



# Complications Following Tibial Tubercle Osteotomy (TTO) at a Tertiary-care Institution

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## BACKGROUND

- Tibial tubercle osteotomy (TTO) is a surgical procedure commonly used to treat patellar instability, patellar maltracking, and to unload areas of patellofemoral articular cartilage injury
- Reported complication rates following TTO range from 1%-46%, with varied definitions of complications
- The knowledge of predictive factors can help identify which patients and time intervals after surgery have the highest risk of complications

## OBJECTIVE

To define the incidence of minor and major complications following TTO at a tertiary-care institution, with determination of predictive factors related to the occurrence of major complications

## METHODS

- Retrospective case series of 436 patients identified between 2011–2023
- Inclusion criteria: All primary TTOs with >30 day clinical follow-up
- Recorded variables included patient demographics, preoperative indication, and operative variables including osteotomy cut angle, number of screws used, screw diameter, screw headedness, use of a bone graft, and concomitant procedures
- Complications were divided into major and minor
- Descriptive statistics were used to characterize the incidence of complications from 0-30 days, 31–90 days, 90 days –1 year, and >1 year
- Binary logistic regression was performed to evaluate associations of preoperative patient characteristics and operative variables with complications

Table 1. Observed Complications following TTO					
Complication	<30 days	30-90 days	91 days– 1 year	>1 year	Total (%Overall)
Major Complication					
Intraoperative Fracture	0	0	0	0	0 (0%)
Postoperative Fracture	2 (12.5%)	0	10 (62.5%)	4 (25%)	16 (3.4%)
Loss of Fixation	0	0	0	0	0 (0%)
Patella Tendon Rupture	0	0	0	0	0 (0%)
Non-union	0	0	2 (50%)	2 (50%)	4 (0.8%)
Delayed-union	0	0	1 (100%)	0	1 (0.2%)
Pulmonary Embolism	0	1 (100%)	0	0	1 (0.2%)
Arthrofibrosis	0	7 (29.2%)	17 (70.8%)	0	24 (5%)
Deep Infection	3 (42.9%)	4 (57.1%)	0	0	7 (1.5%)
Painful Hardware	0	1 (3.2%)	7 (22.6%)	23 (74.2%)	31 (6.5%)
Recurrent Instability	0	1 (5.3%)	5 (26.3%)	13 (68.4%)	19 (4.0%)
Readmission	3 (60.0%)	2 (40.0%)	0	0	5 (1.1%)
Revision			2 (40.0%)	3 (60.0%)	5 (1.1%)
Reoperation other	0	0	6 (31.6%)	13 (68.4%)	19 (4.0%)
Minor Complication					
DVT	2 (100%)	0	0	0	2 (0.4%)
Superficial Infection	17 (63.0%)	10 (37.0%)	0	0	27 (5.7%)
Wound Dehiscence	5 (41.7%)	6 (50%)	1 (8.3%)	0	12 (2.5%)
Neuropraxia	0	2 (50%)	1 (25%)	1 (25%)	4 (0.8%)

Table 2. Comparison of Major Complication Rates by Patient Characteristics and Operative Variables				
		Major Complication	No Major Complication	P-value
Age		30.2 (9.4)	27.7 (9.5)	<b>0.13</b>
Sex				
	Female	81 (71.7%)	245 (67.5%)	.621
Male	32 (28.3%)	117 (32.2%)		
BMI		27.3 (6.3)	27.7 (6.3)	.604
ASA Score				
	ASA 1	40 (48.2%)	165 (55.2%)	.450
	ASA 2	40 (48.2%)	121 (40.5%)	
	ASA 3	3 (3.6%)	13 (4.3%)	
Concomitant Procedures				
	Cartilage	58 (51.8%)	142 (39.1%)	<b>.021</b>
	MPFL/MQTL	52 (46.4%)	218 (60.1%)	
	Lateral Release	86 (76.1%)	300 (82.6%)	
	Other intra-articular	10 (8.8%)	39 (10.9%)	
Indication				
	Instability	64 (56.6%)	244 (67.2%)	<b>.043</b>
	Cartilage Lesion/Arthritis	81 (71.7%)	220 (60.6%)	
	Pain/maltracking	80 (71.4%)	229 (63.1%)	
Prior Surgery				
	Yes	65 (57.5%)	133 (36.6%)	<b>&lt;.001</b>
No	48 (42.5%)	230 (63.4%)		
Osteotomy Cut Angle				
	30º	3 (9.1%)	30 (90.9%)	<b>0.020</b>
	45º	46 (19.9%)	186 (80.1%)	
	60º	54 (29.8%)	127 (70.2%)	

Table 3. Comparison of Preoperative and Operative Variables for Patients Requiring Vs. Not Requiring Hardware Removal				
		Hardware removal (n=31)	No Hardware Removal (n=445)	P-value
Age		27.9 (9.4)	33.5 (10.3)	<b>.002</b>
Sex	Female	28 (8.6%)	298 (91.4%)	<b>.026</b>
	Male	3 (2.0%)	147 (98.0%)	
BMI		26.0	27.7	.169
Number of Screws				.196
	1	1 (20.0%)	4 (80.0%)	
	2	27 (6.0%)	420 (94.0%)	
	3	3 (13.0%)	20 (87.0%)	
Screw Diameter				<.001
	3.50 mm	0 (0%)	6 (100%)	
	4.00 mm	1 (11.1%)	8 (88.9%)	
	4.50 mm	20 (9.3%)	196 (90.7%)	
	4.75 mm	1 (12.5%)	7 (87.5%)	
	5.00 mm	5 (2.3%)	208 (97.7%)	
	6.00 mm	0 (0%)	1 (100%)	
	6.50 mm	1 (100%)	0 (0%)	
Screw Headedness				<.001
	Headless Headed	5 (1.7%) 23 (13.2%)	284 (98.3%) 151 (86.8%)	

## RESULTS

- 462 TTOs in 436 patients with a mean follow-up of 1.9 years
- Overall complication rate was 27.5%
  - Major complications - 23.7%
  - Minor complications - 8.4%
- Most common complications were
  - Painful hardware requiring removal – 6.5%
  - Superficial infection – 5.7%
  - Arthrofibrosis requiring re-operation – 5%
- Most common complications varied by time interval
  - 0-90 days - DVT, PE, infection, wound dehiscence, and readmission.
  - 90 days to 1 year - postoperative fractures and arthrofibrosis.
  - >1 year - painful hardware requiring removal, recurrent instability, reoperation for other indications, and revision.
- Prior ipsilateral surgery was identified as a significant independent predictor of major complication by regression analysis (p = 0.007)
- Hardware removal was more common with headed screws

## CONCLUSIONS

- Tibial tubercle osteotomies are associated with a relatively high rate of complications, with major complications occurring in almost one-third of patients
- Patients who had a major complication were older, had a previous ipsilateral knee surgery, had an indication of cartilage lesion/arthritis, and had a steeper osteotomy cut angle
- Painful hardware requiring removal was the most common complication and was more common in patients with headed screws
- Specific complications varied based on interval after surgery, which can help surgeons to be proactive in identification and management

