CASE REPORT

Recurrent Hemarthroses After TKA Treated With an Intraarticular Injection of Yttrium-90

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Abstract

Background Recurrent hemarthroses after a TKA are uncommon and usually respond to nonoperative treatment or intervention using angiographic embolization or synovectomy. However, in rare circumstances, the problem can be resistant to treatment.

Case Description We report the case of a patient who had recurrent hemarthroses after a TKA. During the first 18 months after surgery, the patient experienced 48 episodes consistent with bleeding into the knee. The bleeding

episodes recurred despite use of traditional treatments, including arthroscopy, open synovectomy and embolization of a small, false aneurysm. The patient ultimately received an intraarticular injection of yttrium-90 silica/citrate, and the hemarthroses ceased soon after the injection. At last review, 25 months after the injection, the patient had experienced no additional bleeding episodes.

Literature Review On review of the literature, we found only one other report in which yttrium-90 was used successfully in a similar situation.

Clinical Relevance Yttrium-90 may be considered a treatment option in patients with recurrent hemarthroses after TKA, especially when the condition has not responded to more traditional treatments. The long-term risk of treatment with yttrium-90 for recurrent hemarthroses after a TKA remains unclear.

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Each author certifies that his institution approved the reporting of this case report, that all investigations were conducted in conformity with the ethical principles of research, and that informed consent for participation in the study was obtained.

This study was performed at Greenslopes Private Hospital and Royal Brisbane and Women's Hospital, Brisbane, Australia.

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Introduction

Recurrent hemarthroses of the knee are uncommon after a TKA, occurring in less than 1% of patients [9, 13, 21]. They can occur with varying frequency and result in knee pain, stiffness, and disability. Numerous causes have been described [2, 3, 5–7, 11, 14, 15, 18], although no etiology can be identified in more than 50% of cases.

Conventional treatments, including aspiration, immobilization, vascular embolization, and arthroscopic or open synovectomy for recurrent knee hemarthroses are usually successful. However, some patients do not respond to traditional methods. In such patients, alternative therapeutic options must be considered. We report the use of intraarticular yttrium-90 injection as an option for treatment of recurrent hemarthroses after TKA.

Table 1. Comparison of cases

Variable	Our patient	Kapetanios et al. [4]
Patient (sex/age)	Female/83 years	Female/50 years
Onset of recurrent bleeding episodes after TKA	Within 4 months	18 months
Conservative treatment	Failed	Failed
Arthroscopy	Failed	Failed
Angiography	False aneurysm ablated but failed to stop bleeding episodes	Negative
Synovectomy	Failed	Not performed
Yttrium-90 injection	Successful	Successful
Bleeding episodes after yttrium-90 injection	Two minor bleeding episodes during first 4 months, no additional episodes at 25 months	No further bleeding episodes

Case Report

An 83-year-old woman underwent a posterior-stabilized left TKA for advanced osteoarthritis in June 2011. She had a previous right TKA without complications. She reported pain and swelling 1 week and 3 weeks after the left knee surgery, but experienced no additional incidents until 4 months postoperatively. Subsequently, she reported between two and eight episodes monthly of painful left knee swelling, consistent with recurrent hemarthroses. She maintained a diary of events affecting her knee.

The patient underwent a left knee arthroscopy at another institution on December 13, 2011. On January 10, 2012, she was admitted through the emergency room at Greenslopes Private Hospital in substantial pain attributable to a tense hemarthrosis. The patient's blood coagulation screening profile was normal and serology for infection and inflammation (complete blood count, erythrocyte sedimentation rate, and C-reactive protein) were not elevated. A femoral artery angiogram showed a 6-mm false aneurysm from a branch of the popliteal artery laterally, which was embolized with four coils. The patient was discharged home after 3 days.

The patient was readmitted 1 day later with another painful hemarthrosis; a CT angiogram did not identify a site of bleeding. Frank blood was aspirated from the knee on two occasions (70 mL and 50 mL) during the readmission. Arthroscopy was performed but no obvious source of bleeding was identified, and open synovectomy was performed immediately under the same anesthetic. Synovial biopsies showed a nonspecific mixed inflammatory infiltrate and hemosiderin deposits. The patient continued to have recurrent bleeding into the knee and on April 18, 2012, was readmitted again with a painful, tense hemarthrosis. A third arthroscopic washout of blood was performed, without a clearly identifiable source of bleeding, and the patient then wore a knee immobilizer for

8 weeks. The knee was quiescent during immobilization but the bleeding episodes recurred 6 weeks after splint removal. A repeat angiogram was negative and on December 3, 2012, an injection of yttrium-90 was administered. Access to the intraarticular joint space was confirmed by aspiration of blood-stained synovial fluid and 6 mCi yttrium-90 then was injected in the knee, followed by 80 mg methylprednisolone acetate. The joint then was immobilized in a splint for 1 month.

The patient reported two minor bleeding episodes during the next 4 months. She was last seen 25 months after injection with yttrium-90 and reported no additional bleeding episodes. She had no knee swelling and a pain-free ROM from 0° to 105°.

Discussion

In our patient, none of the commonly used measures to prevent or limit recurrent hemarthroses after TKA was effective in stopping recurrent bleeding. The patient experienced 48 episodes of bleeding in 18 months. A search of the English literature for the past 30 years revealed one reported case in which the use of an intraarticular injection of yttrium-90 was effective in a similar situation [4] (Table 1).

Recurrent hemarthroses after a TKA are uncommon, reported to occur in less than 1% of patients [9, 13, 21]. As seen with our patient, a hemarthrosis can be a source of considerable pain and restricted motion. The most frequent reported causes of recurrent bleeding into the knee are entrapped proliferative synovial tissue or the fat pad caught between prosthetic components [9]. Other reported causes include tumors [3], retained meniscal fragments [7], pigmented villonodular synovitis [2], vascular causes (aneurysms, pseudoaneurysms, arteriovenous fistulae) [5, 6, 14, 15, 18], hematologic conditions [11], use of

anticoagulants, or mechanical factors causing repetitive minor trauma such as malalignment, instability, and malposition of the implants [16]. In more than 50% of cases, no cause for bleeding is found [9].

Initial treatment of a recurrent hemarthrosis is usually nonsurgical, and includes knee aspiration (which can be diagnostic and therapeutic), rest, immobilization, cryotherapy, and a graduated return to normal activity. If conservative treatments fail, an angiogram can show whether the situation warrants embolization. Angiographic indications for embolization include vascular blush or the presence of an aneurysm. Alternatively, open synovectomy has been reported to be curative in 93% of patients [9]. Open surgery is more effective than arthroscopic synovectomy [8, 9] but requires a longer rehabilitation time and exposes the patient to greater risks, such as infection, compared with treatment by embolization.

Beta-radiation yttrium-90 radioisotope synovectomy is a local form of radiotherapy, usually administered as an intraarticular injection. The yttrium-90 isotope readily penetrates the thickened synovium with the yttrium-90 colloidal particles then being phagocytosed by the synovial macrophages. Beta-radiation-induced ionization of intracellular molecules results in release of free radicals, subsequent macrophage apoptosis, and ablation of the inflamed synovium [1].

Numerous beta-radiation emitting radiopharmaceuticals have been tested because many of these have high lymphatic transport. Yttrium-90 usually is chosen given that it is attached to colloidal particles which are small enough to be phagocytosed by the synovial macrophages, thus ensuring local therapeutic effect [1]. Yttrium-90 is very energetic; mean and maximal tissue penetration are 3.6 mm and 11 mm respectively; maximal beta energy emission is 2.25 MeV [17]. In addition to treating persistent rheumatoid synovitis [20], yttrium-90 has been reported to be beneficial in hemarthrosis and synovitis associated with hemophilia [19], calcium pyrophosphate crystal arthropathy [20], pigmented villonodular synovitis [10], persistent synovitis after joint prosthesis surgery [8], and other forms of chronic synovitis [17].

Absolute contraindications for yttrium-90 synovectomy include pregnancy, breast feeding, ruptured Baker's cyst (knee), local skin infection, and massive hemarthrosis. Relative contraindications include age younger than 20 years, evidence of substantial cartilage loss with associated joint instability and bone destruction [12]. Infection, temporary increase in joint pain attributable to radiation-induced synovitis, lymphedema, and fever have been reported as complications, in rare cases [12]. Late radionecrosis is very rare [17]. Induction of malignancy is a theoretical risk which, to our knowledge, has not been

reported. The long-term effects on polyethylene are unknown.

Yttrium-90 is a potential option to treat recurrent hemarthroses after TKA when other more conventional interventions have failed. The two successful cases that have been reported in the English literature to date are not evidence that the treatment will be universally effective. The potential risks mentioned above should be considered carefully.

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