

Low-Velocity Knee Dislocations in Obese and Morbidly Obese Patients

Rahul Vaidya,^{*†} MD, Matthew Roth,[‡] BSc, Dhiren Nanavati,[§] MD, Matthew Prince,[†] DO, and Anil Sethi,[†] MD

Investigation performed at Wayne State School of Medicine, Detroit, Michigan, USA

Background: Knee dislocations from minor trauma have been reported sparsely in the literature. The consensus is that these injuries tend not to be associated with neurovascular compromise.

Purpose: To present a series of atraumatic knee dislocations in obese and morbidly obese patients and to compare operative versus conservative treatment.

Study Design: Case series; Level of evidence, 4.

Methods: This study included 19 patients (21 knees) who presented with knee dislocation from a low-velocity or ultra low-velocity incident. Charts, radiographs, and magnetic resonance images (MRIs) were reviewed, and patients were reviewed based on their latest follow-up. We included patients in our database from 2001 to 2011 and compared knees of patients who had ligament repair or reconstruction (9 total knees) versus nonoperative treatment (12 total knees). Range of motion, activity levels, and knee laxity information were collected as outcome measures to compare operative and nonoperative results.

Results: The mean age at presentation was 30.3 years (range, 15-74 years), with 5 men and 14 women. The average body mass index (BMI) was 41.4 kg/m² (range, 30-64.4 kg/m²), with an average follow-up of 31 months (range, 12-72 months). Five patients (27%) had a popliteal artery injury, and 7 (44.4%) had a peroneal nerve injury at presentation. Four had a vascular repair, 1 had an amputation, and 3 of 7 patients had return of peroneal nerve. Ligament reconstruction was performed on 9 individuals. The average operating time for ligament reconstruction was 183% of that with injury-matched normal-weight patients. Eight operative patients who complied with therapy had an average range of motion of 91.4° (range, 60°-110°). The nonoperative patients had an average range of motion of 60.45° (range, 0°-120°). Two of these patients later required a total knee arthroplasty (3 total knee arthroplasties overall).

Conclusion: Knee dislocations from minor falls occur in obese patients and are often accompanied by neurovascular complications. While surgical reconstruction is more time consuming and more difficult than that in normal-weight individuals, it may be preferable to nonoperative treatment.

Keywords: knee dislocation; obesity; ligament reconstruction; low velocity; atraumatic

Knee dislocations are major yet uncommon injuries.^{2,5,7,13,14,18,19} They usually result from high-energy trauma, such as falls from height, severe crush injuries, and motor vehicle accidents.^{2,5,18} Knee dislocations occur

in 1 of 5 ways: anterior, posterior, medial, lateral, and rotatory.^{9,18,19} Anterior dislocations are the most common, resulting from anterior displacement of the tibia with respect to the femur, generally due to hyperextension.^{10,15,19} Rotatory knee dislocations occur when the tibia rotates with respect to the femur.⁹ The last two, medial and lateral, are results of varus and valgus forces upon the knee, causing tibial displacement toward the middle of the body (medial) and away from the middle of the body (lateral).^{9,10} Anterior and posterior dislocations are the most prone to neurological and vascular complications.^{9,10,21}

Low-velocity (atraumatic injuries, low energy, often sports injuries) and ultra low-velocity (falls from standing height) knee dislocations have been reported in several case reports^{1,4,17} and 2 case series.^{2,5} One study was in athletes during sporting events,²⁰ and a second in 17 obese patients from minor trauma.² Low-velocity knee dislocations are

*Address correspondence to Rahul Vaidya, MD, Detroit Medical Center, Orthopedics Department, Wayne State School of Medicine, 4G UHC, St Antoine Street, 540 E Canfield Street, Detroit, MI 48201, USA (email: rvaidya@dmc.org).

[†]Detroit Medical Center, Wayne State School of Medicine, Detroit, Michigan, USA.

[‡]Wayne State School of Medicine, Detroit, Michigan, USA.

[§]Kaiser Permanente, Stockton, California, USA

The authors declared that they have no conflicts of interest in the development and publication of this contribution.

The Orthopaedic Journal of Sports Medicine, 3(4), 2325967115575719

DOI: 10.1177/2325967115575719

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TABLE 1
Schenck¹⁸ Classification Scale^a

Classification	Indication
KD-I	Cruciate intact knee dislocation
KD-II	Both cruciates torn, collaterals intact
KD-III	Both cruciates torn, MCL torn, LCL intact
KD-IIIIL	Both cruciates torn, LCL torn, MCL intact
KD-IV	All 4 ligaments torn
KD-V	Periarticular fracture/dislocation

^aLCL, lateral collateral ligament; MCL, medial collateral ligament.

usually isolated injuries, have less catastrophic knee damage, and may have fewer neurological and vascular complications than high-energy dislocations.^{9,13}

Obesity is a medical condition characterized by an excess amount of body fat, classically defined as a body mass index (BMI) ≥ 30 kg/m². Morbid obesity is defined as BMI ≥ 40 kg/m². It is associated with numerous comorbidities, including diabetes, hypertension, coronary artery disease, cancers, osteoarthritis, asthma, and myocardial infarction.²² These disease states can contribute to make the operative and postoperative treatment of morbidly obese patients much more difficult. With increasing BMI, the knee joint becomes subject to increased stresses through increased load, joint space narrowing, and an increased risk of knee injury, creating an unstable environment for the tibiofemoral joint.¹²

The purpose of this study was to present a series of knee dislocations from minor trauma that presented to an urban trauma center, their associated injuries, and to compare conservative versus reconstructive surgery for this problem.

METHODS

An institutional review board–approved retrospective study was performed on patients who were entered into our hospital trauma database between 2000 and 2011. During this time period, 109 patients presented with a knee dislocation, and 19 of them were due to low-velocity mechanisms. There were 5 men and 14 women, with an average age of 30.3 years (range, 15-74 years). Two patients had both knees dislocated, 1 simultaneously, and 1 patient had a dislocation of the opposite knee 2 years after the first, for a total of 21 knees. The average BMI was 41.4 kg/m² (range, 30.0-64.4 kg/m²). Nine patients were obese (BMI, 30.0-39.9 kg/m²), and the other 10 patients were morbidly obese (BMI, 40.0-64.4 kg/m²). Two patients who underwent total knee arthroplasties (TKAs) developed osteoarthritis. Data points included mechanism of injury, Tegner scale scores, Knee Society clinical rating system scores, patient demographics, neurovascular status, magnetic resonance imaging (MRI) findings, treatment either conservatively or reconstruction, range of motion, instability by history or examination, recurrent injury, or additional surgery. Furthermore, all knee dislocations were scored according the Schenck¹⁸ classification for knee dislocations, which grades knee dislocations based on

ligament injury patterns (Table 1). Data were collected retrospectively from operative and consultation reports. The results were then tabulated and analyzed.

All patients presented to our emergency room (ER) and were evaluated by an ER physician as well as the trauma team and orthopaedic surgery resident on call. Patients were reduced in the ER if needed under intravenous sedation and placed in a knee immobilizer. All patients were admitted to monitor pulses for a minimum of 48 hours. Thirteen patients had an angiogram in the first 24 hours to evaluate for vascular injury as a routine procedure. Prior to 2006, patients were treated by either external fixation (n = 4) or a knee immobilizer or cast (n = 5) for 6 weeks (range, 5-8 weeks) as the definitive treatment (Figures 1 and 2). After 2006, all patients were taken to the operating room to do an open repair of the posterolateral corner and reconstruct the lateral collateral ligament (LCL), popliteus, and posterior cruciate ligament (PCL) (Figures 3 and 4), except 1 patient who had an unreparable vascular injury and was treated in an external fixator and went on to an amputation. The PCL was reconstructed with an Achilles tendon allograft. The LCL was reconstructed with either half the biceps tendon when it was still attached to the fibular head with repair of the popliteus attachment or with a second Achilles tendon allograft that was split to reconstruct the popliteus and the LCL. The anterior cruciate ligament (ACL) was reconstructed late if there were ongoing symptoms, as was required for 1 individual. Postoperatively, patients were stabilized in an external fixator, which spans the knee joint for 6 weeks, with about 10° of flexion. At 6 weeks postoperative, the external fixator was removed under anesthesia in the operating room, and the knee was given a gentle manipulation to at least 80°. The patients started physical therapy at 6 weeks postoperative and weightbearing at 12 weeks postoperative. Hinged knee braces were used for the first 3 months, and custom knee braces were prescribed after 5 months but only 5 of 18 patients were able to get braces that could be fit.

Surgical Technique

Reconstruction or repair of the posterolateral corner was decided in a stepwise fashion, similar to that described by Geeslin and LaPrade.⁶ However, repair or reconstruction was done with an open technique. A curved incision was performed over the lateral aspect of the knee ending just below the top of the fibular head. The peroneal nerve was isolated and protected for the duration of the surgery. The iliotibial band was elevated with a handheld retractor, and the components of the posterolateral corner were inspected—the fibular collateral ligament, popliteus tendon, biceps tendon, popliteal-fibular ligament, and joint capsule. Midsubstance tears underwent reconstruction, and avulsions from the fibular head, which often came off as a sleeve including the capsule, were repaired with suture anchors or tunnels (held with interference screws or buttons). The PCL was reconstructed by drilling a tunnel from front to back using a guide and exposure of the posterior aspect of the knee deep to the gastrocnemius. The femoral tunnel was drilled with a small medial parapatellar



Figure 1. Patient 3 was a 45-year-old obese woman who dislocated her knee after a fall. The patient’s ligament tears were treated conservatively, and she had only 30° range of motion at latest follow-up.

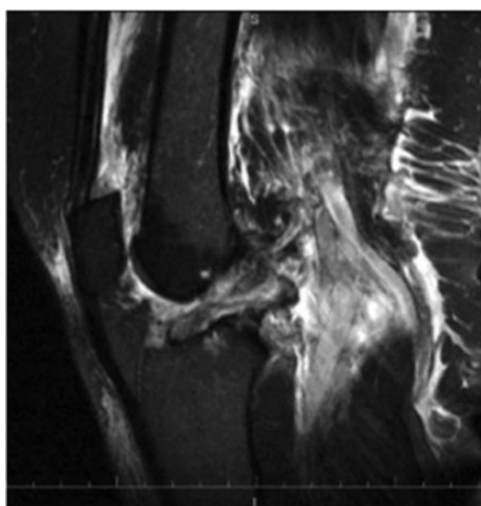


Figure 2. Patient 3 postrelocation magnetic resonance image.



Figure 4. Patient 18 after ligament reconstruction, with and without an external fixator.

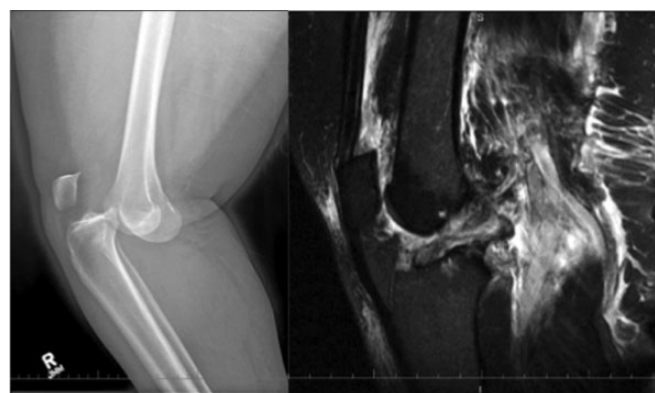


Figure 3. Patient 18 was a 48-year-old obese woman who dislocated her knee after a fall. The patient’s ligament tears were treated through lateral collateral ligament and posterior cruciate ligament reconstruction and posterolateral corner repair. The patient had regained 70° of flexion at follow-up.

approach visualizing the notch from the medial condyle of the femur to the location of the PCL attachment. Achilles tendon allograft was used to reconstruct this ligament. If a reconstruction of the posterolateral corner was required, a second Achilles tendon allograft was used split into 2 strands with the plug in the posterolateral aspect of the tibia and 1 strand going to the head of the fibula to reconstruct the popliteal-fibular ligament passing through the fibular head through a drill tunnel and then onward to the femoral attachment of the fibular collateral ligament through a tunnel. Both ends were held with interference screws or an interference screw in the tibial tunnel and a button for the femoral attachment. A screw was also passed into the tunnel of the fibular head. The second limb reconstructed the popliteus tendon and was attached to the femur with a drill tunnel, interference screw, or button. The capsule was sutured

TABLE 2
Patient Demographics^a

Patient	Age, y	Sex	Height, feet-inches	Weight, lb	BMI, kg/m ²	Mechanism of Injury	Type of Dislocation	Side	Angiogram	ABI	Schenck Scale ^b	Arterial Injury	Nerve Injury
1	32	M	5'-9"	200	30.0	Slip and fall	Anterior	R			KD-IV	None	None
2	74	F	5'-1"	212	40.1	Slip and fall	Anterior	L			KD-IV	None	None
3	45	F	5'-0"	180	35.1	Slip and fall	Lateral	R	Negative		KD-III	None	None
4	17	F	5'-7"	220	34.5	Assault and fall	Posterior	R	Negative		KD-IV	None	None
5	27	F	5'-7"	220	34.5	Wrestling	Posterior	L	Negative		KD-III	None	Peroneal
6	29	F	5'-0"	205	40.0	Slip and fall	Suspected	L	Negative		KD-III	None	Peroneal
7	42	M	5'-6"	265	42.8	Slip and fall	Anterior	R	Positive	Normal	KD-III	Popliteal	Peroneal
8	26	F	5'-3"	202	35.8	Slip and fall	Posterior	L	Negative		KD-IV	None	None
9	26	M	5'-3"	202	35.8	Slip and fall	Anterior	L	Negative		KD-II	None	None
10	26	M	5'-6"	230	37.1	Slip and fall	Anterior	R	Positive		KD-IV	Popliteal	None
11	15	M	5'-7"	411	64.4	Slip and fall	Posterior	R	Positive		KD-III	Popliteal	Peroneal
12	42	F	5'-2"	225	41.1	Slip and fall	Anterior	L			KD-III	None	None
13	19	F	5'-2"	200	36.6	Slip and fall	Anterior	R			KD-IV	None	None
14	23	F	5'-2"	237	43.3	Slip and fall	Anterior	L	Negative	0.875	KD-III	None	None
15	16	F	5'-4"	220	37.8	Assault	Anterior	L	Negative		KD-III	None	Peroneal
16	43	F	5'-4"	220	37.8	Slip and fall	Anterior	L			KD-III	None	Peroneal
17	43	F	5'-8"	298	45.3	Assault	Anterior	R	Positive		KD-IV	Popliteal	None
18	17	M	5'-9"	222	32.8	Slip and fall	Anterior	R			KD-III	None	None
19	29	F	5'-8"	231	35.1	Slip and fall	Suspected	L			KD-III	None	None
20	48	F	5'-1"	249	47.0	Slip and fall	Anterior	R			KD-III	None	None
21	67	F	5'-3"	265	47.0	Slip and fall	Anterior	R	Positive/ amputation		KD-IV	Popliteal	None

^aABI, ankle-brachial index; BMI, body mass index; F, female; L, left; M, male; R, right.

^bSchenck¹⁸ classifications are described in Table 1.

down to the posterior proximal tibia with suture anchors. The PCL graft was secured first to restore the central pivot of the knee, then the posterolateral corner grafts were secured.⁶ We never reconstructed the ACL at the initial surgery and only compared cases in which similar procedures were carried out in normal-weight patients. Postoperatively, all patients were placed in external fixation for 6 weeks, which were then removed to start range of motion.

RESULTS

All included patients had knee dislocations from an ultra low-velocity event such as a fall or altercation. Thirteen patients had at least 1 comorbid condition, and 8 had 2 or more. One dislocation was classified (according to Schenck¹⁸) as KD-II, and there were 11 KD-III (10 KD-III and 1 KD-IIIM) and 9 KD-IV dislocations. MRI findings are reported in Table 2. Of the 21 dislocations, there were 14 anterior, 4 posterior, and 1 lateral. Two patients were reduced at the time of presentation, leaving the orientation of the dislocation unknown. Five patients (26%) had a popliteal artery injury that required repair. Three of the arterial injuries were tears in the popliteal artery, and 1 was an occlusion. Four had their limbs salvaged, and 1 was irreparable because of poor outflow circulation in a diabetic patient that led to an amputation. Seven knees (33%) had a peroneal nerve injury, and 3 of 6 had return of peroneal nerve function at latest follow-up (1 leg amputated).

Our patients who exhibited arterial injuries had an average BMI of 47 kg/m² (46.7 kg/m² for patients with arterial injury, 39.7 kg/m² for patients without). However, these results were not significant, as they failed a 2-tailed unpaired *t* test ($P = .334$) when testing for 95% confidence. The average BMI for patients with peroneal injuries was 45.9 kg/m², while the average BMI for patients without was 38.3 kg/m². The BMI differences between injured and noninjured patients did not show significance to 95% confidence, as determined by a 2-tailed unpaired *t* test ($P = .147$).

Surgical repair was performed on 9 knees (Table 3). The operative time for obese patients ranged between 3.31 hours and 5.71 hours, with a mean time of 4.91 ± 0.935 hours and a median of 5 hours. We compared this to 14 patients with BMIs between 20 and 30 kg/m² with similar surgeries whose surgical times ranged between 2 and 4.1 hours, with a mean of 2.714 ± 0.649 hours and median of 2.5 hours. The 2 data sets were then compared using a Student *t* test, giving a result of $P = .00000395$, providing a significant difference in ligament repair times for our obese and nonobese patients.

The average follow-up was 31 months (range, 12-72 months). Two patients failed reconstruction, 1 at 5 years because of a second injury (Figure 5) and another at 4 months from a fall. Both patients had revision reconstructions. One patient had a late ACL reconstruction after 12 months for ongoing instability. These patients, when asked, were walking well and did not complain of instability events.

TABLE 3
Surgical Treatment^a

Patient	Leg	Duration of Reconstruction	Reconstructive Surgery	Other Surgeries	Postoperative Flexion, deg
1	R	NA	None	External fixation application/removal, TKA	50
	L	NA	None	External fixation application/removal, lysis of arthrofibrosis, TKA	60
2	R	NA	None	External fixation application/removal	70
3	R	NA	None	None	30
4	L	NA	None	None	35
5	L	NA	None	None	120
6	R	NA	None	None	0
7	L	NA	None	None	70
8	L	NA	None	External fixation application/removal	65
9	R	NA	None	External fixation application/removal, lysis of arthrofibrosis	75
10	R	6 h 30 min	PLC repair; PCL and LCL reconstruction	External fixation application/removal, popliteal artery repair, late PCL and PLC repair	65
11	L	5 h 30 min	Left knee LCL < PCL, PLC repair	External fixation application/removal	100
	R	NA	None	Right TKA	NA
12	L	5 h 0 min	PCL and LCL reconstruction; PLC repair and ex fix	External fixation removal	110
13	L	5 h 15 min	MCL and PLC repair; PCL and LCL reconstruction	External fixation application/removal	120
14	L	5 h 43 min	LCL reconstruction, PLC repair	None	60
15	R	4 h 22 min	PCL and LCL reconstruction; PLC and MCL repair	External fixation application/removal	45
16	R	4 h 20 min	PCL and LCL reconstruction; PLC repair	External fixation application/removal	90
17	L	4 h 30 min	LCL PCL repair	External fixation application/removal	90
18	R	3 h 31 min	LCL and PCL reconstruction; PLC repair	External fixation application/removal	70
19	R	NA	None	Amputation	NA

^aL, left; LCL, lateral collateral ligament; MCL, medial cruciate ligament; NA, not applicable; PCL, posterior cruciate ligament; PLC, posterolateral corner; R, right; TKA, total knee arthroplasty.

Eight operative patients who complied with therapy had an average range of motion of 91.4° (range, 60°-110°). One patient was noncompliant with therapy and ended up with only 45° of flexion, and the individual was not included in the comparative analysis for flexion. Non-ACL reconstructed patients had an average range of motion of 60.45° (range, 0°-120°), and it may have been that they had less aggressive rehabilitation. Two patients underwent TKAs to treat ongoing instability and pain. One patient had a TKA performed on each knee, for a total of 3 knees that underwent TKAs in the study. Patients with >60° of flexion (6 patients) complained of occasional giving out while those with more stiff knees (4 patients) did not. Patients' postoperative activity was scored using the Tegner activity scale,³ which was used to compare their pre- and postinjury activity levels. The mean score for preinjury activity levels was 3.0, while after injury and treatment, the mean activity score dropped to 1.79 ($\Delta = -1.21$) (Table 4). Patients were divided between operative and nonoperative groups (patients with 2 knee injuries [1 operative and 1 nonoperative] were removed). Nonoperative patients had an average preinjury activity score of 2.9, which dropped to 1.3 after treatment ($\Delta = -1.6$). Operative patients averaged 3.28 before their knee injury and 2.43 postoperatively ($\Delta = -0.86$).

To determine knee laxity, the anteroposterior (AP) and mediolateral (ML) scores from the Knee Society clinical rating system were used.¹¹ The average follow-up AP score was 3.82 (3.64 for nonoperative patients, 4.44 for operative patients), while the average ML score was 7.06 (5.00 nonoperative, 10.56 operative) (Table 4). The results showed significant differences between operative and nonoperative patients for ML scores ($P = .0008$). The results for AP scores were insignificant ($P = .38$).

DISCUSSION

Knee dislocations are an uncommon injury. In 2 million admissions to the Mayo Clinic between 1911 and 1960, only 14 presented knee dislocations (0.0007%).¹³ Other studies have approximated the incidence to be <0.2% of orthopaedic injuries.¹⁶ Our series is one of the largest to date examining the entity of low-velocity knee dislocation. We found that all our cases of low-velocity knee dislocations were in either obese or morbidly obese patients (mean BMI, 41.4 kg/m²). We also tried to establish the best method of treatment of these damaged ligaments. These were either treated conservatively or through ligament reconstruction. The patients who underwent

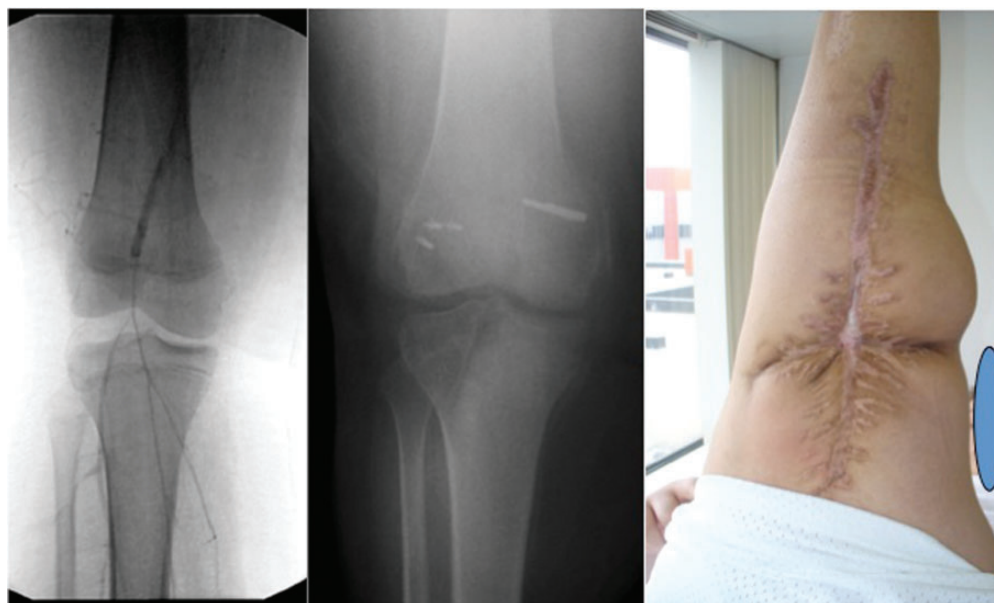


Figure 5. Patient 10 was a 15-year-old morbidly obese man who dislocated his knee after a fall with a popliteal artery injury. The patient was relocated prior to undergoing radiography. Surgery included posterior cruciate ligament and lateral collateral ligament reconstruction and posterolateral corner repair. He required a second reconstruction surgery 5 years later on the same knee because of another fall and dislocation but has since had good results.

TABLE 4
Tegner and Knee Society Clinical Rating System Scores^a

Patient	Age, y	Operative Reconstruction	BMI, kg/m ²	Flexion, deg	Clinical Rating System		Tegner Score		Difference
					AP	ML	Before	After	
1	32	No	30.00	50	5.00	10.00	5	3	-2
		No		60	5.00	5.00	5	3	-2
2	74	No	40.10	70	0.00	5.00	1	0	-1
3	45	No	35.10	30	0.00	5.00	3	1	-2
4	17	No	34.50	35	5.00	5.00	3	2	-1
5	27	No	60.90	120	5.00	10.00	1	1	0
6	29	No	40.00	0	5.00	5.00	3	0	-3
7	42	No	42.80	70	5.00	0.00	3	2	-1
8	26	No	35.80	65	0.00	0.00	2	0	-2
9	26	No	37.10	75	5.00	5.00	3	1	-2
10	15	Yes	64.40	65	5.00	10.00	3	3	0
11	42	Yes	41.10	100	5.00	10.00	2	1	-1
		No		90	5.00	5.00	2	1	-1
12	19	Yes	36.60	110	5.00	15.00	4	4	0
13	23	Yes	43.30	120	5.00	10.00	4	3	-1
14	16	Yes	37.80	60	0.00	5.00	4	3	-1
15	43	Yes	45.30		5.00	10.00	2	2	0
15	17	Yes	32.80	90	5.00	10.00	3	2	-1
17	29	Yes	35.10	90	5.00	10.00	3	1	-2
18	48	Yes	47.00	70	5.00	15.00	3	2	-1
19	67	No	47.00	NA	NA	NA	NA	NA	NA

^aAP, anteroposterior; BMI, body mass index; ML, mediolateral; NA, not applicable.

ligament reconstruction had better range of motion when compared with those whose ligament injuries were treated conservatively, reported less instability events, and had higher activity levels. We also found our operative times were considerably longer than when operating

on normal-weight patients ($P < .05$) and that it was hard to fit custom braces to many of these patients' knees. We also noted that most of our patients had laxity of the uninjured knee when tested. This may be due to obesity or morbid obesity, and these patients are at risk for

dislocation due to hyperlaxity. This was previously suggested by Marin et al¹² in their report of 2 patients.

Knee dislocations pose a major risk to the well-being of patients due to their 2 common complications: vascular injuries and loss of neurologic integrity.^{2,9,10,12,15,19} Frequent monitoring of the peripheral pulse, Doppler pressure measurements (ankle-brachial index), and arteriograms are suggested to evaluate vascular structures. Estimated rates of vascular injury vary from source to source; however, they tend to be decreased in low-velocity injuries because they are less catastrophic injuries.^{9,13,20} Shelbourne and Klootwyk²⁰ reported on 21 athletically inclined patients who had a knee dislocation caused by a low-velocity sporting injury; only 4.8% of patients presented popliteal injuries. Similarly, in the study by Engebretsen et al,⁵ 6% of their 83 patients (40 of whom had dislocations occur in low-velocity events) presented popliteal injuries. In the study by Azar et al,² between 25% and 30% of knee dislocations have a vascular injury reported with them. There are a wide variety of rates of vascular injury for knee dislocations, likely due to the small sample sizes in studies. Our 23.8% rate of popliteal injury corroborated with these results,² which showed that obese patients have a high rate of vascular complications. Our patients who exhibited arterial injuries had an average BMI of 47 kg/m² (46.7 kg/m² for patients with arterial injury, 39.7 kg/m² for patients without). However, these results were not significant, as they failed a 2-tailed unpaired *t* test ($P = .334$), likely due to the small sample size. One patient had an amputation for an unreconstructable vascular injury in a diabetic patient; although we included this patient in our database, no orthopaedic treatment was initiated. The peroneal nerve is the most common nerve injury linked with tibiofemoral dislocations. Our results showed that 7 of the 21 (33%) knee injuries had peroneal nerve injuries, which is within the expected range given by Azar et al.² The mean BMI for patients with peroneal injuries was 45.9 kg/m², while the mean BMI for patients without peroneal injuries was 38.3 kg/m². However, the differences in BMI did not show significance ($P = .147$).

In this series, patients that were treated with immobilization alone (5 were immobilized with external fixation, 6 were immobilized with a cast) and subsequent physical therapy without ligamentous reconstruction did not obtain satisfactory results, with many having significant stiffness with persistent instability. Planchar and Siliski¹⁴ reported on long-term functional results in patients with dislocation of the knee. They reported a statistically significant difference in pain with rest, knee flexion, and return to athletics between patients treated operatively and nonoperatively. Patients treated surgically were also less likely to develop severe radiographic arthritic changes.¹⁴ Their findings demonstrated that patients treated operatively for knee dislocations have better functional results.

Knee dislocations are associated with multiple ligamentous tears, including the cruciate ligaments, collateral ligaments, and the menisci.¹¹ Complete dislocation of the knee joint has been coupled with complete tears of both the ACL

and PCL.^{18-20,22} Of the 18 patients (excluding the amputation) in the study, all had tears in both cruciate ligaments, with 17 patients having additional collateral ligament tears. These were either treated conservatively, with just immobilization and physical therapy, or with surgery to repair the ligaments. The patients before May 2006 did not undergo surgery for ligament repair and were instead treated conservatively (with 1 patient in 2008 being treated without surgery as well). After May 2006, patients generally underwent reconstruction surgery to fix torn ligaments. We feel that range of motion and objective knee stability may be improved with operative management in these patients' knee dislocations, but more data are required to say definitively. The patients who underwent reconstruction averaged 30.95° more mobility than the patients who did not undergo reconstruction. These data suggest that reconstructive surgery yields positive results for range of motion, although results were not significant, likely due to small sample size. The patients who were noncompliant with physical therapy showed clear negative consequences (0° and 45° of flexion for each of the 2 patients). Additionally, 3 knees treated conservatively later underwent total knee arthroplasties to repair tibiofemoral damage, something none of our patients who underwent initial reconstruction surgery have required. However, not all patients who had reconstructive surgery went without complications. Two of 8 failed and required second ligament repairs with good outcomes, and 1 had a delayed ACL repair as well.

The surgical technique employed was to repair the posterolateral corner and reconstruct the LCL and PCL in the acute phase when possible. This is difficult when coupled with a vascular injury. The vascular or trauma surgeon may wish to make a posterior or medial incision to revascularize the limb and then temporize with an external fixator until they feel the vascular repair is stable. In obese patients, this possibly indicates that more obese subjects have a higher rate of popliteal injury. Bending the knee to repair the lateral structures, particularly the PCL, may put pressure on an acute vascular repair. We have found in 2 instances that if a posterior approach is performed at the popliteal artery, one can place the tibial attachment of the PCL from a tunnel in the back at the time of the vascular repair. We usually use Achilles tendon allograft for this reconstruction and prepare it by shaping the bone and using a fiber loop to oversee the tendon. We can easily drill the posterior tunnel at this time, place the bone plug with an interference screw, and place the rest of the tendon into the knee for a later femoral attachment, which can be done with the knee only gently flexed. The size of these legs makes the surgery more difficult than in normal-weight individuals, and our surgical times were considerably longer (183%) than in normal-weight individuals ($P < .05$).

CONCLUSION

Acute knee dislocations following minor trauma in obese patients are unique events and must be managed expeditiously. Neurovascular compromise occurs as frequently as in traumatic dislocations. We feel that surgical repair of

¹¹References 2, 5, 7-10, 13, 15, 18-21, 23, 24.

ligaments should be carried out even though it is more difficult and time consuming than in normal-weight individuals. We were unable to show any significance in outcome in our small series but we feel it is trending toward this.

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