

Endoscopic Resection of Symptomatic Osteochondroma of the Distal Femur

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The surgical risk and complication rates for an open excision of a benign osteochondroma have been reported as high as 13%. The advent of minimally invasive techniques allows a surgical resection with a smaller incision and a potential for less postoperative morbidity. We presumed endoscopic resection of symptomatic osteochondroma of the distal femur would decrease postoperative morbidity of open surgery and improve functional outcome. We performed endoscopic resection of a symptomatic osteochondroma in seven patients among 24 who had surgical excision. Preoperative studies include radiographs and computed tomography scans. At a mean followup of 33 months, patients were functionally evaluated according to the Lysholm score and the International Knee Documentation Committee scale. Four exostoses were located at the anterolateral femoral cortex, one at the trochlea, and two at the anteromedial cortex. Histologic diagnosis of an osteochondroma was confirmed in all cases. The average Lysholm score improved 22 points from a mean of 74 preoperatively to 96 postoperatively, and according to the International Knee Documentation Committee scale, all patients showed a normal knee. In 7 of 24 patients with a symptomatic osteochondroma of the distal femur close to the knee, we performed endoscopic resection with low morbidity and prompt functional recovery.

Level of Evidence: Level IV, therapeutic study. See the Guidelines for Authors for a complete description of levels of evidence.

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Each author certifies that his institution has approved the reporting of this case report and that all investigations were conducted in conformity with ethical principles of research.

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Osteochondromas are the most frequent benign bone tumors, and the knee is the most common location for them.⁵ Although there is an incidence of sarcomatous change between 1% and 2% in solitary osteochondroma,¹ patients undergo surgical resection mainly because of clinical symptoms due to pressure on adjacent tendon, nerves, muscles, or blood vessels. When symptomatic, surgical open excision has been the standard treatment with a low recurrence rate.^{4,7,13} However, complication rates of 11% to 13%^{4,13} for open excision of benign osteochondroma have been reported; these complications include arterial laceration, compartment syndrome, fractures, and nerve palsies.

The advent of minimally invasive techniques allows complete surgical excision with smaller incisions and the potential decrease of postoperative morbidity. Arthroscopic surgery, because of its efficacy and minimally invasive nature, has gained widespread popularity as the method of choice for the treatment of patients with knee disease. This technique allows resection as an outpatient procedure and involves a rapid functional recovery.^{3,6,11,12}

We therefore hypothesized endoscopic resection of symptomatic osteochondroma of the distal femur would decrease postoperative morbidity of open surgery, with no increase in operative time or length of the hospital stay, and improved functional outcome.

MATERIALS AND METHODS

We retrospectively reviewed the records of 41 patients who had surgically excised benign solitary osteochondromas of the knee between January 2002 and December 2004. The exostosis was resected from the distal femur in 24 patients; in seven of these patients, this procedure was performed endoscopically. There were six male patients and one female patient, with a mean age of 21 years (range, 15–38 years). The minimum followup was 24 months (mean, 30 months; range 24–60 months). In six patients, the diagnosis of osteochondroma was based on identifying the characteristic cortical and medullary continuity between lesion

and parent bone in preoperative studies that included radiographs and computer tomography scans (Fig 1); in the remaining patient, a needle biopsy was performed because the images were not characteristic (Fig 2). Four exostoses were located at the anterolateral femoral cortex, one at the trochlea, and two at the anteromedial cortex. Five were pedicle osteochondroma and two sessile. We reviewed the medical records to ascertain the indication for surgery, surgical technique, length of hospitalization, postoperative management, complications, and functional outcome.

The indication for arthroscopic resection was that the osteochondroma must not affect the posterior cortex of the femur due to the possibility of neurovascular damage during the procedure. Extraarticular localization of the exostoses was not considered a contraindication for this procedure, unless the distance from the joint was greater than 15 cm. Inappropriate candidates for this procedure also include those sessile osteochondromas with broad base of implantation (greater than 5 cm), and patients with multiple osteochondromatosis.

Under spinal or general anesthesia, the patient was placed in a supine decubitus position and the tumor location was marked on the skin with a marker. Two working portals were used initially; one anteromedial and one anterolateral, and ligaments, cartilage, and meniscus were evaluated. The tumor was marked percutaneously with a needle (Fig 3A), and soft tissue dissection with a 4.5-mm shaver was performed (Fig 3B). The resection of the osteochondroma was completed with a fine periosteal osteotome (Fig 3C), and the fragments were extracted with a grasping forceps (Fig 3D). Large exostoses required enlarged arthroscopic portals for extraction. Finally, the resection was completed with a 5.5-mm bur to resect all remaining pedicle of the osteochondroma, leaving the bone at the same level as the original femoral cortex (Figs 3E–F).

In all seven cases, histologic examination confirmed the bony part consisted of cancellous bone, and the surface of the tumor

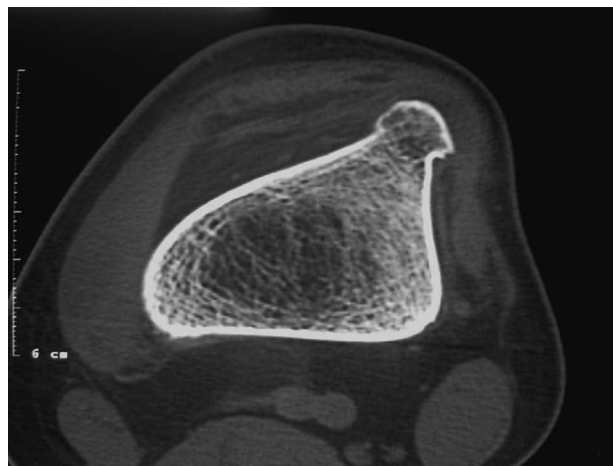


Fig 1. A preoperative axial computed tomography image of an osteochondroma localized in the anterolateral cortex of the distal femur shows the characteristic cortical and medullary continuity between lesion and parent bone.

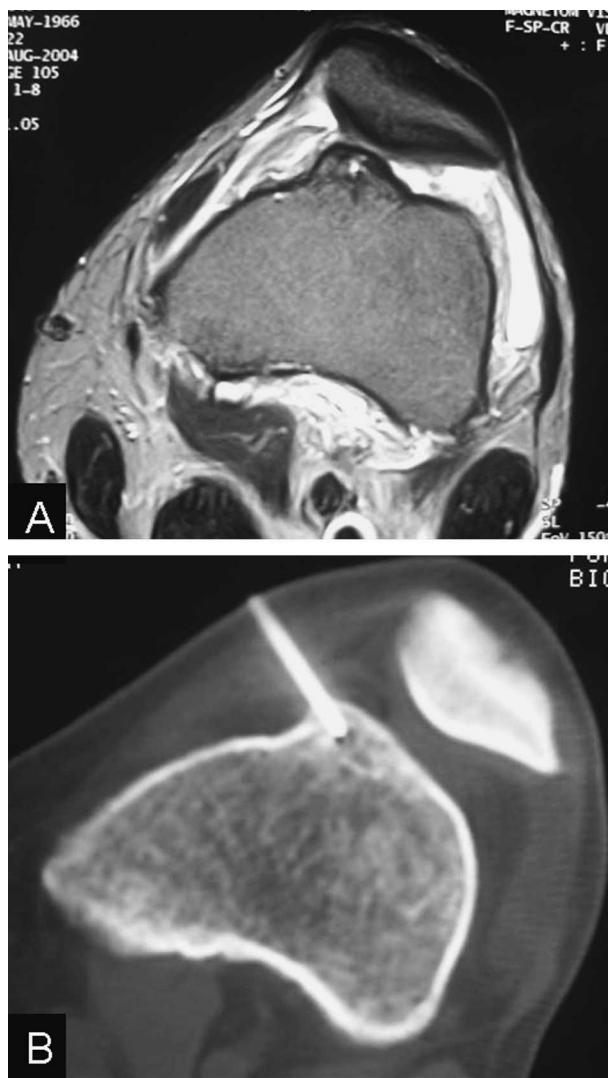


Fig 2A–B. Preoperative images of a 30-year-old man with pain and frequent locking symptoms show an osteochondroma of the trochlea. (A) An axial magnetic resonance image shows the exostosis located in the trochlea that subluxates the patella. (B) An axial computed tomography image at the moment of the needle biopsy confirms the diagnosis of osteochondroma.

was covered with cartilage tissue and diagnosed as an osteochondroma. The mean size of the resected tumors was 2.4 cm (range, 1–4 cm).

The patient was seen by a physical therapist after surgery and instructed on crutches walking and quadriceps contractions. Ice or a cryotherapy device was used to help minimize postoperative swelling and discomfort. Passive and active flexion exercises were begun at the first week after the operation and full weight-bearing was indicated. Most patients were seen postoperatively at 1 week, 2 weeks, 1 month, 2 months, 3 months, and every 6 months thereafter until 2 years. Plain radiographs were taken at every visit beginning 1 month after the operation.

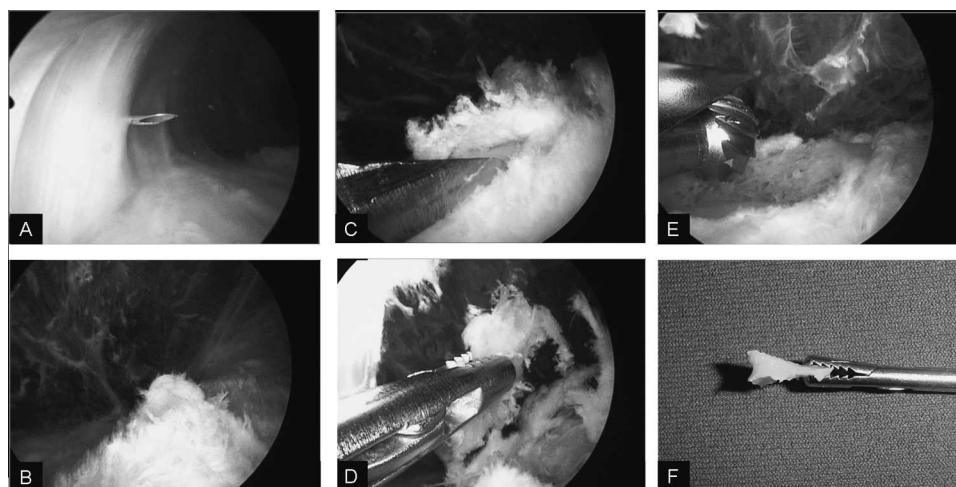


Fig 3A–F. Intraoperative photographs show the surgical technique for arthroscopic resection of distal femoral osteochondroma. (A) The tumor is marked percutaneously with a needle. (B) After shaving the soft tissue, the osteochondroma is identified. (C) The resection of the osteochondroma is performed with a fine periosteal osteotome. (D) The osteochondroma is extracted with a grasping forceps. (E) The resection is completed with a 5.5-mm bur to resect all remaining pedicle of the osteochondroma, leaving the bone at the same level as the original femoral metaphysis. (F) Intraoperative photograph shows the osteochondroma specimen.

Patients were functionally evaluated according to the Lysholm knee score⁹ and the International Knee Documentation Committee (IKDC) subjective knee form.⁸ The Lysholm knee score is a condition-specific outcome measure that contains eight domains: limp, locking, pain, stair climbing, use of supports, instability, swelling, and squatting. An overall score of 0 to 100 points is calculated, with 95 to 100 points indicating an excellent outcome, 84 to 94 points a good outcome, 65 to 83 points a fair outcome, and fewer than 65 points a poor outcome. The IKDC rating is based on group ratings for function, symptoms, range of motion, and laxity. Each group rating is based on two or more items that are rated as normal, nearly normal, abnormal, or severely abnormal. The worst rating for any item within a group determines the group rating, and the worst group rating determines the overall final rating. Thus, the worst rating for any particular item determines the overall final rating.

RESULTS

Pain and other related symptoms completely disappeared after arthroscopic resection within 2 weeks (range 1–4 weeks). In one patient, an arthrocentesis was performed 1 week after the procedure to remove a hemarthrosis, with no consequences in the final functional results.

The average length of surgical time for resection of the seven osteochondromas was 45 minutes with a range between 40 and 50 minutes. The mean length of hospitalization was 20 hours. In the postoperative radiographs in six patients, the resection was complete; in the remaining one, there was a residual exostosis of 0.5 cm, with no subsequent symptoms. The followup radiograph taken at 6

months showed remodeling of the pedicle, no tumor relapse, and no heterotopic calcifications.

The Lysholm knee score showed a progressive and substantial increase during the review period compared with the preoperative condition. The mean preoperative score was 74 points (range, 68–82 points). No patient had limp, instability, squatting problems, or the need for use of supports. Three patients had swelling during strenuous activity and three during moderate activity. Three patients had pain during strenuous activity, three during moderate activity, and one during light activity. Four patients had no related problem with stair climbing, and three had minimal difficulties. Two patients had no locking symptoms, while four had a subjective sensation of locking and the remaining one had frequent locking symptoms. The mean postoperative score was 96 points (range, 91–100 points), rated as an excellent outcome. No patient had limp, instability, squatting or stair-climbing problems, or the need for use of supports. Three patients had swelling during strenuous activity. One patient had pain during strenuous activity. Two patients had a subjective sensation of locking. The IKDC score at final followup examination was in all patients graded as normal based on group ratings for function, symptoms, range of motion, and laxity.

DISCUSSION

Osteochondromas account for more than 1/3 of all benign tumors. In most cases, patients undergo surgical treatment

because of pain, decreased range of movement, cosmesis, or symptoms secondary to compression of peripheral nerves, tendons, or vessels.^{2,4,13,14} Open surgery of osteochondromas has been associated with a high complication rate,^{4,13} although they are benign lesions and surgical treatment for them is frequently an elective procedure. We report a group of patients with solitary osteochondroma of the distal femur resected with arthroscopic assistance to decrease morbidity and improve preoperative function.

We note several limitations to our study. The study was retrospective, and there was no comparison to other types of resection procedure. These endoscopic procedures were selected based on the localization of the tumor in the distal femur, although we were able to resect extraarticular ones. However, these are demanding and somewhat individualized surgical procedures for a limited patient population and it would be difficult to compare substantially different techniques at the same institution.

Open surgical resection is an alternative procedure for patients with symptomatic osteochondromas of the knee. However, complication rates between 11.7%⁴ and 12.5%¹³ have been reported. In addition, in one recent report,¹³ 11 patients (16.2%) who complained of pain preoperatively had persistent pain at followup, and four of these would not undergo surgery again.

In contrast to open procedures, minimally invasive techniques allow complete surgical excision with smaller incisions and the potential decrease of postoperative morbidity. However, although it has been suggested arthroscopic surgery is an effective treatment for symptomatic osteochondromas,^{6,11,12} there are no series reports and no functional evaluation of the patients with this procedure. In our patients, the Lysholm score improved from a preoperative mean of 74 points to a postoperative mean of 96 points, and the IKDC score at final followup examination was graded as normal in all patients.

Although arthroscopy has gained widespread popularity because of its efficacy and minimally invasive nature, the orthopaedic surgeon must be aware evaluation of musculoskeletal tumors requires a thorough preoperative approach, so the characteristics and extent of tumor can be

assessed before invasive procedures are undertaken.^{6,10} Six of the exostoses in our patients had clear images indicating an osteochondroma, while in the one where the imaging was unclear we performed a needle biopsy.

In seven of 24 selected patients with a symptomatic osteochondroma of the distal femur close to the knee, an endoscopic resection could be performed with low morbidity and prompt functional recovery.

References

1. Ahmed AR, Tan TS, Unni KK, Collins MS, Wenger DE, Sim FH. Secondary chondrosarcoma in osteochondroma: report of 107 patients. *Clin Orthop Relat Res.* 2003;411:193–206.
2. Antonio ZP, Alejandro RM, Luis MR, Jose GR. Femur osteochondroma and secondary pseudoaneurysm of the popliteal artery. *Arch Orthop Trauma Surg.* 2006;126:127–130.
3. Bahamonde L, Catalan J. Bone tumors around the knee: risks and benefits of arthroscopic procedures. *Arthroscopy.* 2006;22:558–564.
4. Bottner F, Rodl R, Kordish I, Winklemann W, Gosheger G, Lindner N. Surgical treatment of symptomatic osteochondroma: a three- to eight-year follow-up study. *J Bone Joint Surg Br.* 2003;85:1161–1165.
5. Dahlin DC, Unni KK. Osteochondroma (osteocartilaginous exostosis). *Bone Tumors.* Springfield, IL: Charles C Thomas; 1986:18–32.
6. Díaz AA, Miguel A. Endoscopic resection of a distal femoral osteochondroma: description of the technique and case report. *Arthroscopy.* 2002;18:23E.
7. Humbert ET, Mehlman C, Crawford AH. Two cases of osteochondroma recurrence after surgical resection. *Am J Orthop.* 2001;30:62–64.
8. Irrgang JJ, Anderson AF, Boland AL, Harner CD, Kurosaka M, Neyret P, Richmond JC, Shelborne KD. Development and validation of the International Knee Documentation Committee Subjective Knee Form. *Am J Sports Med.* 2001;29:600–613.
9. Lysholm J, Gillquist J. Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. *Am J Sports Med.* 1982;10:150–154.
10. Muscolo DL, Ayerza MA, Makino A, Costa-Paz M, Aponte-Tinao LA. Tumors about the knee misdiagnosed as athletic injuries. *J Bone Joint Surg Am.* 2003;85:1209–1214.
11. Schmoyer S, Ciullo JV. Arthroscopic resection of an osteochondroma of the knee. *Arthroscopy.* 2001;17:765–767.
12. Takahashi M, Nishihara A, Ohishi T, Shiga K, Yamamoto K, Naganano A. Arthroscopic resection of an intra-articular osteochondroma of the knee in the patient with multiple osteochondromatosis. *Arthroscopy.* 2004;20:28–31.
13. Wirganowicz PZ, Watts HG. Surgical risk for elective excision of benign exostoses. *J Pediatr Orthop.* 1997;17:455–459.
14. Wong KT, Chu WC, Griffith JF, Chan YL, Kumta SM, Leung PC. Pseudoaneurysm complicating osteochondromas: symptom relief with embolization. *Clin Orthop Relat Res.* 2002;404:339–342.