PROCEDURE 16

c0016 # Distal Femoral Osteotomy

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s0010 ## INDICATIONS

u0010 • Age less than 60 years old.
u0015 • Symptomatic unicompartmental arthritis.
u0020 • Malalignment with or without cartilage deficiency.
u0025 • Malalignment with or without meniscal deficiency.
u0030 • Normal, or correctable, ligamentous status.
u0035 • Willing to comply with rehabilitation.

s0015 ## ABSOLUTE AND RELATIVE CONTRAINDICATIONS

u0040 • Tricompartmental arthritis.
u0045 • Opposite compartment articular surface pathology.
u0050 • Flexion contracture >10°.
u0055 • Baseline knee flexion <90°.
u0060 • Medial/lateral tibial subluxation >1 cm.
u0065 • Inflammatory arthritis.
u0070 • Body mass index >35 kg/m^2.
u0075 • Smoker unwilling to quit.

s0020 ## EXAMINATION/IMAGING

u0080 • Examination
u0085 • Inspection
u0090 • Alignment (Q-Angle)
u0095 • Muscle bulk
u0100 • Prior surgical incisions
u0105 • Palpation
u0110 • Tenderness
u0115 • Crepitus (medial, lateral, patellofemoral)
u0120 • Active and Passive Range of Motion
u0125 • Hip
u0130 • Knee
u0135 • Strength
u0140 • Core
u0145 • Lower extremity
u0150 • Flexibility
u0155 • Ober test
u0160 • Hamstring
u0165 • Neurovascular Exam
u0170 • Bilateral lower extremity
u0175 • Patellar Exam
u0180 • Tilt
u0185 • Apprehension
u0190 • J sign
u0195 • Static and dynamic Q angle assessment
u0200 • Crepitus
u0205 • Knee tests of stability and special tests
u0210 • Pivot shift, Lachman, anterior drawer
u0215 • Posterior drawer
u0220 • Varus and valgus stress (at full extension and at 30° of flexion)

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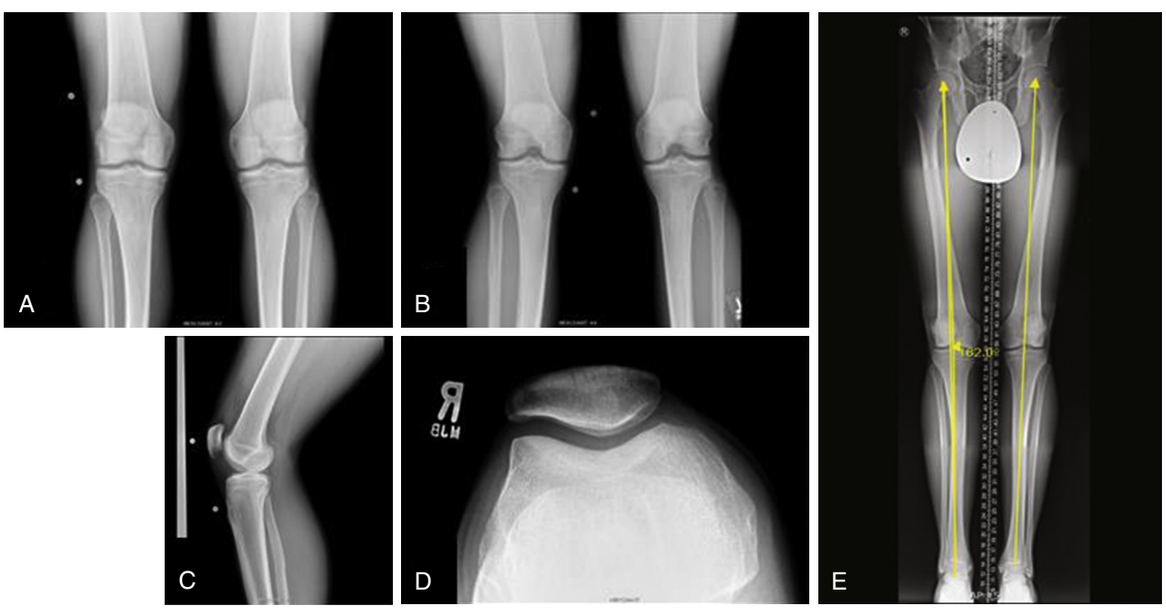
- McMurray, Thessaly u0225
- Anteromedial rotary instability u0230
- Posterolateral rotary instability u0235

- Imaging (Fig. 16.1) u0240
  - Standard weight bearing radiographic series u0245
    - Anteroposterior (AP), Rosenberg, lateral, and Merchant views u0250
      - Used to evaluate joint degeneration and overall alignment. u0255
      - Standardized sizing AP radiographs are performed weight bearing with the knees flexed 45° and the beam angled 10° in the caudal direction. u0260
      - A calibration marker is placed at the level of the joint on the affected side. u0265
    - Long-leg alignment views u0270
      - Measurements of the mechanical axis are documented on the long-leg radiographs. u0275
    - Lateral nonweight bearing u0280
      - Sizing radiograph performed with the markers placed at the level of the patella and the joint line. u0285
    - Magnetic resonance imaging u0290
      - Used to evaluate the soft tissues of the knee and the presence or absence of soft tissue fluid or joint effusion. u0295
      - The articular cartilage, menisci, and ligaments should be closely evaluated. Unicompartmental bone edema can be an indicator of chronic compartment overload. u0300
      - Meniscal volume can be assessed using the coronal and sagittal sequences; however, caution should be used in evaluating meniscal injury following a prior meniscal surgery. u0305
      - Gradient echo sequences are used to decipher articular cartilage from the surrounding joint fluid and subchondral bone; however, gradient echo sequences are not able to identify intrasubstance cartilage defects. u0310
      - T2-weighted or short tau inversion recovery fluid sequences are used to evaluate internal signal within the cartilage or subchondral bone edema. u0315
    - Computed tomography scans u0320
      - Helpful adjuvant in cases of prior anterior cruciate ligament reconstructions in which there is concern for bone tunnel enlargement. u0325

b0010

TREATMENT OPTIONS

- Oral anti-inflammatory medications
- Cortisone injections
- Viscosupplementation
- Activity modifications
- Varus producing off-loader brace
- Assistive devices (canes, walkers)



f0010

FIG. 16.1

s0025 ## SURGICAL ANATOMY

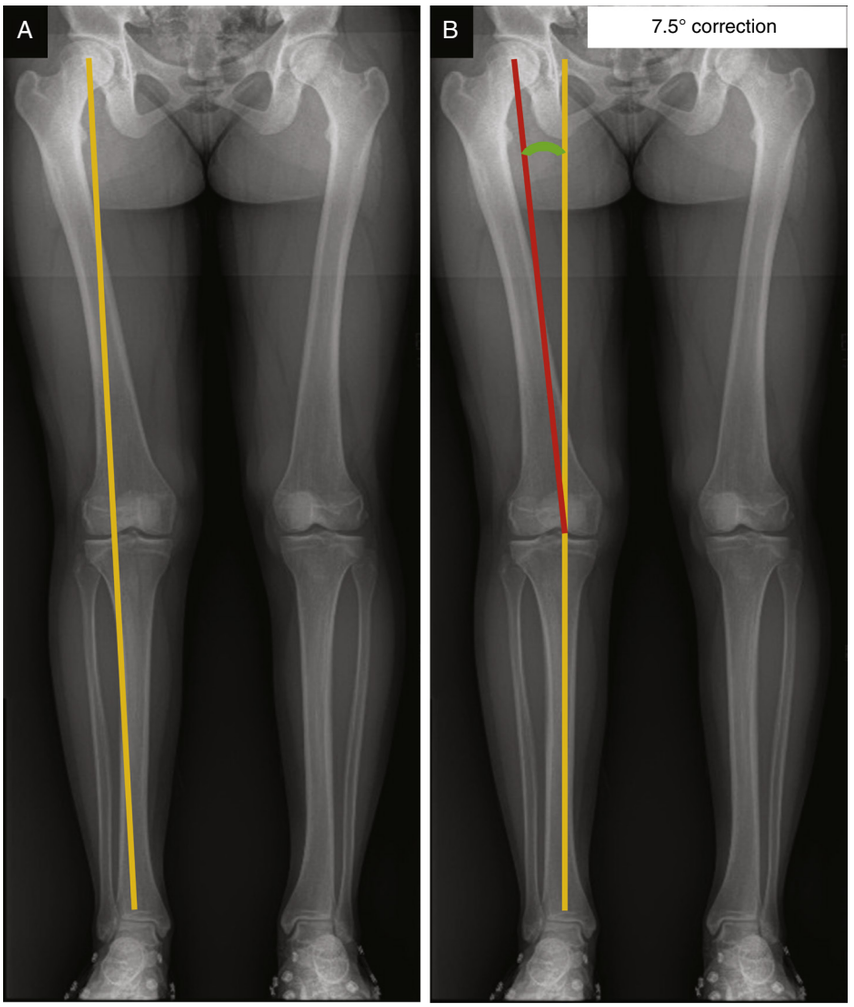
u0360 • A line is drawn from the center of the femoral head to the desired point on the plateau (Fig. 16.2).
u0365 • Another line is drawn from the point on the plateau to the center of the tibial plafond.
u0370 • The angle formed by the two lines is the degree of correction needed (Fig. 16.3).
u0375 • The correction point for correction of valgus arthrosis may be to the medial tibial spine or slightly into the medial compartment.
u0380 • The correction point for correction of valgus alignment in the setting of cartilage preservation or meniscal transplantation may be more modest such as into a neutral alignment between the tibial spines or to the medial tibial spine; however, the correction should not overcorrect into the medial compartment.

s0030 ## POSITIONING

u0385 • The patient is placed supine on the operating table. A radiolucent extension is applied to enable fluoroscopic examination. Alternatively, the patient can be placed on the ipsilateral edge of the table to enable fluoroscopic access by abducting the leg.
u0390 • A lateral post is applied in the middle of the thigh for the arthroscopic procedure.
u0395 • A tourniquet is applied and can be used if needed. It is usually deflated prior to closure to obtain adequate hemostasis.
u0400 • If a large correction is anticipated, the ipsilateral iliac crest is draped and a rolled blanket is placed under the same buttock.

b0015 **POSITIONING PEARLS**

- Bump the hip until the leg is in neutral alignment with the patella facing straight up.
- Ensure adequate fluoroscopic examination can be performed prior to prepping and draping.



f0015 **FIG. 16.2**

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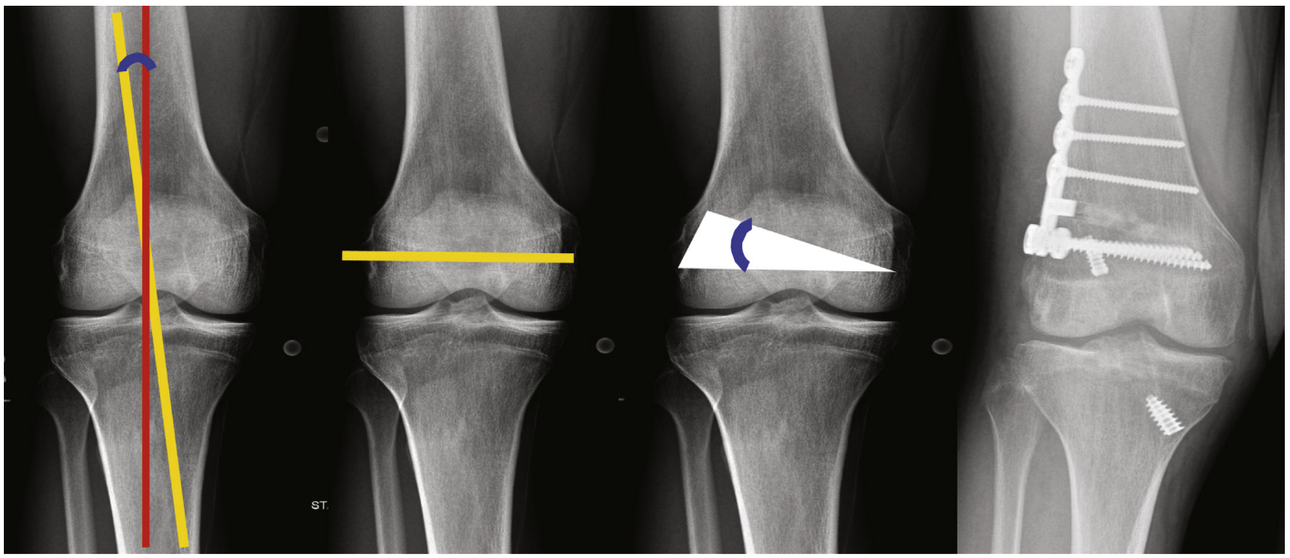

FIG. 16.3

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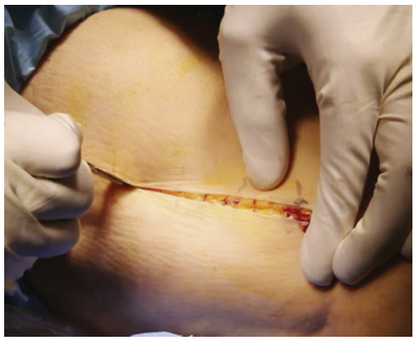

FIG. 16.4

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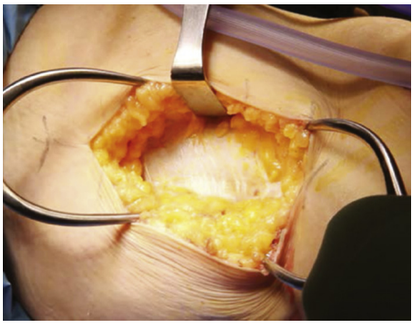

FIG. 16.5

PORTALS/EXPOSURES s0035

- A diagnostic arthroscopy is performed to verify that the patient is a good candidate for the osteotomy procedure, which includes no arthritis in the medial compartment. u0415
- Two standard arthroscopy portals (anteromedial and anterolateral) are utilized. u0420
- The irrigation fluid is aspirated at the end of the arthroscopic evaluation. u0425

PROCEDURE s0040

Step 1 Incision and Approach s0045

- The planned incision is marked out on the lateral thigh beginning 2 cm to 3 cm distal to the lateral femoral epicondyle and extending proximally 12 cm to 15 cm (Fig. 16.4). u0430
- The skin is incised and the subcutaneous tissues are dissected to the iliotibial band. u0435
- The iliotibial band is incised in-line with the skin incision (Fig. 16.5). u0440
- Care is taken to incise only the tendinous portion of the iliotibial band and not the vastus musculature deep to it. u0445
- The vastus lateralis is bluntly elevated anteriorly off the posterior intermuscular septum (Fig. 16.6). u0450
- Cautery is used to coagulate any large femoral perforating vessels as they are encountered. u0455
- Once the distal femur is exposed, retractors are carefully placed anteriorly and posteriorly to protect the soft tissue and neurovascular bundle, respectively. u0460

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STEP 1 PEARLS

- The surgical approach is done in a stepwise and methodical fashion to avoid the femoral perforating vessels, which can be cut and retract into the posteromedial thigh making hemostasis difficult.

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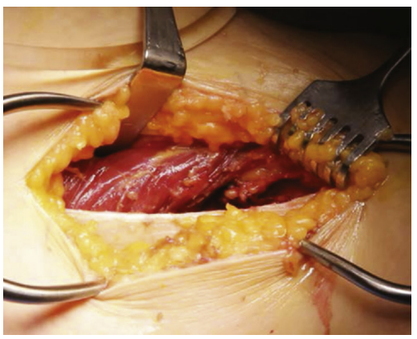

FIG. 16.6

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FIG. 16.7

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FIG. 16.8

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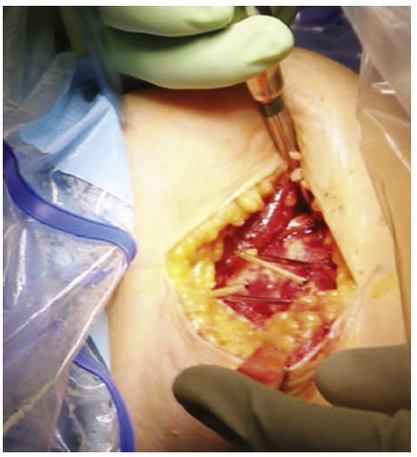

FIG. 16.9

s0050 ## Step 2 Guide Pin Insertion

u0470 • Once the exposure is complete, the knee is extended and under fluoroscopic guidance a guidewire is inserted mirroring the trajectory of the osteotomy (Fig. 16.7).

u0475 • The appropriate guidewire starting position is 2 cm proximal to the lateral epicondyle, aiming distally toward to proximal aspect of the medial epicondyle.

u0480 • A second guidewire is placed parallel to the first (Fig. 16.8).

s0055 ## Step 3 Lateral Opening-Wedge Osteotomy

u0490 • A small oscillating saw is used to initiate the osteotomy on the lateral cortex (Fig. 16.9).

u0495 • Cutting proximal to the parallel pins, further from the joint surface, decreases the likelihood of stress-riser propagation into the trochlea or through the medial cortex (Fig. 16.10).

u0500 • The saw is followed by osteotomes in stacked fashion to a depth 1 cm from the medial cortex (Fig. 16.11).

s0060 ## Step 4 Correction

u0535 • Calibrated anterior and posterior wedges are placed to the planned preoperative level of correction (Fig. 16.12).

u0540 • The wedge position is assessed (Fig. 16.13).

u0545 • The anterior wedge is removed and the plate is placed in the osteotomy site (Fig. 16.14) and secured with sequential screws (Fig. 16.15).

b0025

STEP 2 PEARLS

- Ensure proper placement of the guide pins. The superior aspect of the trochlea can be marked under fluoroscopy to avoid pin placement into the patellofemoral joint.

b0030

STEP 3 PEARLS

- Avoid violating the medial femoral cortex.
- Use osteotome (instead of saw) to finish the cut.
- Use fluoroscopy to guide the bone cuts.

b0035

STEP 3 PITFALLS

- Avoid using thick osteotomes.
- If medial femoral cortex is fractured, fix with medial sided plate and/or staples.

b0040 [AU5]

STEP 3 CONTROVERSIES

- Medial closing wedge DFO has reduced risk of nonunion, but requires two separate cuts for osteotomy.

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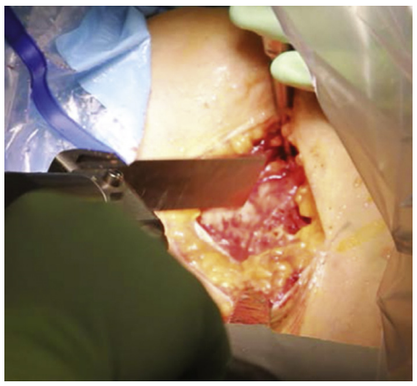

FIG. 16.10

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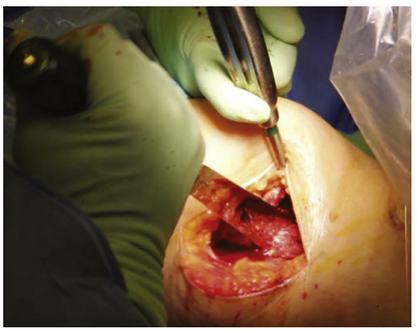

FIG. 16.11

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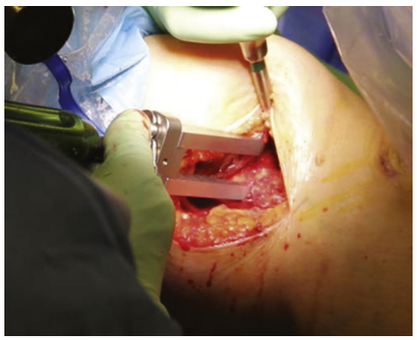

FIG. 16.12

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FIG. 16.13

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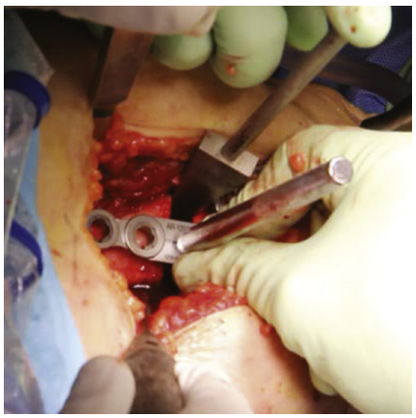

FIG. 16.14

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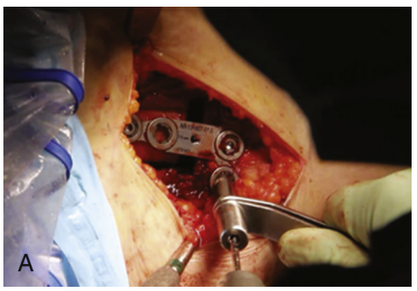

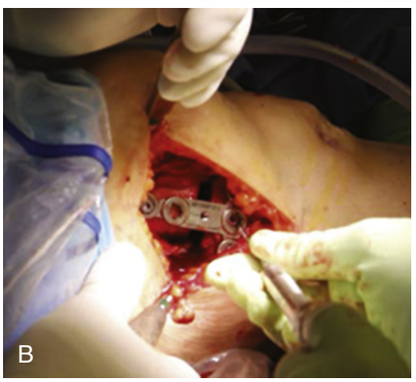

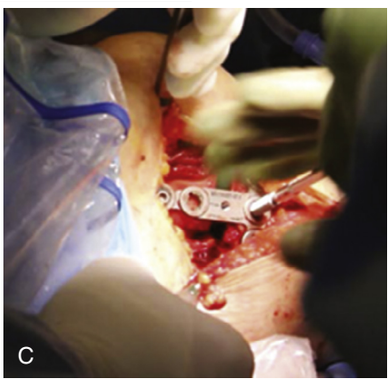

FIG. 16.15

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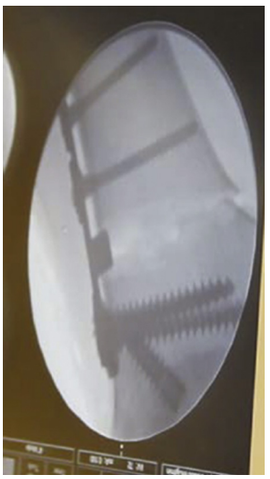

FIG. 16.16

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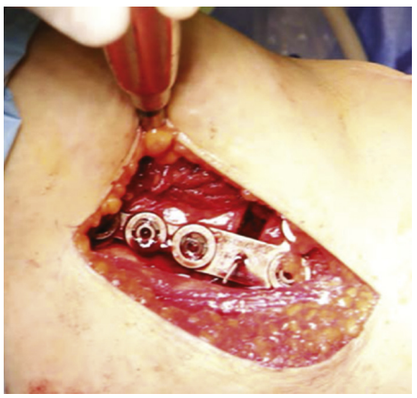

FIG. 16.17

s0065 ## Step 5 Assess Position and Closure

u0560 • Under fluoroscopic guidance, care should be taken to ensure the plate wedge is securely in the osteotomy site (Fig. 16.16).

u0565 • Cortical and cancellous allograft can be used in the osteotomy site.

u0570 • The tourniquet is released and hemostasis is achieved.

u0575 • The wound is then irrigated and closed in a standard layered fashion (Fig. 16.17).

s0070 ## POSTOPERATIVE CARE AND EXPECTED OUTCOMES

u0590 • Osteotomies are performed as an outpatient procedure at our institution; however, these procedures can be long in duration and an overnight stay is reasonable.

u0595 • At the conclusion of the sterile dressing, patients have a cooling unit incorporated into the dressing and a hinged knee brace locked in extension placed on the operative leg.

u0600 • The weight bearing status is dictated by the concomitant procedures; however, 4 weeks to 6 weeks of nonweight bearing is customary.

u0605 • For isolated osteotomies, with newer locking plate technology, early weight bearing may be appropriate but at the surgeon's discretion.

u0610 • Range of motion is encouraged in the early postoperative period.

u0615 • Progressive weight bearing begins at 4 weeks to 6 weeks with a goal of full weight bearing without a brace at 8 weeks to 10 weeks.

s0075 ## EVIDENCE

Ekeland A, Nerhus TK, Dimmen S, Heir S: Good functional results of distal femoral opening-wedge osteotomy of knees with lateral osteoarthritis, Knee Surg Sports Traumatol Arthrosc: official journal of the ESSKA 24(5):1702–1709, 2016.

In this study, the authors reported functional outcomes using the Knee Injury and Osteoarthritis Outcome Score (KOOS) for twenty-four consecutive patients with lateral knee osteoarthritis treated with DFO. KOOS increased significantly as compared with baseline during the first year by 28% to 122% for all five subscores. This notable gain in functional outcomes remained at 10-year follow-up for those with surviving osteotomy. Six knees (25%) were converted to total knee arthroplasty at a mean of 6.4 years (CI 3.3–9.6, range 4.0–11.8). The DFO survival rate was 74% at 10 years.

Finkelstein JA, Gross AE, Davis A: Varus osteotomy of the distal part of the femur. A survivorship analysis, J Bone Joint Surg Am 78(9):1348–1352, 1996.

The authors followed 21 knees (20 patients) long term or until failure after undergoing DFO. The probability of survival at 10 years was 64%(95 CI 48–80%). The authors concluded DFO is effective for the treatment of lateral compartment arthritis in the indicated patient with valgus deformity.

Saithna A, Kundra R, Getgood A, Spalding T: Opening wedge distal femoral varus osteotomy for lateral compartment osteoarthritis in the valgus knee, Knee 21(1):172–175, 2014.

In this study, the authors reported on 18 patients undergoing DFO (21 knees). Four patients underwent total knee arthroplasty (19%) at a mean of 4.5 years. The cumulative survival rate for the procedure was 79% at 5 years. Functional outcomes scores (KOOS Pain and International Knee Documentation Committee) in the surviving cohort improved significantly from baseline.

b0045

STEP 4 PEARLS

- Intraoperative alignment rods or the bovie cord may be used to assess correction; however, these methods have been shown to be largely unreliable.
- Preoperative planning of correction is the best measure of successful correction.

b0050

STEP 5 PEARLS

- Ensure hemostasis before closure.

b0055

STEP 5 PITFALLS

- Large perforating femoral vessels can cause hematoma and compartment syndrome if injured and not checked by releasing the tourniquet.

b0060

POSTOPERATIVE PEARLS

- Early motion is encouraged.

b0065

POSTOPERATIVE PITFALLS

- Early weight bearing (within the first 1 week to 2 weeks) is discouraged.

Thein R, Bronak S, Thein R, Haviv B: Distal femoral osteotomy for valgus arthritic knees, J Orthop Sci 17(6):745–749, 2012.
This study reported on six patients (7 knees) after undergoing DFO with a mean followup of 6.5 years. Clinical outcomes were assessed by the Oxford Knee Score. The mean Oxford Knee Score improved from 13.1 ± 8.6 to 26 ± 12.5 from preoperation to most recent followup. No patients required additional surgery.

Wang JW, Hsu CC: Distal femoral varus osteotomy for osteoarthritis of the knee, J Bone Joint Surg Am 87(1):127–133, 2005.
In this study, 30 patients (30 knees) were managed with DFO for the treatment of noninflammatory lateral-compartment arthritis with an associated valgus deformity. The authors reported 25 patients (83%) had a satisfactory result, 2 (7%) had a fair result according to the Hospital for Special Surgery rating system, and 3 (10%) were converted to a total knee arthroplasty. With conversion to total knee arthroplasty as the end point, the cumulative 10-year survival rate for all patients was 87% (95% CI, 69% to 100%).

Zarrouk A, Bouzidi R, Karray B, Kammoun S, Mourali S, Kooli M: Distal femoral varus osteotomy outcome: Is associated femoropatellar osteoarthritis consequential? Orthop Traumatol Surg Res 96(6):632–636, 2010.
The authors reported on 20 patients (22 knees) after undergoing opening DFO for lateral tibiofemoral osteoarthrosis of a valgus knee. Eighteen knees had good or excellent results (80%), two had fair results (9.5%), and two had poor results (9.5%). The 8-year survival rate was 91% (CI, 69–100%). The mean preoperative International Knee Society score increased from 49.28 to 74.23 at the most recent follow-up.