JB&JS OPEN ACCESS

Total Hip Arthroplasty in a Low-Income Country

Ten-Year Outcomes from the National Joint Registry of the Malawi Orthopaedic Association

Simon Matthew Graham, MBChB, MRCS, MSc(Res), FRCS, Nicholas Howard, MBChB, MRCS, MSc, FRCS, Chipiliro Moffat, Nicholas Lubega, MBChB, MMed(Ortho), FCS(ECSA), MBA, Nyengo Mkandawire, BMBS, FRCS, MCh(Orth), FCS(ECSA), and William J. Harrison, MA(Oxon), FRCS(Tr&Orth)

Investigation performed at Beit CURE International Hospital, Blantyre, Malawi

Background: We describe our 10-year experience performing total hip arthroplasty (THA) in patients enrolled in the National Joint Registry of the Malawi Orthopaedic Association.

Methods: Eighty-three THAs were performed in 70 patients (40 male and 30 female) with a mean age of 52 years (range, 18 to 77 years). The cohort included 24 patients (14 male and 10 female; mean age, 52 years [range, 35 to 78 years]) who were human immunodeficiency virus (HIV)-positive.

Results: The main indications for surgery were osteonecrosis (n = 41 hips) and osteoarthritis (n = 26 hips). There were no deaths perioperatively and no early complications at 6 weeks. Forty-six patients (59 THAs) were seen at 10 years postoperatively, with a mean Harris hip score (HHS) of 88 (range, 41 to 91) and a mean Oxford Hip Score (OHS) of 46 (range, 25 to 48). Five hips (8% of 59) were revised due to loosening (n = 4) and fracture (n = 1). There were no infections or dislocations. Fourteen patients died, including 4 HIV-positive patients, of unknown causes in the follow-up period, and 10 patients were lost to follow-up. In the group of 24 HIV-positive patients, there were no early complications, and the mean HHS was 88 (range, 76 to 91) at >10 years.

Conclusions: Our 10-year experience and long-term outcomes after primary THA in a low-income setting show that good results can be achieved within a controlled hospital environment, thereby establishing a benchmark against which other hospitals and registries in similar low-income countries can compare their results.

Level of Evidence: Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.

Total joint arthroplasty (TJA) is increasingly performed in low-income countries, such as Malawi in sub-Saharan Africa[1-3]. The reasons for this include, among other factors, greater surgical resources and longer life expectancy[2]. However, many of these countries do not have adequate resources to offer this form of service to all potential patients who require or will benefit from it[4]. Indications for surgery and the age of the patient can be considerably different than in high-income settings, with a larger proportion of patients with human immunodeficiency virus (HIV)[1]. The training of surgeons and allied health professionals, available facilities, and resources can also differ substantially[2]. To our knowledge, long-term outcomes and survivorship of TJA performed in low-income countries have not previously been reported.

Beit CURE International Hospital (BCIH), where the majority of the procedures recorded in the National Joint Registry of the Malawi Orthopaedic Association (NJRMOA) take place, is an example of a health-care system in which the hospital provides scheduled hip and knee arthroplasty services that, in turn, fund other health-care services that are provided for free. The NJRMOA was set up in 2005 to ensure that patients undergoing TJA received follow-up and that surgical and functional outcomes were accurately recorded for the purposes of both clinical governance and research. The registry includes every patient who has undergone TJA at Beit CURE.

Our primary objective was to describe what we believe to be the first study of total hip arthroplasty (THA) in a low-income country to assess complications, patient-reported outcomes,

Disclosure: This study was funded by The John Charnley Trust, Heraeus South Africa, the AO Alliance Foundation, and the British Orthopaedic Association Joint Action Fund, which support the National Joint Registry of the Malawi Orthopaedic Association (NJRMOA). The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSOA/A126).

JBJS Open Access • 2019:e0027. openaccess.jbjs.org 2

and survivorship data extending over 10 years. Our hope is that our findings will provide a benchmark against which other hospitals and registries based in similar jurisdictions can compare their outcomes.

Materials and Methods

All patients who underwent THA during the period of January 2005 to February 2008 were identified from the NJRMOA and included in the study. All data were derived from the registry, which was set up with ethical approval from the Research and Ethics Committee of the College of Medicine of the University of Malawi.

THA was performed on 83 hips in 70 patients (40 male and 30 female) with a mean age of 52 years (range, 18 to 77 years); bilateral THA was performed in 13 patients. The main indications for surgery in the cohort as a whole were osteonecrosis (n = 41 hips) and osteoarthritis (n = 26 hips) (Table I). The cohort included 24 HIV-positive patients (14 male and 10 female) with a mean age of 52 years (range, 35 to 78 years) who underwent THA primarily because of osteonecrosis (Table II).

The procedures were performed by 6 surgeons at 3 institutions, with most procedures (66, 80%) performed at BCIH. No operating theater had a laminar flow system. Two different all-cemented prostheses with well-established good long-term survivorship were used[5-7]: a Charnley prosthesis (DePuy Orthopaedics) with either a flanged or round-backed femoral stem and a standard long posterior wall or an Ogee acetabular component (DePuy) in 61 (73%) of the procedures, and a Stanmore implant with modular stems and 28-mm cobalt-chromium head (Biomet) in 22 (27%) of the procedures. Implants were secured using SMARTSET GHV cement with gentamicin (DePuy). At the start of surgery, patients also received a single dose of cefuroxime intravenous antibiotic, replaced by gentamicin in those allergic to penicillin. HIV-positive patients were administered antibiotic prophylaxis along with co-trimoxazole (trimethoprim-sulfamethoxazole) (960 mg), in accordance with Malawi national policy and World Health Organization guidelines[8].

TABLE I Demographic and Surgical Data of Patients in the Malawi National Joint Registry Who Underwent THA During the Study Period

Demographic and Surgical Data	No. of Patients (Hips)
Entered in registry	70 (83)
Lost to follow-up	10
10-yr follow-up in registry	46
Died	14
HIV-positive	24
HIV-negative	46
Indication for surgery	
Osteonecrosis	(41)
Osteoarthritis	(26)
Previous infection	(9)
Fractured neck of femur	(2)
Failure of internal fixation	(1)
Other	(4)
Type of implant	
Charnley	(61)
Stanmore	(22)

TABLE II Demographic and Surgical Data of HIV-Positive Patients in the Malawi National Joint Registry Who Underwent THA During the Study Period

Demographic and Surgical Data	No. of Patients
Entered in registry	24
Lost to follow-up	0
10-yr follow-up in registry	24
Indication for surgery	
Osteonecrosis	16
Osteoarthritis	3
Previous infection	3
Other	2
Type of implant	
Charnley	14
Stanmore	10

Patients were mobilized on the first postoperative day and used thromboembolism-deterrent graduated-compression stockings along with low-dose aspirin for the following 6 weeks.

Postoperatively, at 6 weeks, 3 and 6 months, and annually thereafter, a senior research nurse in partnership with a senior surgeon evaluated all patients for pain, postoperative complications, and function. Outcome measures include the Oxford Hip Score (OHS) and the Harris hip score (HHS)[9]. However, use of the OHS as a patient-reported outcome was introduced after 2013, and therefore, preoperative scores are not available for comparison. Furthermore, although the HHS was collected preoperatively as of 12 months following the commencement of the registry, the data are incomplete and preoperative values are not reported in this study.

Surgical wounds were assessed in the first 6 weeks using the ASEPSIS system (Additional treatment, the presence of Serous discharge, Erythema, Purulent exudate, and Separation of the deep tissues, the Isolation of bacteria, and the duration of inpatient Stay), which assigns a total possible score of 70 on the basis of appearance and any additional treatment required[10]. For the purpose of the present study, we considered a score of >10 as indicative of early surgical site infection, a threshold approved by the National Institute for Health and Care Excellence in the U.K[11]. Late wound infection was diagnosed if there was wound breakdown or sinus formation >6 weeks postoperatively, or unexplained late pain with associated radiographic changes consistent with periprosthetic joint infection or

JBJS Open Access • 2019:e0027. openaccess.jbjs.org

microbiological confirmation following revision surgery, irrigation, or aspiration.

Anteroposterior and lateral radiographs of the hip were made at each follow-up appointment. The most recent radiographs were reviewed by the first author (S.M.G.), who had not been involved in the surgical procedures and who assessed the images for signs of loosening. For all HIV-positive patients, antiretroviral therapy was administered according to national guidelines.

Results

Of the 70 patients who underwent primary THA, 24 were unavailable at the most recent follow-up and were excluded from analysis. Of these 24 patients, 14 (20% of the original cohort) had died, including 4 HIV-positive patients, before the most recent follow-up and 10 (14%) were lost to follow-up, leaving 46 patients (66%; 59 THAs) included in the final analysis of 10-year outcomes after primary THA. No accurate recorded information was available for reporting the outcomes of the patients who had died; however, none are thought to have died as a result of their procedure or from complications of their procedure.

All patients were seen at 6 weeks postoperatively. There were no early complications, including deep vein thrombosis, pulmonary embolism, or surgical site infection. This was reflected by the fact that no patient had an ASEPSIS score of >10.

Overall, 5 revision procedures (5 of 59 THAs, 8%) were performed, for aseptic loosening (n = 4) and a periprosthetic fracture (n = 1); the latter patient underwent successful revision in India following the fracture, which occurred 5 years after the primary procedure. All 5 patients who had revision surgery, including 2 HIV-positive patients, are alive and are currently being followed >10 years after the primary procedure. No revision procedures had been performed among the patients who died or were lost to follow-up.

Of the 4 revision procedures carried out for aseptic loosening, 1 patient had a single-component acetabular revision 9 years postoperatively, 2 patients had both components revised for loosening 9 years after the primary procedure, and the fourth patient, who had undergone THA for trauma, had revision of both components 5 years after the primary procedure because of loosening and a re-revision for loosening 7 years after the primary procedure. Samples from both of these procedures were taken, but no organism was grown on culture to suggest low-grade infection. There were no revision procedures for periprosthetic joint infection and no evidence of infection in any of the patients who underwent revision. There were also no revision procedures performed for instability or dislocation and no signs of loosening on radiographs in the patients without revision.

Hip scores were recorded for 36 and 46 patients at 5 and 10 years of follow-up, respectively. Additional OHS and HHS data were available in the registry for 18 patients (26% of the original cohort) who had >10 years of follow-up (Table III). There was a decline seen in the HHS at 10 and >10 years and in the OHS at >10 years. The scores were comparable with those of other series at the same time points from high-income settings and are above the scores correlating with the suggested need for revision surgery[12-14].

TABLE III Postoperative Harris Hip Score (HHS) and Oxford Hip Score (OHS) Results

Follow-up *(yr)*	No. of Patients	Mean (Range) HHS	Mean (Range) OHS
2	16	86 (44-91)	46 (32-48)
5	36	97 (36-91)	47 (36-48)
10	46	88 (41-91)	46 (25-48)
>10*	18	75 (44-91)	40 (9-48)

*Mean follow-up, 10.9 years.

Discussion

We believe that our study is the first to present long-term follow-up data of patients who have undergone primary THA in a low-income country. Our aim was to provide a benchmark for use by other hospitals and registries in similar settings when evaluating their own data. In particular, our study is the first, to our knowledge, to report 10-year follow-up data of a cohort of HIV-positive patients who have undergone THA, with most reports for this population focusing on perioperative complications and infections[15-17]. The perioperative mortality rate was 0%, and there were no early complications at 6 weeks. An overall revision rate of 8% at 10 years and functional scores that were good at 5 years and fair at 10 years indicate good long-term survivorship[9].

Two-thirds of the world's population is estimated to live in lower-middle and low-income countries, and arthritis ranks as the eleventh highest contributor to global disability[3]. Arthroplasty, in some form, is becoming increasingly available in most African countries, with reported results from South Africa, Senegal, Kenya, Malawi, Zambia, Botswana, Burkina Faso, and the Maghreb[1,2,15,18-20], most of which are defined as middle-income countries[21]. There is, however, a paucity of literature from low-income countries, with studies of small cohorts focusing on perioperative and short-term complications.

Of 6 identified reports on THAs performed in low-income countries[15,18,22-25], 1 was a case series from Burkina Faso that included 136 patients who underwent THA after an arthroplasty service was initiated by a visiting surgical program; a high intraoperative complication rate of 51% and a perioperative complication rate of 16% were reported[22]. Only 1 paper, from Senegal, had follow-up of >18 months: 38 patients were followed for a maximum of 5 years after THA for sickle cell disease; the complication rate was 19%[24]. To our knowledge, no country other than Malawi has produced results beyond 5 years. Our longest follow-up duration previously reported from Malawi was a mean of 3.5 years[15].

Both the population and indications for THA differ from those in higher-income countries: our registry showed that 58%

of the procedures were performed in men, and the average age was 52 years, compared with 40% men, average age of 68 years, in the U.K. This may well have implications on results, with national registries showing higher revision rates among younger patients[26]. The indications for THA are also poorly reported in low-income countries. Osteoarthritis is responsible for 92% of all hip replacements in the U.K. compared with 31% in Malawi, where osteonecrosis is the leading indication, at 49%. Fractures account for 2% of procedures in Malawi and 5% in the U.K[27].

Our study showed promising results, with outcomes comparable with those of the national joint registries of high-income countries[27]. Ten-year mortality was 20% compared with 25% in the U.K., no doubt reflecting the younger cohort in the Malawi registry, although life expectancy is notably less than the U.K[28]. Overall revision rates are similar: 8% at 10 years compared with 5% in the U.K., a figure that climbs to 8% among those <55 years of age, matching the younger Malawi cohort[27]. One might expect infection and dislocation to represent notable complications in the short and long term for THA in low-income countries; however, in our study, neither of these complications was recorded. The mean HHS of 75 and OHS of 40 at >10 years in our cohort compare favorably with functional outcomes in high-income countries[29]. Functional scores were even better in the HIV-positive cohort, with a mean HHS of 88 (range, 76 to 91) at >10 years. Reasons for this are not clear, but possible explanations from our experience are the younger, more active population seen in the Malawian cohort.

The main limitations of our study were the relatively small number of patients included and the loss to follow-up. Follow-up of patients in this environment can be challenging. Our hospital is 1 of only 3 in the country at which TJA is performed. Therefore, patients commonly live long distances from the hospital, making follow-up challenging and costly for the patient. Furthermore, since there is a lack of arthroplasty services in neighboring countries, some of our patients do not live in Malawi, again resulting in challenges with follow-up. In addition, despite the small number of patients reported as having ≥10 years of follow-up, we believe that this is the largest study of this type with this length of follow-up from a low-income country in Africa. Our institute provides only a private, elective hip and knee arthroplasty service, which subsequently funds free orthopaedic health care for children. Therefore, this limits the number of arthroplasty procedures performed each year because the services are only available through private or insurance funding.

Our 10-year experience of THA within a controlled hospital environment in a low-income setting has demonstrated that our encouraging early results can be sustained in the long term. We previously called for other institutes and low-income countries in our region to establish joint registries[30]. Comparative registries will highlight strengths and weaknesses in different forms of arthroplasty services. They can also help to focus training or adjustment of clinical practice, and thus optimize good clinical governance for TJA in the region. Furthermore, pooling the data may allow conclusions about long-term outcomes to be derived earlier. ■

Simon Matthew Graham, MBChB, MRCS, MSc(Res), FRCS[1,2,3]
Nicholas Howard, MBChB, MRCS, MSc, FRCS[3]
Chipiliro Moffat[4]
Nicholas Lubega, MBChB, MMed(Ortho), FCS(ECSA), MBA[4]
Nyengo Mkandawire, BMBS, FRCS, MCh(Orth), FCS(ECSA)[4]
William J. Harrison, MA(Oxon), FRCS(Tr&Orth)[5]

[1]Liverpool School of Tropical Medicine, Liverpool, United Kingdom

[2]Orthopaedic Research Unit, Groote Schuur Hospital, Cape Town, South Africa

[3]Aintree University Hospital NHS Trust, Liverpool, United Kingdom

[4]Beit CURE International Hospital, Blantyre, Malawi

[5]Countess of Chester Hospital, Chester, United Kingdom

Email address for S.M. Graham: simonmatthewgraham@doctors.org.uk

ORCID iD for S.M. Graham: 0000-0002-4091-7548
ORCID iD for N. Howard: 0000-0001-7133-6247
ORCID iD for C. Moffat: 0000-0003-2809-1154
ORCID iD for N. Lubega: 0000-0002-3846-3495
ORCID iD for N. Mkandawire: 0000-0002-1357-8173
ORCID iD for W.J. Harrison: 0000-0001-7229-0041

References

1. Davies PS, Graham SM, Maqungo S, Harrison WJ. Total joint replacement in sub-Saharan Africa: a systematic review. Trop Doct. 2019 Apr;49(2):120-8. Epub 2019 Jan 12.

2. Lubega N, Mkandawire NC, Sibande GC, Norrish AR, Harrison WJ. Joint replacement in Malawi: establishment of a national joint registry. J Bone Joint Surg Br. 2009 Mar;91(3):341-3.

3. Nugent R. Chronic diseases in developing countries: health and economic burdens. Ann N Y Acad Sci. 2008;1136:70-9.

4. Usenbo A, Kramer V, Young T, Musekiwa A. Prevalence of arthritis in Africa: a systematic review and meta-analysis. PLoS One. 2015 Aug 4;10(8): e0133858.

5. Hirose S, Otsuka H, Morishima T, Sato K. Outcomes of Charnley total hip arthroplasty using improved cementing with so-called second- and third-generation techniques. J Orthop Sci. 2012 Mar;17(2):118-23. Epub 2011 Dec 22.

6. Junnila M, Laaksonen I, Eskelinen A, Pulkkinen P, Ivar Havelin L, Furnes O, Marie Fenstad A, Pedersen AB, Overgaard S, Kärrholm J, Garellick G, Malchau H, Mäkelä KT. Implant survival of the most common cemented total hip devices from the Nordic Arthroplasty Register Association database. Acta Orthop. 2016 Dec;87(6):546-53. Epub 2016 Aug 23.

7. Ng Man Sun S, Gillott E, Bhamra J, Briggs T. Implant use for primary hip and knee arthroplasty: are we getting it right first time? J Arthroplasty. 2013 Jun;28(6):908-12. Epub 2013 Mar 16.

8. Hutchinson E. The development of health policy in Malawi: the influence of context, evidence and links in the creation of a national policy for cotrimoxazole prophylaxis. Malawi Med J. 2011 Dec;23(4):109-14.

9. Singh JA, Schleck C, Harmsen S, Lewallen D. Clinically important improvement thresholds for Harris Hip Score and its ability to predict revision risk after primary total hip arthroplasty. BMC Musculoskelet Disord. 2016 Jun 10;17: 256.

10. Wilson AP, Treasure T, Sturridge MF, Grüneberg RN. A scoring method (ASEPSIS) for postoperative wound infections for use in clinical trials of antibiotic prophylaxis. Lancet. 1986 Feb 8;1(8476):311-3.

11. National Institute for Health and Care Excellence. Healthcare-associated infections: prevention and control in primary and community care: clinical guideline. 2012. https://www.nice.org.uk/guidance/cg139. Accessed 2019 Sep 9.

12. Nath R, Gupta AK, Chakravarty U, Nath R. Primary cemented total hip arthroplasty: 10 years follow-up. Indian J Orthop. 2010 Jul;44(3):283-8.

13. Devane P, Horne G, Gehling DJ. Oxford hip scores at 6 months and 5 years are associated with total hip revision within the subsequent 2 years. Clin Orthop Relat Res. 2013 Dec;471(12):3870-4.

14. Kjærgaard N, Kjærsgaard JB, Petersen CL, Jensen MU, Laursen MB. Thresholds for the Oxford Hip Score after total hip replacement surgery: a novel approach to postoperative evaluation. J Orthop Traumatol. 2017 Dec;18(4):401-6. Epub 2017 Jul 6.

15. Graham SM, Lubega N, Mkandawire N, Harrison WJ. Total hip replacement in HIV-positive patients. Bone Joint J. 2014 Apr;96-B(4):462-6.

16. Chalmers BP, Abdel MP, Taunton MJ, Trousdale RT, Pagnano MW. Mid-term results of total hip and total knee arthroplasty in patients with human immunodeficiency virus. Orthopedics. 2017 Jul 1;40(4):e699-702. Epub 2017 May 31.

17. Dimitriou D, Ramokgopa M, Pietrzak JRT, van der Jagt D, Mokete L. Human immunodeficiency virus infection and hip and knee arthroplasty. JBJS Rev. 2017 Sep;5(9):e8.

18. Mulla Y, Munthali J, Makasa E, Kayumba K. Joint replacement in Zambia: a review of hip and knee replacement surgery done at Zambian-Italian Orthopaedic Hospital. Med J Zambia. 2010;37(3):13.

19. Lisenda L, Mokete L, Mkubwa J, Lukhele M. Inpatient mortality after elective primary total hip and knee joint arthroplasty in Botswana. Int Orthop. 2016 Dec;40(12):2453-8. Epub 2016 Aug 21.

20. Lisenda L, Mokete L, Nwokeyi K, Gureja YP, Lukhele M. Development of a lower limb arthroplasty service in a developing country : Lessons learned after the first 100 cases (joints). Acta Orthop Belg. 2016 Sep;82(3):570-8.

21. The World Bank. World Bank country and lending groups. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups. Accessed 2019 Sep 9.

22. Dossche L, Noyez JF, Ouedraogo W, Kalmogho E. Establishment of a hip replacement project in a district hospital in Burkina Faso: analysis of technical problems and peri-operative complications. Bone Joint J. 2014 Feb;96-B(2):177-80.

23. George AO, Ofori-Atta P. Total knee replacement—the evolving sub-Saharan experience. Trop Doct. 2009 Apr;39(2):118-23.

24. Sene M, Dansoko A, Ndiaye A, Mbaye E, Niang CD, Faye M. [Total hip arthroplasty after avascular necrosis due to sickle cell disease in Senegal: series of 48 replacements]. Med Trop (Mars). 2009 Dec;69(6):573-6.

25. Anyaehie UE, Eyichukwu GO, Nwadinigwe CU. Total knee replacement in a resource constrained environment: A preliminary report. Niger J Clin Pract. 2017 Mar;20(3):369-75.

26. Bayliss LE, Culliford D, Monk AP, Glyn-Jones S, Prieto-Alhambra D, Judge A, Cooper C, Carr AJ, Arden NK, Beard DJ, Price AJ. The effect of patient age at intervention on risk of implant revision after total replacement of the hip or knee: a population-based cohort study. Lancet. 2017 Apr 8;389(10077):1424-30. Epub 2017 Feb 14.

27. National Joint Registry for England. Wales, Northern Island and Isle of Man. 14th annual report. 2017. http://www.njrreports.org.uk/Portals/6/PDFdownloads/NJR%2014th%20Annual%20Report%202017.pdf. Accessed 2019 Aug 8.

28. Dwyer J. Global health and justice. Bioethics. 2005 Oct;19(5-6):460-75.

29. Söderman P, Malchau H, Herberts P, Zügner R, Regnér H, Garellick G. Outcome after total hip arthroplasty: Part II. Disease-specific follow-up and the Swedish National Total Hip Arthroplasty Register. Acta Orthop Scand. 2001 Apr;72(2):113-9.

30. Graham SM, Moffat C, Lubega N, Mkandawire N, Burgess D, Harrison WJ. Total knee arthroplasty in a low-income country: short-term outcomes from a national joint registry. JB JS Open Access. 2018 Mar 12;3(1):e0029.