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Outcome of Total Knee Arthroplasty in Hemophilic Arthropathy

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ABSTRACT

The clinical histories of 45 consecutively performed TKAs in 32 patients with hereditary bleeding disorders were reviewed retrospectively. The mean follow up was 88.7 (range, 24–232) months. The cumulative probability of infection free-survival was 87.8% after 180 months. When removal of component was defined as endpoint, the survival probability was 86.4% after 180 months. In regression analysis no significant independent risk factors for infection or aseptic loosening were identified. The HSS score improved significantly from 45 to 85 points. Hemophilic patients can be considered to be at high risk for prosthetic failure, our study has demonstrated favorable functional results of total knee arthroplasty in hemophilic patients.

The knee is the most commonly involved joint for bleeding episodes in patients with hereditary bleeding disorders [1–3]. In persons with hemophilia and advanced hemophilic arthropathy the quality of life is significantly reduced by pain, impairment and loss of mobility [1,4].

Previous reports described good functional results and pain relief after total knee arthroplasty (TKA) with varying survival, complication and infection rates [5–17].

Information concerning the perioperative factor concentration and risk factors of prosthesis failure in these patients is scanty. Therefore, the aims of this study were to identify risk factors associated with infection or aseptic loosening after TKA, to investigate the influence of the perioperative factor concentration for substitution therapy on postoperative hematoma and in consequence on decreased mobility, function and survival and to evaluate the outcome of 45 consecutively performed TKAs in 32 patients with a hemophilic arthropathy of the knee.

Patients and Methods

Study Design and Patients

The clinical histories of 45 consecutively performed TKAs in 32 patients (all male) with hereditary bleeding disorders (hemophilia A, B and von Willebrand disease) were reviewed retrospectively. All patients were treated by a single senior orthopedic surgeon (HW) and followed regularly by the first (JP) and the senior author (HW).

Data including type and severity of the hereditary bleeding disorder, presence of inhibitors, type of endoprosthesis, pre- and postoperative functional parameters and perioperative and postoperative factor concentration for substitution therapy, infection and revision surgery were collected.

The study was approved by the local ethics committee.

Clinical Assessment

The functional status of total knee arthroplasty was measured preoperatively and at the latest follow up by the Hospital for Special Surgery (HSS) knee rating scale [18] (Table 1). The HSS Score measures pain, function, range of motion (ROM), flexion deformity and instability and ranges from 0 to 100 points. A score of 85–100 points is rated as excellent, 70–84 as good, 60–69 as fair and <60 as poor. The ROM was measured with a conventional goniometer preoperatively and at the latest follow up.

Periprosthetic joint infection was evaluated by the staging system described by McPherson et al [19,20]. Patients were graded according to infection type (I, II, III), systemic host grade (A, B, C) and local extremity grade (1, 2, 3).

Surgical Technique and Postoperative Course

All TKA procedures were performed in a laminar flow operating theatre under general anesthesia by a surgeon experienced in hemophilia care. Surgery was done under tourniquet control with a standard midline incision and a medial parapatellar approach.

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Table 1
Hospital for Special Surgery (HSS) Knee Rating Scale.

Pain (30 points)		Muscle Strength (10 points)	
No pain at any time	30	Excellent: cannot break the quadriceps power	10
No pain on walking	15	Good: can break the quadriceps power	8
Mild pain on walking	10	Fair: moves through the arc of motion	4
Moderate pain on walking	5	Poor: cannot move through the arc of motion	0
Severe pain on walking	0	Flexion Deformity (10 points)	
No pain at rest	15	No deformity	10
Mild pain at rest	10	Less than 5°	8
Moderate pain at rest	5	5-10°	5
Severe pain at rest	0	More than 10°	0
Function (22 points)		Instability (10 points)	
Walking and standing unlimited	12	None	10
Walking distance of 5–10 blocks and standing ability intermittent (<0.5 h)	10	Mild: 0–5°	8
Walking 1–5 blocks and standing ability up to 0.5 h	8	Moderate: 5–15°	5
Walking less than 1 block	4	Severe: more than 15°	0
Cannot walk	0	Substraction	
Climbing stairs with support	2	One cane	1
Transfer activity	5	One crutch	2
Transfer activity with support	2	Two crutches	3
Range of Motion (18 points)		Extension lag of 5°	2
1 point for each 8° of arc of motion (maximum of 18 points)		Extension lag of 10°	3
		Extension lag of 15°	5
		Each 5° of varus	1
		Each 5° of valgus	1

Antibiotic prophylaxes were administrated intravenously 30 minutes before surgery (Cefazolin 2 g or Clindamycin 600 mg) and continued at 8 hour intervals until the postoperative drains were removed. Drains were removed after 48 to 72 hours postoperatively. All prosthesis components were cemented with antibiotic loaded bone cement (Refobacin Palacos®, Biomet Inc., Warsaw, Indiana USA; Palacos R + G®, Heraeus Medical GmbH, Germany).

Different types of endoprosthesis (cruciate retaining bicondylar surface replacement prosthesis (n = 33), semiconstrained (n = 7), constrained (n = 5)) were used in order to address different joint state (contracture, ligamentous instability, bone loss) (11× LCS CR, DePuy, 10× Emotion CR, Braun Aesculap, 12× Duracon ISA CR, Stryker, 5× Modular Rotating Hinge, Stryker, 2× PCA Primary, Howmedica, 1× GSB, Sulzer Medica, 2× ESKA, ESKA Implants, 2× Duracon Total Stabilizer, Stryker).

After surgery intensive physical therapy was applied and continuous passive motion was used in all patients. Patients were mobilized with crutches with partial weight bearing for 6 weeks.

Young age, hepatitis C, or HIV was not considered as contraindication for surgery.

Hematological management

The perioperative factor substitution regimen was prescribed by hemophilia experts from the Department of Medicine I, Clinical Division of Haematology and Haemostaseology. The factor VIII replacement therapy was administered by bolus to raise factor VIII (F VIII) and IX (F IX) to appropriate levels prior to the invasive procedure (initial F VIII dosage 60 IU/kg and initial F IX dosage 80–100 IU/kg). The targeted peak F VIII levels were 100–120% and F IX levels were 60–80% preoperatively (as close to induction of anesthesia as possible). The goal was to maintain trough levels of 60–80% 72 hours postoperatively. Factor VIII and IX trough levels were monitored on a regular basis and dosage of replacement therapy was adjusted accordingly with bolus therapy. The preoperative assessment included inhibitor screening. One patient (with low-titer inhibitors after therapy according to the Malmö protocol) had continuous infusion with FVIII 500 IU h^{-1}. One patient with high-titer inhibitors received recombinant factor VIIa (rFVIIa, Novoseven® Novonordisk) as bolus therapy according to the prescribed regimen. The other factor substitutions were administered via bolus therapy. All patients received the same product already used for home treatment. At surgery the peak level of factor VIII (F VIII) was kept at a mean of 122.6% (±SD 23.62) for patients with hemophilia A and of factor IX (F IX) at a mean of 64.4% (±SD 7.89) for patients with hemophilia B. Antithrombotic prophylaxis was not used after surgery.

Statistical Analysis

The Wilcoxon signed rank test was utilized to compare preoperative to postoperative values which were not distributed normally. Prosthetic survival was assessed by Kaplan-Meier survivorship analysis. End-point was defined as component removal for infection or any other reason. Comparison of survival curves was performed with the log-rank test. A P-value <0.05 was considered as statistically significant. Logistic regression was applied to investigate the association between the perioperative factor concentration and postoperative hematoma. Linear regression was performed to identify potential risk factors. Risk factors for infection were hypothesized to be age at surgery, HIV, follow-up period, bilateral procedure, inhibitors, for aseptic loosening age at surgery, type of implant, follow-up period, bilateral procedure.

Statistical analysis and graphical visualization were performed using GraphPad Prism®, Version 5.0 for Mac, GraphPad Software, La Jolla, CA, USA and IBM SPSS Statistics®, Version 19 for Mac, SPSS Inc, Chicago, IL, USA.

Results

Follow Up and Outcome

Twenty-four patients had hemophilia A (all severe, two with inhibitors), 4 patients hemophilia B (all severe), 3 patients von Willebrand disease (all type III) and one patient a combined factor V and VIII deficiency with 20% activity of F VIII. The mean follow up was 88.7 (range, 24–232) months. Four patients had died of liver failure during this time period. The mean age at surgery was 40.7 (range, 20–58) years.

All patients were seropositive for hepatitis C, 8 had hepatitis B, and 5 were positive for HIV. The mean flexion improved significantly from preoperatively 82.9° (range, 30–140) to 94.1° (range, 30–140) ($P < 0.0001$) at the latest follow up. The extension deficiency decreased from 16.3° (range, 0–60) to 3.4° (range, 0–40) ($P < 0.0001$).