M. Fehily · P. Fleming · E. O'Shea · O. Smith
H. Smyth

Total knee arthroplasty in patients with severe haemophilia

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Abstract We reviewed the perioperative records of haemophilic patients who underwent total knee replacement (TKR) over the period 1990–1999 and followed up the surviving patients. Nine knees were replaced in eight patients. Seven of the nine patients did not require blood transfusion. Mean perioperative haemoglobin drop was 2.9 g/dl. There were no significant complications. All surviving patients (eight TKRs) were reviewed clinically using a standard scoring system. The mean follow-up period was 51 months. All patients scored excellent (>90/100) in the functional category. The frequency of haemarthroses fell significantly from the rate experienced prior to TKR, and pain scores were zero.

Résumé Nous avons examiné les dossiers périopératoire de malades hémophiles qui ont subi une arthroplastie de genou sur la période 1990–1999, et avons suivi les malades survivant. Neuf genoux ont été remplacés chez huit malades. Sept des neuf arthroplasties n'ont pas exigé de transfusion de sang. Le taux moyen d'hémoglobine périopératoire était 2.9 g/dl. Il n'y avait pas de complications notables. Tous les patients survivant (8 arthroplasties) ont été examiné, en utilisant un système de score standard. Le suivi moyen était 51 mois. Tous les malades ont un score fonctionnel excellent (>90/100). La fréquence des hémarthroses a considérablement diminué et les scores de la douleur étaient nuls.

M. Fehily (✉)
Burnley General Hospital, Burnley, Lancashire, UK
e-mail: maxfehily@btinternet.com
Tel.: +44-798-9342203

M. Fehily · P. Fleming · H. Smyth
Department of Orthopaedic Surgery, St. James's Hospital,
Dublin, Ireland

E. O'Shea · O. Smith
National Centre for Inherited Coagulation Disorders,
St. James's Hospital, Dublin, Ireland

Present address:

M. Fehily, 45 Brooklawn Drive, Withington,
Manchester M20 3GY, UK

Introduction

Haemophilia care has improved significantly in the last four decades. Recent advances in the treatment of haemophilia A and B have remarkably improved the life-style, quality of life, and life expectancy [1]. The orthopaedic surgeon has played a major role in the first two of these advances, frequently being involved in the treatment of the musculoskeletal problems that complicate haemophilia A and B. These complications include haemarthroses and soft tissue haematomas, pseudotumours, and arthritic change characterised by subchondral cysts, osteophytes, a marked synovitis, and joint contractures [11]. Septic arthritis and soft-tissue infections are common in haemophilic patients in general, particularly in immunocompromised patients. The knee is the most common joint affected (50.9%), followed in order of frequency by the ankle (42.8%), the elbow (38.5%), the shoulder (13.3%), and the hip [13].

The precise mechanism of joint damage has not been fully elucidated, but it is thought that initially there is a minor injury to the joint causing a haemarthrosis. This leads to hypertrophy of the synovium and increased sensitivity to injury, and a cycle of recurrent bleeding develops [11]. With repeated bleeding there is damage to the articular cartilage, enlargement and deformity of bone ends, and eventually joint destruction known as haemophilic arthropathy [6, 10]. In the immature skeleton a hyperaemic response to recurrent injury may cause hypertrophy of the growth plate and an asymmetric growth deformity, classically a valgus deformity at the proximal tibia [2].

Over the past three decades there have been significant advances in the management of haemophilia, including the use of home factor therapy and prophylactic transfusions prior to "high-risk" activities. These have been shown to significantly decrease the incidence of both joint damage and deformity [8]. The use of continuous factor replacement since 1995 in the perioperative period has led to better haemostatic control around the time of surgery [7]. Since 1998 the use of purely recombinant

Table 1 Protocol for factor replacement

1. Bolus only (before 1995)	
Preop.	100% bolus
Postop.	Maintain factor level at 100% for days 1–5 Maintain factor level at 80% for days 6–14
Discharge	F-IX: 80% twice per week × 2 weeks
prophylaxis	F-VIII: 80% three times per week × 2 weeks
2. Continuous infusion (after 1995)	
Preop.	100% bolus
	Continuous infusion at 4 IU/kg h
Postop.	Maintain factor level at 80–100% for 5 days, adjusting infusion appropriately
	Bolus rise to 80% twice daily for 2 days
	Bolus rise to 80% once daily for 3 days
	Bolus rise to 80% on alternate days for 4 days
Discharge	F-IX: 20–40 IU/kg twice per week × 6 weeks
prophylaxis	F-VIII: 20–40 IU/kg three times per week × 6 weeks

factors VIII and IX has eradicated the serious threat of viral transmission.

Our hospital houses the National Haemophiliac Centre and is the main haemophilia treatment unit for the Republic of Ireland, covering a population of approximately 3 million people. We present our experience performing total knee replacement (TKR) in patients with haemophilia A and B using modern factor-replacement strategies.

Materials and methods

During the period 1990–1999 we performed a total of nine TKRs on eight patients. The decision to undergo surgery was agreed upon after discussion between the patient, haematologist, and orthopaedic surgeon. It was based primarily on the severity of pain in the presence of significant arthropathy. All patients were men and all had a severe form of either haemophilia A or B (i.e. <1% of normal factor levels). The average age at time of surgery was 37.6 (range 28–46) years. One patient was unavailable for follow-up, as he died 2 years after surgery from an AIDS-related illness with no collateral evidence of complications regarding his knee arthroplasty. A standard resurfacing TKR with synovectomy was performed in each case. Since 1995 the factor replacement has been delivered using a continuous infusion over the perioperative period. The regimen was calculated using weight, plasma clearance, and baseline factor level. The patient was initially given a bolus infu-

sion to bring their factor level up to 100%. This was checked with pre- and postinfusion levels. The patient was then commenced on a continuous infusion at an initial rate of 4 IU/kg h. This was then adjusted daily, as required, to maintain normal factor levels (see Table 1 for both bolus and continuous infusion protocols). At day 2 all drains were removed and a programme of early physiotherapy was commenced, which included the use of continuous passive motion devices.

A retrospective chart review was carried out in all nine TKR procedures performed to determine blood loss (difference in haemoglobin between pre- and postoperative samples), blood transfusion requirements, and perioperative complication rates.

Other information was ascertained from the records of the Blood Transfusion Services such as type of concentrate used, viral status, method of administration, perioperative factor levels, T-cell levels, etc. (Table 2).

All seven available patients (eight TKRs) were reviewed clinically. The mean follow-up period was 51.6 months, with five joints >24 (range 6.0–103.2) months. Patients were assessed using the American Knee Society scoring system [3] (preoperative scores were not available) and the verbal numerical rating score for pain (a verbal score between 1 and 10), both pre- and postoperatively. The frequency of haemarthroses before and after knee replacement was documented, and the patients' HIV and hepatitis status was determined.

Results

Blood transfusion requirements

Over the nine TKR operations the mean blood transfusion requirement per procedure was 0.44 (range 0–2.0) units. However, this result was weighted by the first two patients in the series (1990 and 1991) who received 2 units of red blood cells postoperatively; none of the remaining six patients (seven TKRs) required transfusion. The mean perioperative decrease in haemoglobin concentration between the immediate preoperative and second-day postoperative full blood counts was 2.9 (range 1.4–6.1) g/dl.

Perioperative complications

There was one episode of pyrexia of unknown origin (PUO), which was treated successfully with oral broad-spectrum antibiotics. One patient had an intra-articular

Table 2 Patient details. *n.a.* not available

Joint	Haemo- philia	Date	Concentrate	Viral status	Units used	Method of administration	Average daily level	Th-cells	Function score	Knee score	Length of stay (days)
1	A	1990	Solvent detergent heat treated	Hep A/B/C HIV	n.a.	Bolus	n.a.	0.29×10 ⁹	n.a.	n.a.	n.a.
2	A	1991	Solvent detergent heat treated	Hep A/B/C	n.a.	Bolus	n.a.	n.a.	100	56	n.a.
3	B	1992	Monoclant	Hep A/B/C	56175	Bolus	144%×14/7	n.a.	100	51	19
4	B	1995	Monoclant	Hep A/B/C	84435	Continuous	69%×14/7	n.a.	100	71	21
5	B	1995	Monoclant	Hep A/B/C	85170	Continuous	85%×13/7	n.a.	100	73	18
6	A	1997	Solvent detergent heat treated	Hep A/B/C HIV	133,000	Continuous	106%×14/7	0.36×10 ⁹	100	85	16
7	A	1998	Recombinant	Hep A/B/C HIV	82500	Continuous	123%×14/7	0.745×10 ⁹	100	69	15
8	B	1998	Monoclate	Hep A/B/C	126500	Continuous	86%×14/7	n.a.	100	76	21
9	A	1999	Recombinant	Hep A/B/C HIV	30500	Continuous	129%×14/7	0.69×10 ⁹	90	72	22

bleed 2 days following the procedure. There were no episodes of either superficial or deep wound infection, or of clinical venous thromboembolic disease.

Results at follow-up

Each of the seven patients (eight TKRs) available for follow-up was assessed using the American Knee Society scoring system. All patients scored greater than 90/100 on the function score, which reflected their ability to walk, climb stairs, etc. The knee score assesses the presence or absence of pain, range of movement, and presence of contraction deformities. The mean score was 69.1 (range 51–85). The mean preoperative verbal pain score (retrospectively) was 6.9; in all cases this had dropped to zero on follow-up.

The mean number of bleeds per month prior to surgery was 1.3 (range 0.5–2.0). This fell to 0.04 (range 0–0.25) following TKR. There were no episodes of joint infection in any of the patients from our series. Of the remaining seven surviving patients, all tested positive for hepatitis C, and three were HIV-positive.

Discussion

Since the early 1990s there has been a gradual move away from the bolus method of factor replacement in favour of a continuous infusion. Studies have shown that the latter leads to lower factor requirements, the avoidance of peaks and troughs in factor levels, and better overall haemostatic control [7, 9, 12]. Our results are consistent with these findings.

There are relatively few published series on TKR in haemophiliac patients [5, 12, 14]. The majority of these reports are on patients operated on between the 1970s and 1980s using pulse doses of factor replacement and demonstrate a significant complication rate. Karthaus et al. [4] showed significant complications in 10 out of 11 TKRs, including epistaxis, haemarthrosis, haematuria, phlebitis, anaphylactic reactions, and PUO. Eight of the 11 knees required manipulation under anaesthesia in the second or third week postoperatively. Thomason et al. [14] showed a 17% incidence of both significant bleeding episodes and deep joint infection.

In comparison, we have been able to show a low perioperative complication rate, both with regard to bleeding and infection, and an excellent long-term functional result. All of our patients reported a lower frequency of joint bleeds, an absence of pain, and a greater level of mobility following TKR (which was shown by the high functional scores). The low knee scores reflected the fact that, while the patients were all pain free, they continued to have contractures, although this did not significantly limit their mobility or function. Each patient recorded a high level of satisfaction with the joint replacement.

Since 1995 and the introduction of continuous factor replacement, the blood transfusion requirements fell to zero. We believe that this fact, and the decreased rate of complications associated with continuous factor replacement, allows more aggressive rehabilitation in the early postoperative period, which includes the use of continuous passive motion. None of our patients have required joint manipulation to improve range of motion.

The introduction of recombinant factor replacement since 1998 has been a major development in the care of these patients, removing the unacceptably high risk of viral transmission (especially HIV and hepatitis B and C) which existed before then.

It is our experience that TKR is a safe and effective procedure in the management of haemophiliac joint arthropathy. With the use of continuous infusion and recombinant factor replacement the complication rate and functional result are approaching that of the general population, although these patients need to be followed long term to see if this applies to the lifespan of the prosthesis.

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