CASE REPORT

Expanding the indications: distal femoral osteotomy used successfully to treat recurrent knee effusion

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Accepted 6 December 2014

SUMMARY

Distal femoral osteotomy (DFO) is successful in treating painful valgus arthritis of the knee. We present a case where painless recurrent knee effusion was attributed to constitutional valgus. The absence of pain made the indication for surgery atypical so DFO was carefully considered and planned. A small correction was performed, bringing alignment closer to neutral with complete resolution of the recurrent effusion. We suggest that the indications for knee osteotomy can be expanded to include recurrent joint effusion in carefully selected patients.

BACKGROUND

Varus medial compartment disease is the commonest pattern of knee arthritis.¹ There is a modern revival in knee osteotomies,² particularly high tibial osteotomy. Surgeons with greater experience have expanded the standard indications³; such that knee osteotomies are now being performed in patients under 40, above 60, in patients with obesity and in combination with additional joint preserving procedures such as cartilage surgery or meniscal transplantation.⁴ Knee osteotomies may also have beneficial effects on distant joints.⁵

Valgus knees with associated lateral compartment degeneration present less frequently. Accordingly the indications for distal femoral osteotomy (DFO) are yet to be clearly defined.⁶ DFO is appropriate in younger and more active patients, symptomatic from valgus lateral compartment knee arthritis, where arthroplasty is unlikely to meet aspirations for high activity.⁷ DFO is intended as a joint

preserving procedure to reduce pain and disease progression by unloading the lateral compartment.⁸ We present a case report where DFO was used successfully to address a painless but recurrent knee effusion, with a view to raising awareness of the broadening indications for knee osteotomies.

CASE PRESENTATION

A 54-year-old fit and well builder and businessman presented with insidious onset posterolateral joint line pain and the sensation of something getting trapped in his left knee. He led an active lifestyle, attending the gym for 6 days of the week. Bilaterally his knees were in valgus. A slight effusion was detected with posterolateral joint line tenderness and positive provocation tests for the lateral meniscus. A meniscal cyst was palpated posteriorly and confirmed with MRI. A lateral meniscal tear was suspected as the aetiology of his cyst and symptoms. He was offered arthroscopic meniscectomy but he elected on that occasion to continue with conservative measures.

Two years later he represented aged 56, with a lateral clunk and intermittent pain. MRI at this stage confirmed tears of the posterior horns of both and medial and lateral menisci. With progressive symptoms he took up the offer of arthroscopy. Both menisci were trimmed to stable margins. Grade 2 changes were observed on hyaline cartilage surfaces of medial and lateral tibiofemoral compartments. Initially he did well following this surgery without immediate complication.

Three months later he returned with a large effusion following a strenuous bike ride. His Oxford

Table 1 Frequency, description, volumes colour and localised treatment for his recurrent effusion

Date	Effusion description	Volume drained	Colour	Injection
13/08/10	Bit	30	Straw	Steroid (Depomedrone)
16/08/10	Increasing	Not stated		
18/10/10	Bit	20	Straw	Steroid
15/01/11	Big	50	Straw	
30/01/11	Large	30		
14/03/11	Big	40		
26/03/11	Large	50		
27/04/11	Recurrence	50		Steroid
18/05/11	Recurrence	30	Straw	Steroid
03/06/11	Small amount	not stated		Steroid
06/06/11	Lots	60		
19/07/11		60		
05/08/11	Recurrence	not stated		
15/08/11	Surgery

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To cite: Elson DW, Malpas C-MC, Wilson C. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2014-206492

Figure 1 Rosenberg's¹¹ flexed anteroposterior (AP) view demonstrates a degree of joint space narrowing in the lateral compartment.

Knee Score (OKS)^{9 10} was 38 (of 48). The effusion was drained and a small volume of steroid infiltrated. He returned a few days later and then 2 months later with further effusions following strenuous exercise. Presenting with recurrent effusions in this knee then became a frequent pattern, usually after strenuous activity in the gymnasium. The frequency and volume of these effusions is shown in table 1.

Figure 2 Full-leg alignment views show the weight-bearing axis of Mikulicz as it passes through the knee; (A) is taken prior to distal femoral osteotomy and (B) was taken after surgery. The zoomed views show Mikulicz point at 62% of the tibial width prior to surgery (C). Following a small correction, Mikulicz point is closer to the centre of the knee at 55% (D).

INVESTIGATIONS

Plain radiographs suggested that the knee was in valgus and a Rosenberg *et al*¹¹ view of his knee (figure 1) confirmed mild narrowing of the lateral joint space. A full-leg alignment view (figure 2) was measured according to conventional parameters¹² as shown in table 2. The medial proximal tibial angle at the knee was normal, but the reduced mechanical lateral distal femoral angle located the deformity in his distal femur. Mikulicz's weight-bearing line transected the knee at 62% of the tibial width (from medial to lateral). Bone scintigraphy (figure 3) demonstrated increased uptake in the lateral compartment of his knee.

Postoperatively full-leg alignment views (figure 2) were repeated showing a subtle correction with Mikulicz's weight-bearing line now crossing the knee at 55% of the tibial width (from medial to lateral). A lateral radiograph shows the osteotomy to be fully united (figure 4).

DIFFERENTIAL DIAGNOSIS

A rheumatological opinion was sought, but the aetiology was not considered to be inflammatory with a negative aspirate for crystals and organisms. The use of a yttrium synovectomy was ruled out. The patient was advised to limit his frequent exercise habits. However, unable to avoid occupational loading and still enthusiastic for gymnasium activity his symptoms persisted.

TREATMENT

The hypothesis that gradual lateral compartment overload leading to a loss of joint homeostasis was advanced. Subsequently DFO was offered to unload the lateral compartment where the deformity had been identified in the distal femur. The patient spoke with others who had undergone similar surgery successfully, albeit for more standard indications. In the face of his frequent effusions, resistant to all conservative measures, he elected to proceed.

Surgeons are understandably apprehensive when operating outside standard indications. We were aware that employing DFO to treat recurrent knee effusion would be considered such

Table 2 Assessment of long leg alignment radiographs before and after surgery

Variable	Population normal value*	Before surgery	After surgery
mTFA (varus)	1.3 (varus)	−3.0 (valgus)	−1.3 (valgus)
mLDFA	87.8	84.7	87.0
Mikulicz point	45%	62%	55%
MPTA	87.2	87.9	88.1

The leg was in 3° of valgus with a low mLDFA and close to normal MPTA indicating that the deformity was femoral. The small correction achieved through DFO has increased the mLDFA and reduced the Mikulicz point essentially bringing these values closer to the population normals.

*Normal values cited for mTFA,²⁰ MPTA,¹² mLDFA.¹² Mikulicz point at 45% is calculated from a known mean axis deviation of 4 mm medial to the centre of the knee²¹ for an average tibia measuring 80 mm across.

DFO, distal femoral osteotomy; mLDFA, mechanical lateral distalfemoral angle; MPTA, medial proximal tibial angle; mTFA, mechanical tibiofemoral angle.

an unusual indication. Subsequently the literature was searched for guidance on specific indications, but was found to be lacking. We looked to the writings of Dye^{13 14} who has advanced the theories of tissue homeostasis and a functional envelope for the knee, which may be exceeded by supraphysiological loading. Clinical improvement has been observed when loading is restricted to the confines of a diminished envelope of function.¹³ The patient was made aware of our rationale for choosing this operation but he received the guarded counselling that there could be no guarantee of symptomatic improvement.

The long-leg views were annotated¹⁵ aiming for a correction to neutral which generated a small correction angle of 5°. DFO was performed through a medial subvastus approach to the femur. An anterior biplanar osteotomy was performed above the metaphyseal flare and a 5 mm medial closing wedge of bone was excised (figure 5) to correct his valgus to a neutral position.

Figure 3 A bone scan demonstrating increased uptake in the lateral compartment of the left knee.

Figure 4 A lateral view of the femur shows the osteotomy fully united.

The osteotomy was held with a medial femoral tomofix plate (Synthes, Welwyn Garden City, UK). Partial weight bearing was recommended for 6 weeks.

OUTCOME AND FOLLOW-UP

His recovery was uneventful. He was followed up at 4, 8 and 30 months with no further episodes of effusion and a straight

Figure 5 A small wedge of bone resected from the medial metaphysis of the femur prior to this gap being closed.

leg. At the last attendance his OKS was 46 (of 48). He has been discharged because he is now asymptomatic following his surgery, satisfied and reporting that his knee is 'much better'.

DISCUSSION

In this case slight deformity in the lower limb caused painless recurrent joint effusions. However, mild degenerative changes were present in the lateral compartment and it was hypothesised that correction of his valgus deformity would improve knee biomechanics and reduce effusion frequency. We searched the literature to find examples of knee osteotomies used to treat painless recurrent effusion. The absence of such a report has prompted us to prepare this manuscript. There is a paucity of guidance in the literature relating to the indications for DFO. A 2007 Cochrane review of knee osteotomies¹⁶ identified only 13 suitable papers, all of which concerned high tibial osteotomy. A 2012 systematic review of DFO⁶ was based on the evidence from only six case series. Cumulative survival using arthroplasty as an end point ranged from 64% to 82% at 10 years.⁶ DFO has been used successfully to treat patellofemoral arthritis of the lateral facet in valgus knees¹⁷ and chronic patella dislocation.¹⁸

Typically function is poor prior to DFO. In one case series¹⁹ the mean preoperative OKS was 13.1. The patient in this case reported an OKS of 38 indicating a high level of function with minimal pain. This prompted the initial drive to exhaust conservative therapies and precluded arthroplasty as a realistic option to meet his high activity levels. The joint effusions became so troublesome and frequent that when non-surgical options persistently failed, osteotomy was offered. A small correction was planned and performed without complication, achieving complete resolution of the effusion with an improvement in OKS from 38 to 46.

In this case the indication for DFO was atypical but justified because true alignment improves function of the lower limb. Tissue homeostasis has been restored when knees are loaded within the constraints of a reduced functional envelope.¹³ We hypothesised that DFO would be an appropriate method to achieve this offloading effect and the successful outcome in this case supports this hypothesis. Thorough clinical examination is essential and in this case the valgus deformity was more apparent when the patient was standing. We recommend that

careful patient selection prior to DFO remains essential as do the processes of preoperative planning and meticulous surgical technique to maximise the chances of a success. In well selected and planned cases, knee osteotomy may be beneficial in treating recurrent effusion.

Contributors DWE conducted all analyses, wrote the first draft of the manuscript and rewrote new drafts based on input from coauthors. CW planned the case report and gave input on manuscript drafts. C-MCM performed literature and background research, drafted the background and discussion and gave input on manuscript drafts. All authors read and approved the final manuscript.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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Learning points

- ▶ Distal femoral osteotomy (DFO) is a successful operation for patients with symptomatic valgus knee arthritis.
- ▶ In this case, the indications for DFO were expanded to include recurrent knee effusion without pain.
- ▶ Alignment is critical to limb function, where restoration of alignment can result in excellent outcomes.
- ▶ Realignment surgery can offload a knee to the confines of a diminished functional envelope, which subsequently improves tissue homeostasis.

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