleen A. Thomas, LISW-S <sup>a</sup>,  
Nicholas J. Giori, MD, PhD <sup>a, b, \*</sup>

<sup>a</sup> VA Palo Alto Health Care System, Palo Alto, CA, USA

<sup>b</sup> Department of Orthopedic Surgery, Stanford University, Redwood City, CA, USA

### ARTICLE INFO

#### Article history:

Received 19 February 2017

Received in revised form

1 April 2017

Accepted 4 April 2017

Available online 6 May 2017

#### Keywords:

Homeless

Veteran

Joint replacement

Total hip

Total knee

Employment

### ABSTRACT

Total joint arthroplasty (TJA) in a homeless patient is generally considered contraindicated. Here, we report our known medical and social (housing and employment) results of homeless veterans who had TJA. Thirty-seven TJAs were performed on 33 homeless patients (31 men) at our hospital between November 2000 and March 2014. This was 1.2% of all TJAs. Average age was 54 years. Average hospital stay was 4.1 days. There were no major inpatient complications. Thirty-four cases had at least 1-year follow-up in any clinic within the Veterans Affairs health care system. There were no known surgery-related reoperations or readmissions. At final follow-up, 24 patients had stable housing and 9 were employed. The extensive and coordinated medical and social services that were provided to veterans from the Department of Veterans Affairs contributed to our positive results.

Published by Elsevier Inc. on behalf of The American Association of Hip and Knee Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### Introduction

The Veteran population is disproportionately affected by homelessness. There are an estimated 49,933 homeless veterans, comprising over 8% of the American homeless population [1]. As in the general population, some veterans, including homeless veterans, develop severe and debilitating osteoarthritis of the hip or knee.

Joint replacement surgery is an effective and widely used treatment for advanced arthritis of the hip and knee. Overall, 14,349 primary joint replacement cases were performed in the Veterans Affairs (VA) health care system in 2015 [2]. From fiscal year 2011 to fiscal year 2015, joint replacement case volume in the VA health care system increased 21% [2]. Many studies have shown the positive impact of joint replacement surgery on health-related quality of life, mobility, and pain reduction in the general population [3]. By relieving pain and improving function, joint replacement surgery allows patients to preserve an independent lifestyle that contributes to social interaction and psychological well-being [4–6]. These

benefits are seen early in the postoperative period and can last for decades [5,7,8].

Despite these potential benefits, recommending joint replacement surgery to a homeless veteran is difficult due to comorbidities that are prevalent in the homeless population. Smoking, alcohol misuse, drug dependency, food insufficiency, obstructive lung disease, liver conditions, renal insufficiency, dental problems, and many psychiatric conditions have all been found to be more prevalent in the homeless population compared with the nonhomeless population [9]. Overall, homeless individuals are about twice as likely to have untreated chronic medical conditions, struggles with substance abuse, and mental illness than the general population [9–11]. In addition to the medical risks caused by these various chronic medical conditions, substance abuse and mental illness may compromise a patient's ability to adhere to postoperative precautions and thus increase their risk of postoperative complications. High prevalence of poor dentition put the homeless at increased risk of transient bacteremia, which may subsequently seed a prosthetic implant [12,13]. Unsanitary living conditions also pose a concern for proper hygiene and wound care. In addition, there is evidence that the rate of methicillin-resistant *Staphylococcus aureus* colonization among the homeless may be 10–20 times greater than it is in the general population [14]. Exacerbating matters, homeless patients commonly lack access to transportation for reliable follow-up. Understandably, homelessness is generally

No author associated with this paper has disclosed any potential or pertinent conflicts which may be perceived to have impending conflict with this work. For full disclosure statements refer to <http://dx.doi.org/10.1016/j.artd.2017.04.001>.

\* Corresponding author. Surgical Service (112), VA Palo Alto Health Care System, 3801 Miranda Ave., Palo Alto, CA 94304, USA. Tel.: +1 650 493 5000.

E-mail address: [ngiori@stanford.edu](mailto:ngiori@stanford.edu)

<http://dx.doi.org/10.1016/j.artd.2017.04.001>

2352-3441/Published by Elsevier Inc. on behalf of The American Association of Hip and Knee Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

considered to be a contraindication to elective joint replacement surgery.

Many of these homelessness-related risk factors for postoperative complications, however, are manageable or reversible. This is particularly true in the VA health care system where there are resources that are not available to the general population. At our institution, all patients (homeless or nonhomeless) presenting with advanced osteoarthritis of the hip or knee undergo a thorough preoperative screening process. In addition to a thorough history and physical examination, all patients are routinely screened with standard preoperative laboratory tests that include complete blood count, comprehensive metabolic panel, and international normalized ratio. Among other medical problems, these tests serve to identify abnormalities in liver or renal function that are prevalent in homeless patients and trigger appropriate referrals to specialists as needed. All patients are screened for blood glucose abnormalities and HbA1C which will trigger a referral to the primary care doctor to manage uncontrolled diabetes. In addition, we screen all surgical patients for HCV antibody, which will trigger a referral to the liver clinic if hepatitis is poorly controlled or viral infection was not previously known. We discontinued screening for HIV after we found that we failed to identify any patients who were HIV positive who were not already known to be HIV positive. All patients undergo a drug screen and will not proceed to surgery if the drug screen returns a positive result for any substance that is not prescribed. All patients are also screened for alcohol misuse, currently with the AUDIT-C [15], although other screens were used before our adoption of the AUDIT-C. For both drug and alcohol abuse, surgery is deferred and patients are referred to alcohol and drug treatment programs that are available from the VA. All chronic conditions such as diabetes, coronary artery disease, hypertension, pulmonary disease, renal disease, and hepatitis are evaluated and optimized by the primary care physician or the appropriate specialist. Psychiatric conditions that are deemed to be poorly controlled are referred to a mental health professional. The patient's dentition is evaluated and VA dental care is arranged if needed. As a part of obtaining the social history, we identify if the veteran is homeless. If so, a social worker will see the patient preoperatively to develop a plan for safe postoperative disposition and postoperative care (including rehabilitation) commonly to a VA-specific facility. The unified electronic medical record in the VA system is essential to keep track of the patient's status and progress through the clearance process. The surgery will not proceed unless the patients clear all these medical screening processes and have a safe and clean postoperative destination arranged.

To the authors' knowledge, no reports have been published on the outcomes of joint replacement surgery in a homeless patient population. The purpose of this study is to report on the complications, readmissions, reoperations, follow-up rate, final living situation, and employment status of homeless veterans who had joint replacement surgery at our institution.

### Case series

Following institutional review board approval, we searched our medical records for patients who underwent primary total hip or knee arthroplasty (ICD-9 codes V43.64 or V43.65) at our institution from November 2000 to March 2014 and who carried the diagnosis of lack of housing (V60.0) or inadequate housing (V60.1). Charts were then individually reviewed to verify that patients were indeed homeless immediately before surgery. Homelessness was defined as living in a shelter, motor vehicle, hotel, friend's home, or tent.

The VA Computerized Patient Record System across all VA health care facilities was reviewed to determine demographics, length of stay, discharge location, length of orthopaedic follow-up,

**Table 1**  
Preoperative patient demographics.

Age, mean (SD), y	53 (7.6)
BMI, mean (SD), kg/m <sup>2</sup>	31.7 (6.3)
Charlson Comorbidity Index, mean (SD)	2 (1.3)
Patients with stable psychiatric illness, %	22 (59.5)
Former substance abusers (none active), %	28 (75.7)
Using narcotic pain medicines preoperatively, %	3 (8.1)
Preoperative living situation, %	
Shelter	21 (56.8)
Friend	5 (13.5)
Vehicle	4 (10.8)
Hotel	4 (10.8)
Camping	3 (8.1)

BMI, body mass index; SD, standard deviation.

length of radiographic follow-up, length of follow-up of any kind in any VA clinic, complications, reoperations, final housing status, and employment at final follow-up. In addition, because urgent and emergent care obtained at facilities outside of the VA system are usually coordinated with and approved by the VA, visits to non-VA facilities were also generally identifiable.

From November 1, 2000 to March 31, 2014, a total of 2964 primary total hip, total knee, or unicompartmental knee replacement surgeries were performed at our institution. In this period, we identified 33 patients who were homeless immediately before surgery. Thirty-seven primary joint replacement surgeries performed in these 33 patients were included in our analysis. Among the 37 joint replacement cases, 35 were performed on men and 2 on women. The mean age at the time of surgery was  $53.7 \pm 7.6$  years (range 38–74 years). Additional demographic data are shown in Table 1.

There were 18 total knee replacements, 18 total hip replacements, and 1 unicompartmental knee replacement performed. There were 3 minor in-hospital complications in 2 cases. Two patients had urinary retention requiring recatheterization and one of these patients also experienced a transient peroneal nerve palsy. The average length of stay was  $4.1 \pm 1.4$  days (range 2–7 days). Of the 37 cases, there were 17 discharges to an inpatient rehabilitation facility, 13 discharges to a shelter, 3 discharges to a friend's home, 3 discharges to a family member's home, and one discharge to a hotel. Among the 30 discharges to an inpatient rehabilitation facility or a shelter, 24 of these discharges were to a veteran-specific facility.

Follow-up rates at various time points after surgery are shown in Table 2. At 1 year, 13 cases (35%) had radiographic follow-up, 11 cases (30%) had orthopaedic clinic follow-up, and 34 cases (92%) had a follow-up visit in any clinic within the VA health care system.

There were three complications related to surgery that presented following discharge from the hospital. All three led to emergency department visits by the patients. There were two hematomas that were managed conservatively with observation, and one hip dislocation that was treated with closed reduction. At final follow-up for all the patients, we identified no readmissions, reoperations, infections, major medical complications, or deaths.

At final follow-up, 24 patients had found stable housing, 6 had temporary housing arrangements, 2 had returned to homelessness, and 1 patient's housing status was unknown. In addition, 3 patients were working full time and 6 were working part time. The remaining 24 patients were unemployed.

### Discussion

Ending veteran homelessness is a priority for the Department of Veterans Affairs [1]. Uninsured homeless veterans are a vulnerable population who depend on the VA for their health care [16]. Homelessness is generally considered to be a contraindication to joint replacement surgery. We are unaware of a study that provides

**Table 2**  
Follow-up rates for veteran homeless total joint arthroplasty cases.

Radiographic follow-up	
Mean (SD), d	517 (783)
Minimum, d	0
Maximum, d	3143
No. (%) $\geq 3$ mo	22 (59%)
No. (%) $\geq 6$ mo	18 (49%)
No. (%) $\geq 12$ mo	13 (35%)
Orthopaedic follow-up	
Mean (SD), d	340 (465)
Minimum, d	0
Maximum, d	1896
No. (%) $\geq 3$ mo	21 (57%)
No. (%) $\geq 6$ mo	17 (46%)
No. (%) $\geq 12$ mo	11 (30%)
Follow-up in any VA clinic	
Mean (SD), d	1532 (1237)
Minimum, d	145
Maximum, d	5301
No. (%) $\geq 3$ mo	37 (100%)
No. (%) $\geq 6$ mo	36 (97%)
No. (%) $\geq 12$ mo	34 (92%)

SD, standard deviation; VA, Veterans Affairs.

guidance regarding management of the homeless patient who is otherwise a total joint arthroplasty candidate.

Our findings provide some support for doing joint replacement surgery on homeless veterans who are properly medically cleared for surgery and who have access to the unique and extensive medical, dental, psychiatric, and social support that is provided by the Department of Veterans Affairs. Our patients had no significant cardiopulmonary disease, although many had a history of substance abuse in remission and/or stable psychiatric illness. Homeless patients in this series were younger than the average joint replacement patient at our facility. It is important to emphasize, however, that not all homeless patients with advanced arthritis received an operation. We were unable to determine how many homeless veterans with advanced osteoarthritis were seen in our clinics and deemed not suitable for surgery over the same period.

Our findings also provide some evidence supporting the positive effects that such surgery can have on patients' lives, including obtaining permanent housing and gainful employment. All our patients were homeless preoperatively, and 73% were permanently housed (24 of 33) at final follow-up. Nine percent of our patients (3 of 33) were employed part-time before surgery, and 27% of our patients (9 of 33) had either full- or part-time employment at final follow-up. Reduced pain and increased mobility likely contributed to these positive results, in addition to being connected to the resources provided by the Department of Veterans Affairs at the time of hospitalization.

This case series involves a relatively small cohort of 37 joint replacement surgeries at our medical center. In this age of Big Data, one might think that a much larger study using administrative data over the entire VA system would be more informative, but what we learned in this study was that homelessness is a highly changeable condition that is not well captured by an ICD-9 code that is attached to a patient record. It would be impossible to do a study such as ours on a large administrative database as we actually had to read through text notes in the charts to confirm that patients were indeed homeless immediately before surgery. We also had to read through text notes in every chart to determine final disposition, housing status, and work status.

This study does have important limitations. First, this is a retrospective study conducted at a single center. Screening processes and decision making are physician and center dependent, and it is uncertain whether the results of this study can be

extrapolated to other VA medical centers. Furthermore, because of the demographics of the VA patient population, very few women were included in this study. Finally, we were unable to draw pain or functional outcome measures from our retrospective chart review.

Although all patients were at least 2 years postoperative from surgery, actual documented follow-up was shorter in some patients. Follow-up within the orthopaedic clinics was limited to 30% at 1 year, a low rate that may be the best that can be expected in this patient population and with this study design. In comparison, funded prospective studies on homeless patients that involve patient recruitment, informed consent, and staff to track down patients for follow-up can achieve a 6-month to 1-year follow-up rate as high as 52%–82% [17,18]. Despite the low orthopaedic clinic follow-up rate, our patients did follow-up within the VA system for primary care and other medical care at the rate of 92% at 1 year. If a significant orthopaedic related problem became evident in that period, this would have been documented in the chart and referred back to orthopaedic surgery for care. We are uncertain regarding our ability to track patients outside of the VA system. However, uninsured veterans who seek medical care receive the vast majority of that care within the VA system [16]. It is possible that some complications were missed if patients presented emergently to outside centers; however, in this scenario, it is common for patients to have care coordination notes placed in the VA chart or for patients to transfer back to our center.

#### *Current controversies and future considerations*

Performing total joint arthroplasty at all in a homeless population is certainly controversial, and the purpose of our case series was to provide some data to the literature on our experience with this challenging patient population. The patients reported on in our series were highly selected and did not have the stereotypical appearance and uncontrollable medical, psychiatric, and social issues that people commonly associate with homelessness. Although, to our knowledge, these patients ended up having successful surgery and recovery, additional follow-up over a longer period would be obviously needed to determine the overall results and advisability of elective joint replacement in homeless veterans. Such future work will be challenging as this patient population can be difficult to track and follow over an extended period of time.

#### **Summary**

Our case series demonstrates the unique and substantial benefits that homeless veterans receive from the Department of Veterans Affairs. These benefits not only include all the medical and surgical care needed to have the surgery itself, but also the coordinated and extensive postoperative social services and rehabilitation that are needed for a safe and successful recovery. With the recent policy debates surrounding the Department of Veterans Affairs, our study demonstrates the unique capacity of the VA to coordinate complex and multispecialty care for its most needy and deserving patients. In our cohort, patients were relatively young, had well-managed medical comorbidities, and were not abusing drugs or alcohol. They were discharged to clean and safe locations. Perioperative complications were low and included no infections or major medical or surgical complications. With the follow-up that we have available in this difficult to study patient population, we believe that homelessness alone is not a contraindication to elective joint replacement surgery in veterans. Rather, we have seen that properly selected homeless veterans can have successful joint replacement surgery and have a reasonable chance of obtaining stable housing and gainful employment.

**KEY POINTS**

- Homeless patients are generally considered contraindicated for joint replacement due to associated comorbidities, but homeless veterans can access an extensive network of medical, psychiatric, dental, rehabilitation, and social services that are unavailable to nonveteran homeless. This makes elective joint replacement conceivable in a subset of homeless veterans.
- In our experience, just over 1% of our elective total joint replacements have been performed on veteran patients who were confirmed to be homeless at the time of surgery. They were cleared through an extensive screening process.
- Given the follow-up available in this retrospective study, we found that surgery was performed safely with minimal complications, and no known readmissions or reoperations.
- Veterans benefitted socially from this operation. Almost  $\frac{3}{4}$  of our patients had stable housing at final follow-up and more than  $\frac{1}{4}$  were employed.
- The substantial medical and social resources available from the Department of Veterans Affairs were vital to the success we observed in our cohort.

**References**

- [1] National Alliance to End Homelessness. Fact Sheet: Veteran Homelessness [National Alliance to End Homelessness web site]. 2015. <http://www.endhomelessness.org/library/entry/fact-sheet-veteran-homelessness> [accessed 13.10.16].
- [2] National Surgery Report 2015. National Surgery Office, Department of Veterans Affairs. 2015.
- [3] Ethgen O, Bruyère O, Richy F, Dardennes C, Reginster J-Y. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. *J Bone Joint Surg Am* 2004;86-A:963.
- [4] Healy WL, Sharma S, Schwartz B, Iorio R. Athletic activity after total joint arthroplasty. *J Bone Joint Surg Am* 2008;90:2245.
- [5] Laupacis A, Bourne R, Rorabeck C, et al. The effect of elective total hip replacement on health-related quality of life. *J Bone Joint Surg Am* 1993;75:1619.
- [6] Wiklund I, Romanus B. A comparison of quality of life before and after arthroplasty in patients who had arthrosis of the hip joint. *J Bone Joint Surg Am* 1991;73:765.
- [7] Aarons H, Hall G, Hughes S, Salmon P. Short-term recovery from hip and knee arthroplasty. *J Bone Joint Surg Br* 1996;78:555.
- [8] Toms AD, Davidson D, Masri BA, Duncan CP. The management of periprosthetic infection in total joint arthroplasty. *J Bone Joint Surg Br* 2006;88:149.
- [9] Lebrun-Harris LA, Baggett TP, Jenkins DM, et al. Health status and health care experiences among homeless patients in federally supported health centers: findings from the 2009 patient survey. *Health Serv Res* 2013;48:992.
- [10] Martens WH. A review of physical and mental health in homeless persons. *Public Health Rev* 2001;29:13.
- [11] Folsom DP, Hawthorne W, Lindamer L, et al. Prevalence and risk factors for homelessness and utilization of mental health services among 10,340 patients with serious mental illness in a large public mental health system. *Am J Psychiatry* 2005;162:370.
- [12] Susser E, Miller M, Valencia E, et al. Injection drug use and risk of HIV transmission among homeless men with mental illness. *Am J Psychiatry* 1996;153:794.
- [13] Gelberg L, Linn LS, Rosenberg DJ. Dental health of homeless adults. *Spec Care Dentist* 1988;8:167.
- [14] Landers TF, Harris RE, Wittum TE, Stevenson KB. Colonization with *Staphylococcus aureus* and methicillin-resistant *S. aureus* among a sample of homeless individuals, Ohio. *Infect Control Hosp Epidemiol* 2009;30:801.
- [15] Harris AH, Reeder R, Ellerbe L, et al. Preoperative alcohol screening scores: association with complications in men undergoing total joint arthroplasty. *J Bone Joint Surg Am* 2011;93(4):321.
- [16] Nelson KM, Starkebaum GA, Reiber GE. Veterans using and uninsured veterans not using Veterans Affairs (VA) health care. *Public Health Rep* 2007;122:93.
- [17] Kip KE, D'Aoust RF, Hernandez DF, et al. Evaluation of brief treatment of symptoms of psychological trauma among veterans residing in a homeless shelter by use of Accelerated Resolution Therapy. *Nurs Outlook* 2016;64(5):411.
- [18] Brown RT, Miao Y, Mitchell SL, et al. Health outcomes of obtaining housing among older homeless adults. *Am J Public Health* 2015;105(7):1482.