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Knee haemophilic arthropathy care in Chile: Midterm outcomes and complications after total knee arthroplasty

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Abstract

Introduction: Total knee arthroplasty (TKA) can improve knee function in the general population, but challenges arise for TKA use in haemophilic patients (HPs).

Aim: This study aimed to evaluate the midterm clinical experience of a single medical centre in TKA in HPs.

Methods: We performed a case series of consecutive TKAs from 2007 to 2013 in HPs. All patients received coagulation factor supplementation according to the institutional protocol. Surgery was performed without a tourniquet by a standard midline medial parapatellar approach. We compared the range of motion (ROM) and flexion contracture before surgery and 1-year postoperative using paired Wilcoxon-non-parametric test ($P < .05$ was considered significant). The need for revision surgery was considered TKA survival failure.

Results: Forty-one HP/60 TKAs were reviewed (19 cases were bilateral). Preoperative median ROM and flexion contracture was 75° (range, 0°-95°) and 20° (range, 5°-80°), respectively. The postoperative median ROM increased to 83° (range, 45°-110°), and median flexion contracture decrease to 0° (range, 0°-40°) a statistically significant difference ($P < .01$). Postoperative median clinical Knee Society Score (KSS) and functional KSS were 88 (range, 59-97) and 100 (range, 30-100), respectively. Six patients required revision (6.66%) due to infection. TKA survival at 5 years was 92% (range, 82%-96%).

Conclusion: This study supports that TKA improves function and ROM in haemophilic knee arthropathy. The protocol of coagulation factors used in this cohort is valid as no related complications were reported. A higher incidence of complications, especially infections, must be expected compared with a TKA in non-HPs.

KEYWORDS

haemophilic knee arthropathy, simultaneous bilateral TKA, TKA complications, TKA survival, total knee arthroplasty

1 | INTRODUCTION

Haemophilia is an X-linked inherited bleeding disorder resulting from the lack of factors VIII or IX. Haemophilic patients (HPs) have spontaneous intra-articular bleeding or after minimal trauma, especially in patients with factor concentration <1 IU/dL. The bleeding will cause a unique type of joint degeneration known as haemophilic arthropathy. The most accepted hypothesis is that iron and haemosiderin deposits produce chronic inflammation in the joint.[1-3] The knee is the most affected joint of haemophilia, causing significant disability in younger patients.[4]

In Chile, Haemophilia was included in the Explicit Health Guarantees (GES) in 2006. GES is a set of benefits guaranteed by law allowing access, opportunity, financial protection and quality of care in a designated list of diseases.[5] Before 2006 there was a lack of reliable data and access to treatment which led to a higher incidence of haemophilic arthropathy.[6]

Total knee arthroplasty (TKA) is a cost-effective treatment that has improved function and quality of life in HPs. Nevertheless, TKA for HPs is one of the more challenging surgical scenarios due to deformity, stiffness, bleeding and surgically related complications.[7,8]

Bleeding is an important issue; preoperative planning before TKA must include the replacement of clotting factors. Nevertheless, rates of postoperative haematomas are as high as 36%.[9] Another strategy to diminish bleeding-related complications is to perform autotransfusion, which has been proven safe.[10]

The rate of infection is higher in HPs than in non-HPs, reaching as high as 7%. This higher prevalence may be due to haematoma formation, as blood is an excellent culture medium for bacteria.[2,11]

Thromboprophylaxis after TKA in HPs is controversial; only high-risk patients should undergo pharmacological prophylaxis. Otherwise, early mobilization and antiembolism stocking are enough.[12] Vascular complications occur at a higher rate in HPs, so pseudoaneurysm is a complication to consider.[7] Preoperative range of motion (ROM) is a strong predictor for functional outcome after TKA, and HPs are not an exception; however, the newest series has shown good results even with severe flexion contracture.[11]

This study aimed to evaluate the midterm clinical experience of a single Chilean medical centre in terms of the need for revision, complications and functional outcomes in HPs receiving TKA.

2 | MATERIALS AND METHODS

This case series study consisted of a review of the clinical records of all HPs that underwent TKA between 2009 and 2013 (inclusive) in a single medical institution, Hospital San Jose. This institution is the national reference centre for HPs, so the clinical records contain each patient's full medical information. Also, HPs undergoing TKA have an individual sheet in their clinic record that states surgical complications, need for revision, the cause of revision, Knee Society Score (KSS) score at 1 year after TKA and the ROM (before and after surgery).

2.1 | Knee society score

Knee society score was assessed 1 year after TKA. KSS has two dimensions: a clinical score and a functional score. The first part asses range of motion, alignment, pain and stability; meanwhile, the second part asses walking performance, stair performance and type of aids used for walking.[13] Both parts range from 0 to 100 points, and the interpretation was performed according to Asif et al.[14] Less than 60 points are interpreted as a 'poor' outcome, between 60 and 70 points a 'fair' outcome, between 70 and 80 points a 'good' outcome and >80 an 'excellent' outcome.

2.2 | Range of motion

During the passive ROM assessment, each patient was invited to lay supine with both hips in a neutral position. A 360° universal plastic goniometer with a 30-cm movable arm and scale of 1° increment (Baseline®, Chattanooga Group Inc) was used for all measurements. The stationary arm was placed along the femur to the greater trochanter. The movement arm was placed along the fibula to the lateral malleolus. The fulcrum was placed visually to the trans-epicondylar axis of the knee joint. For the knee flexion ROM, the heel of the foot was required to be in contact with the examination couch during the assessment.[15] For the passive knee extension ROM, a cylinder roll was placed underneath the heel of the foot to allow the knee to extend as much as possible.[15] The ethics committee of our institution approved the revision of the clinical records of this cohort. All HPs patients at the time of admission to the total arthroplasty programme for both hip and knee are asked if the clinical information can be used for research purposes and if they agree they sign an informed consent. In addition, two patients were contacted to request their authorization

TABLE 1 Protocol for factor administration. The same protocol is followed in bilateral or unilateral TKA procedures

	Haemophilia A Factor VIII	Haemophilia B Factor IX
Day of surgery	40 IU/kg every 8 h iv Target: 80% PL	80 IU/kg every 12 h iv Target: 80%PL
1st day after surgery	30 IU/kg every 8 h iv Target: 60% PL	60 IU/kg every 12 h iv Target: 60% PL
2nd to 7th day after surgery	30 IU/kg every 12 h iv Target: 60%PL	60 IU/kg every 24 h iv Target: 60%PL
8th to 30th day after surgery	30 IU/kg daily iv Target: 50%PL	60 IU/kg daily iv Target: 50%PL
2nd month after surgery	30 IU/kg every 48 h iv	60 UI/kg every 48 h iv
3rd to 4th month after surgery	30 IU/kg 3 d a week iv	60 IU/kg 2 d a week iv

Abbreviations: IU, international units; iv, intravenous; PL, plasmatic level.

TABLE 2 Summary of patient groups

	Unilateral group	Bilateral group	Total	*P* (Fisher)
N° Patients	22	19	41	NA
N° Patients revised	3	2	5	.57
N° Knee revised	3	3	6	.38

Note: Fisher's exact test was used to compare revision proportions; no significant difference was found.

Abbreviation: NA, not applicable.

for the use of their clinical images and gave authorization by written informed consent.

2.3 | Patient-specific preparation

On the day of the surgery, the plasmatic factor level targeted was at least 80% of normal value either for Haemophilia A or B. From the first day after surgery, the target level was 60% of the plasmatic normal value. Table 1 summarizes the protocol. The same protocol is followed for unilateral or bilateral TKA. All patients were negative for clotting factors inhibitors.

All patients, regardless of the type of Haemophilia, received 50 mg/kg/d of tranexamic acid intravenous every 8 hours for 7 days, then the drug was orally continued for another 7 days. No patient was prescribed pharmacological prophylaxis for thromboembolic disease.

2.4 | Surgery

The three senior authors performed all surgeries (AO, CB, AM). Surgery was performed with the patient in the supine position, without a tourniquet, by a standard midline medial parapatellar approach. Three types of implants were used posterior stabilized (PS), condylar constrained knee system and rotating hinge, according to deformity and the surgeon's preference. A first-generation cephalosporin was used for 72 hours after TKA. No drain was used. The day after surgery, patients began physiotherapy, full ROM was encouraged, and partial weight-bearing was allowed for 3 weeks. The physiotherapy programme did not differ from non-HP TKA use. For patients requiring bilateral TKA, the procedures were performed sequentially in a single operation by the same surgical team.

2.5 | Statistical analysis

A descriptive analysis was first performed. Median, range and interquartile range (IQ) were calculated. Box plotting was used to show the distribution of preoperative and postoperative flexion contracture and ROM along with a 1-year postoperative KSS. Then, a paired Wilcoxon-non-parametric test was used to compare ROM and flexion contracture. Fisher's test was used to compare the revision rate between the unilateral and bilateral groups. Finally, a Kaplan-Meier curve was constructed to analyse TKA survival. Revision surgery was used as a failure for survival analysis, with the last follow-up occurring on 31 May 2019. A significance level of 0.05 was established. All analyses were performed using Stata v11.2 (StataCorp LP).

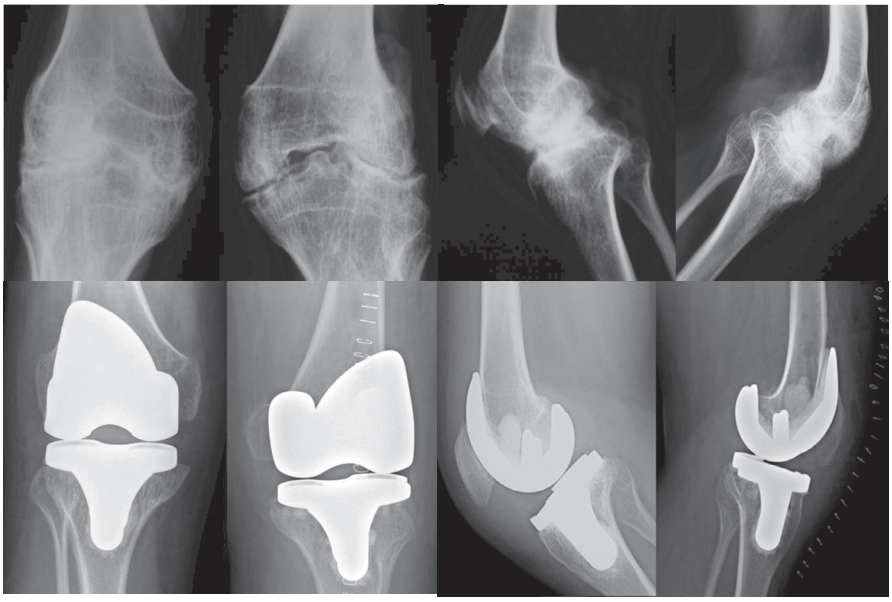

FIGURE 1 Preoperative and postoperative radiographs of a haemophilic patient with a severe varus deformity with flexion contracture. The patients underwent simultaneous bilateral TKA. Despite deformity, PS prosthesis was used, achieving adequate stability. PS prosthesis was the most frequent model used in this cohort. PS, posterior stabilized; TKA, total knee arthroplasty

3 | RESULTS

Forty-one HPs underwent surgery for TKA from 2007 to 2013. A total of 60 TKAs were performed, 22 patients (54%) were unilateral, and 19 (46%) were bilateral, as shown in Table 2.

The median age at the time of surgery was 42 years (range, 24-75 years). Twenty-one patients (51.2%) were positive for hepatitis C, eight (20%) were positive for human immunodeficiency virus (HIV), and five (12%) were positive for hepatitis B. The median follow-up was 7 years (range, 5-11 years). Despite deformities, the most used type of prosthesis was PS in 29 knees (48%; Figure 1). An unconstrained cruciate-retaining model (AGC®, Biomet®) was used in four knees (7%), and anterior-stabilized models (Vanguard®, Zimmer®) were used in 15 knees (25%). Only five knees (8%) required a constrained prosthesis (Figure 2).

The median improvement in ROM was 20° (range, −5° to 61; IQ, 10°-30°). Before TKA, the median ROM was 70° (range, 0°-95°; IQ, 43°-80°). After TKA, the median ROM was 83° (range, 45°-110°; IQ, 73.5°-90°; Figure 3). The median flexion contracture before TKA was 20° (range, 5°-80°; IQ, 11°-28°), and after TKA, it decreased to 0° (range, 0°-40°; IQ, 0°-10°; Figure 4). The median improvement in flexion contracture was 15° (range, 0°-40°; IQ, 10°-18°). Both ROM and flexion contracture reached a significant difference ($P < .001$ for both).

One year after TKA, median clinical KSS and functional KSS were 88 (range, 59-97; IQ, 84-93) and 100 (range, 30-100; IQ, 100-100), respectively. Functional KSS after TKA was <100 points in four patients, and 33 patients (80.7%) patients achieved clinical KSS ≥80 points (Figure 5). Only one patient (1.79%) grade 'poor' in functional KSS and three (5.36%) patients' grade 'poor' in the clinical KSS (see Table 3).

Only seven patients (17.1%) required a blood transfusion—all of whom had bilateral TKA. No clinically relevant deep vein thrombosis (DVT) or nerve lesion was noted. Five patients (12.1%) and six knees (10%) underwent revision surgery for an infection. Two patients in the bilateral group underwent revision, one of whom in both knees (see Table 2). One of the revised patients required arthrodesis; this patient also had a lateral genicular pseudoaneurysm. No aseptic loosening was registered. TKA survival rate at 5 years was 92% (range, 82%-96%), and 10-year survival was 79% (range, 51%-92%). Figure 6 presents the Kaplan-Meier estimated curve.

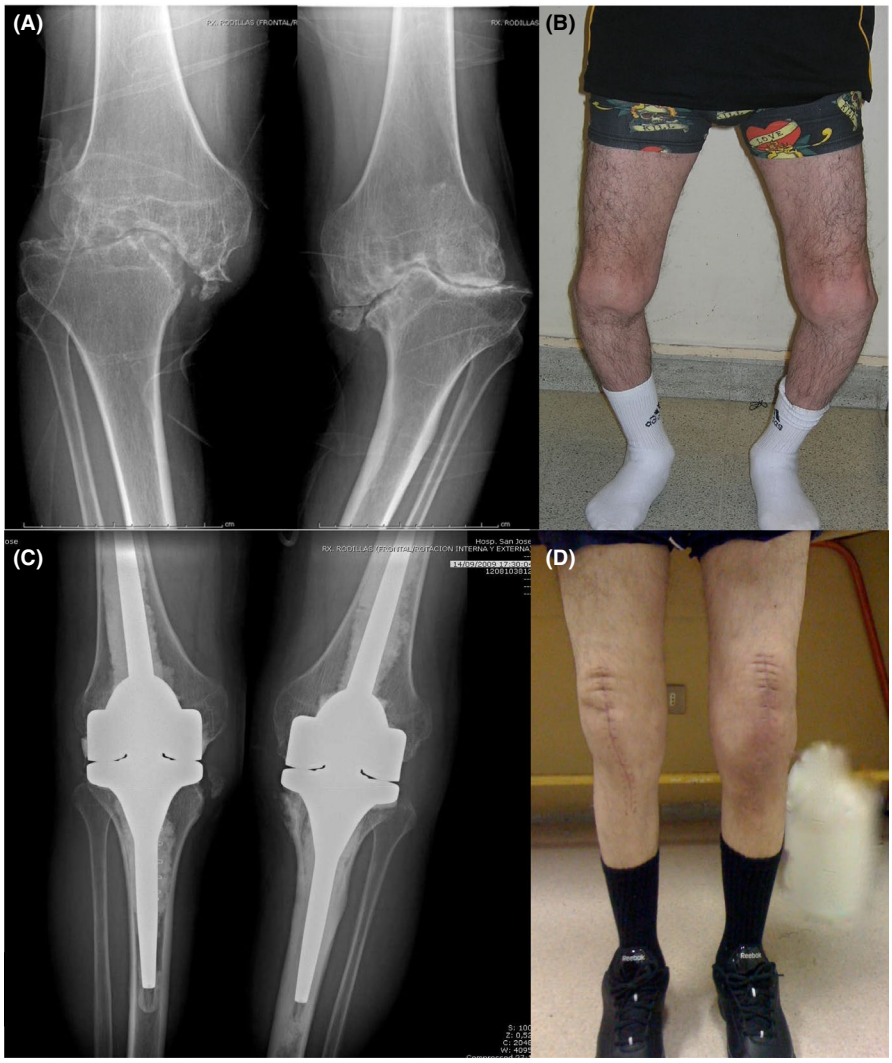

FIGURE 2 Varus deformity in haemophilic patients. A, Anteroposterior radiograph of both knees, severe deformity is seen in both the medial and lateral compartment. B, Bilateral flexion contracture and varus deformity. C, The patient underwent simultaneous bilateral TKA. A constrained prosthesis was used (Endo-Model®). D, Adequate correction of varus alignment was achieved. TKA, total knee arthroplasty

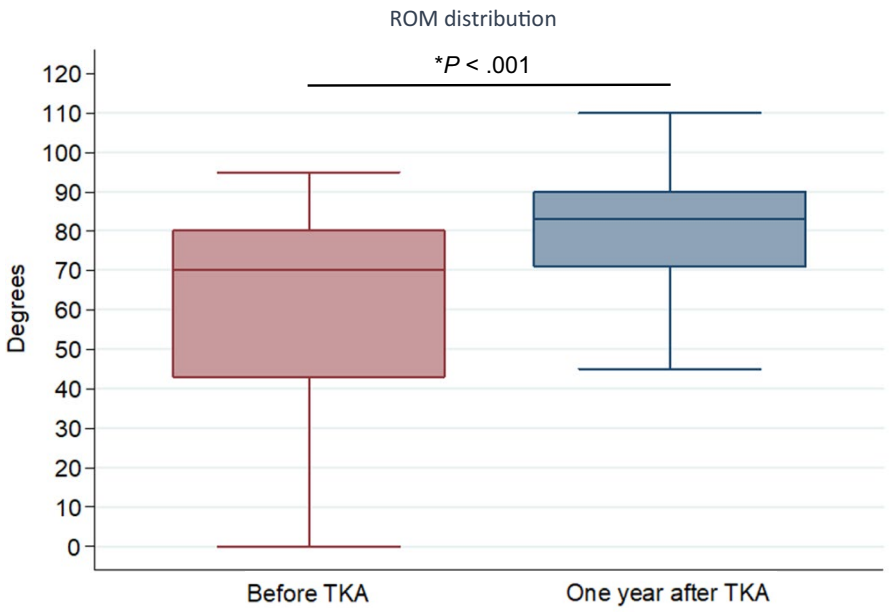

FIGURE 3 Distribution of knee range of motion before and after surgery. The median increase of range of motion was 13°, reaching a significant difference in the non-parametric median test ($P < .001$). After TKA, 75% of the patients achieve 75° or a higher range of motion compared to only 50% before surgery. TKA, total knee arthroplasty

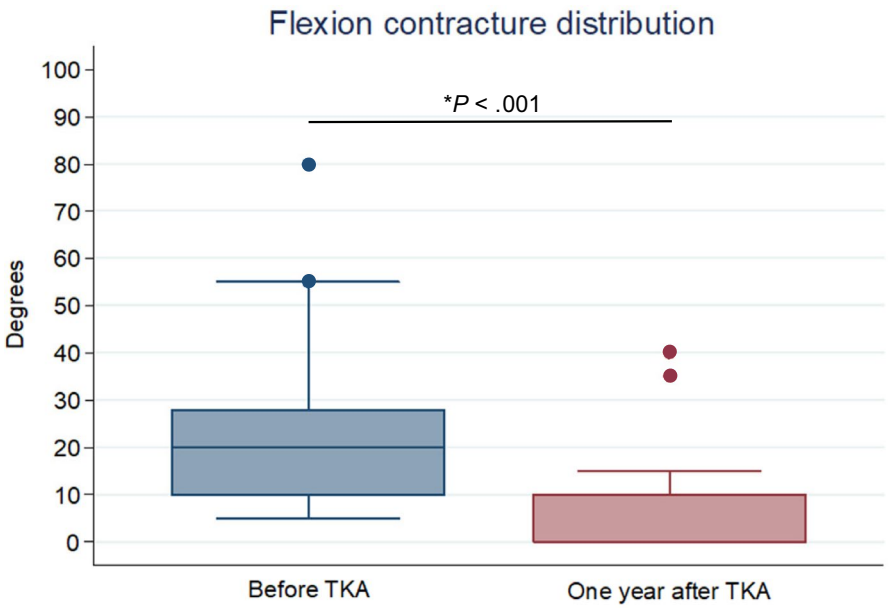

FIGURE 4 Distribution of flexion contracture before and after surgery. The median flexion contracture before TKA was 20° (range, 5°-80°; IQ, 11°-28°) and after TKA decreased to 0° (range, 0°-40°; IQ, 0°-10°), reaching a significant difference in the non-parametric median test ($P < .001$). TKA, total knee arthroplasty

4 | DISCUSSION

This case series shows excellent functional and clinical KSS after TKA. The increase in the ROM and decrease in flexion contracture after surgery was statistically significant. These findings are supported by other publications that show an improvement in the quality of life and better KSS score. This makes TKA an effective treatment for haemophilic arthropathy.[3,16,17] There is a paucity of data in haemophilic TKA publications; nevertheless, there is a consensus that TKA for HPs is one of the more challenging scenarios for the orthopaedic surgeon.[1,9,16] Therefore an interdisciplinary approach is mandatory in HPs to achieve success.

Despite articular deformities, unconstrained knee prosthetic models were used in most cases, and only five knees (8%) required a constrained prosthetic model. According to Panotopoulos et al,[18] aseptic loosing is not implant-related. The excellent functional results and midterm survival found in this revision encourage the limited use of constrained prostheses in HPs.

One outstanding issue of this case series report is the protocol for factor administration. A bolus administration is used instead of continuous infusion. This is different from other series, as UK and Canadian guidelines recommend continuous infusion for 2 weeks aiming to reach 100% of factor plasma level.[9,16,19] The protocol used in this case series is safe and achieves similar rates of bleeding-related complications compared with other series. This is important

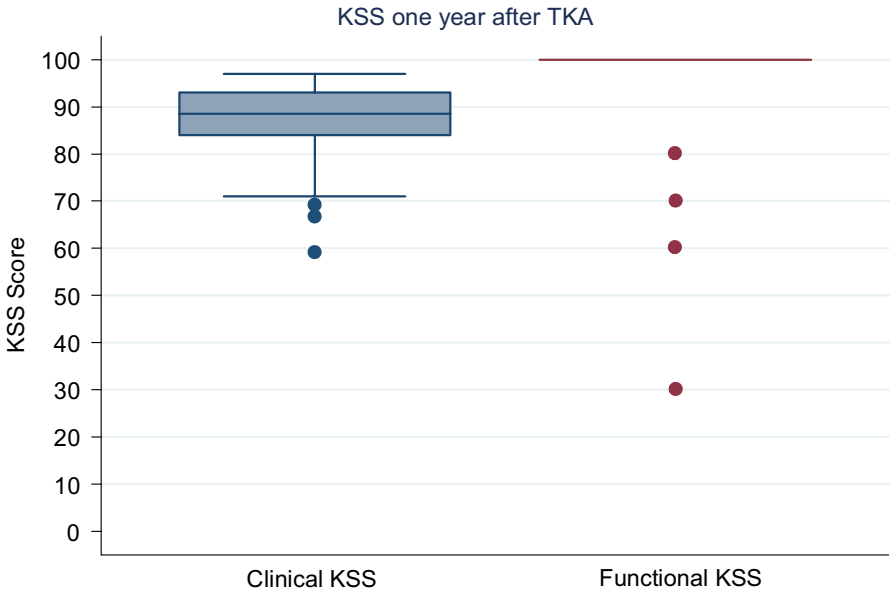

FIGURE 5 Distribution of KSS scores 1 y after TKA. A total of 33 patients (80.7%) achieved more than 80 points, which is considered good-excellent results in clinical KSS. KSS, Knee Society Score; TKA, total knee arthroplasty

TABLE 3 Distributions of KSS outcomes 1 y after TKA, according to Asif et al[14] grading

KSS grading	Clinical KSS	Functional KSS
Excellent	45 (80.36%)	43 (76.79%)
Good	7 (12.50%)	7 (12.50%)
Fair	3 (5.36%)	3 (5.36%)
Poor	1 (1.79%)	3 (5.36%)

since one of the main difficulties is the cost of administering clotting factors.

Nearly half of the patients underwent simultaneous bilateral TKA, and no increase in complications was noted. Nevertheless, bilateral TKA tend to require more blood transfusion than unilateral TKA, in the revision performed by Vaish et al[20] 32% of male patients without haemophilia who underwent bilateral TKA required blood transfusion. In this report, 17% of the patients required blood transfusion and all of them underwent bilateral TKA suggesting that the risk of requiring blood transfusion in this cohort is more related to surgery than to the clotting factor administration protocol. The higher transfusion burden is a worthy risk when compared to the benefits of a one-time surgery. Recently, Mortazavi et al[21] reported their experience in bilateral TKA in HPs and concluded that it is a safe and cost-effective procedure.

Like all types of surgery, TKA in HP is not free of complications. In this series, no DVT or pulmonary thrombosis (PT) is reported but remain significant concerns, as they are potential life-threating complications in TKA. For DVT/PT prophylaxis, early mobilization

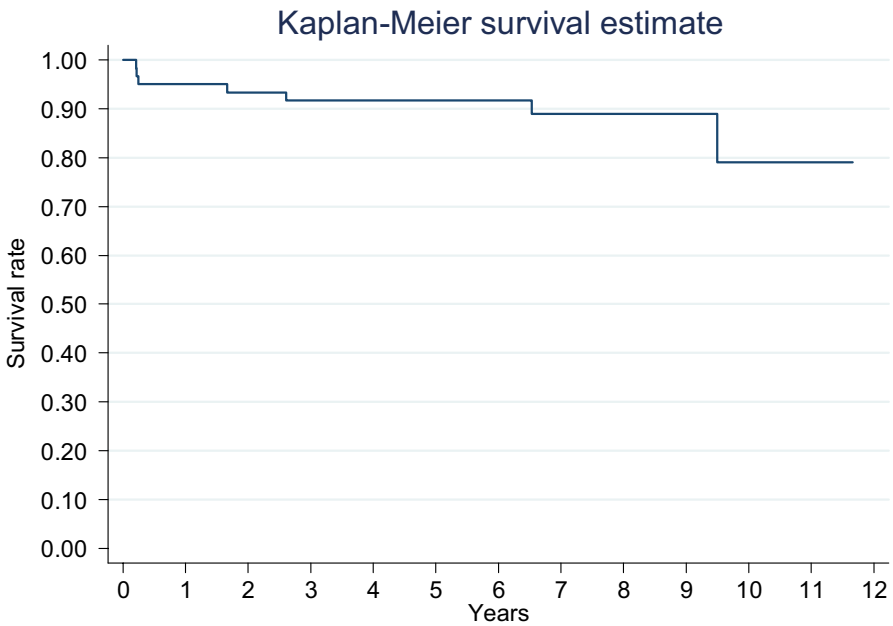

FIGURE 6 Kaplan-Meier survival estimated curve. TKA survivor at 5 y was 92% (range, 82%-96%), and at 10 y was 79% (range, 51%-92%). TKA, total knee arthroplasty

and mechanical prophylaxis (intermittent pneumatic compression/compression socks) in all patients was used; in contrast, no pharmacological prophylaxis was used. Similar protocols are used in other series. DVT and PT are considered rare in HP, and the consensus is to use pharmacological prophylaxis only in high-risk patients for DVT/PT.[22,23]

Only five patients (12.1%) underwent a reoperation. Causes of reoperation in this series were prosthesis infection (n = 6) and pseudoaneurysm (n = 1). Infection is a significant concern in HPs undergoing TKA and is more frequent in HPs than in the general population,[24] reported as up to 17% in this population.[25] No relationship has been found between infection prevalence and HIV status in HPs.[26] Panotopoulos et al[18] performed a regression analysis and did not identify any correlated factors for infection in HPs. All possible action must be considered to avoid infection in any patient, but especially for HPs. TKA survival in HP is 92% at 5 years, according to Westberg et al[19]; which is similar to the survivor rate we recorded. All revision TKAs were due to infection. There was no aseptic loosening in this series, which can be explained due to the midterm period of observation.

A recent meta-analysis performed by Moore et al[27] reported an improvement in flexion contracture of 9.72° and 15.69° ROM. Our results are slightly better, reaching a median of 15° in flexion contracture and 20° ROM. Therefore, consistent with the metanalysis,[27] we assume a concurrent improvement in the quality of life of the patients included in this study.

Proper treatment is critical to prevent arthropathy in HPs.[28] Since Haemophilia was included in GES in 2006, the treatment for HPs is guaranteed in Chile,[5] so a decrease in the incidence of bleeding complications is expected, including knee arthropathy. However, if haemophilic arthropathy cases occur, TKA can achieve excellent clinical results.

5 | CONCLUSIONS

This study supports that TKA improves function and ROM in haemophilic knee arthropathy. Also, it demonstrates that a well-trained and interdisciplinary team can reproduce the good results reported in the literature. However, a high incidence of complications, especially infections, must be expected in HPs compared with non-HPs receiving TKA. The protocol of coagulation factors infusion used in this series of cases seems to be as useful as other recommendations in preventing bleeding-related complications in HPs undergoing TKA. This study validates our programme and should encourage other medical centres to develop a multidisciplinary team to offer a better quality of life for people with haemophilia.

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DISCLOSURES

The authors stated that they had no interests which might be perceived as posing a conflict or bias.

AUTHORS CONTRIBUTION

AO conceived the study and performed a critical review of the paper. CB and AM performed critical review of the paper. MB designed the study, performed data analysis and wrote the paper. VS collected the data, performed systematic controls of the patient and supervised factor administration. CC collected the data and wrote the paper. CCM performed KSS test and functional survey, and performed critically final review of the paper.

DATA AVAILABILITY STATEMENT

The data used to support the findings of this study are restricted by the ethics board of our institution to protect patient privacy. Data are available by formal request to the corresponding author pending to approval of the ethics board of our institution.

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