Your Patella Dislocated: Will it Happen Again? An Assessment of MRI Criteria for Recurrent Patella Dislocation After an Initial Event

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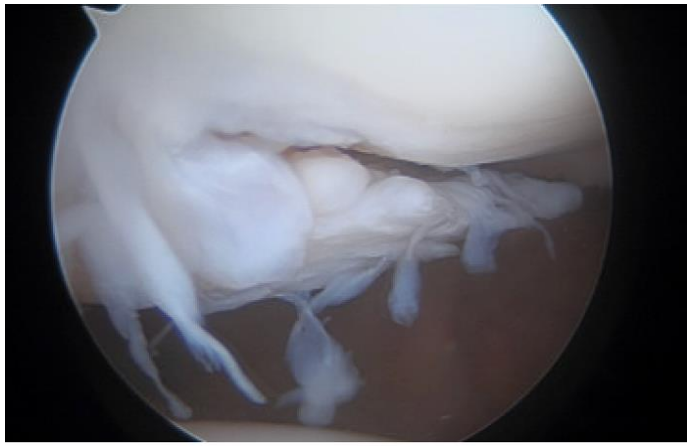
Introduction

- Patella dislocation (PD)
  - Common pediatric injury
  - Multifactorial etiology[1]
- First-time: non-operatively
  - Recurrence rates[4] are 50% to 60%.
- Recurrent dislocations
  - Disruptive – missed activities
  - Osteochondral injury
  - Degenerative disease



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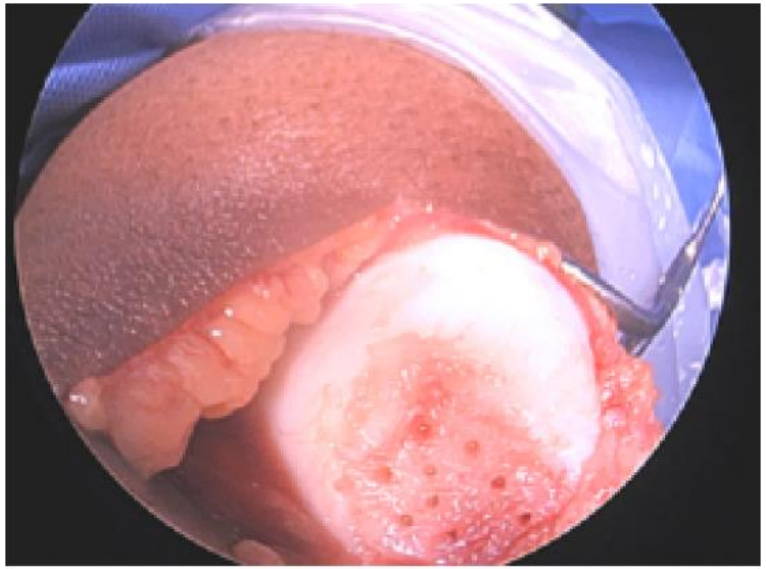
Introduction

Predicting recurrence would guide clinical decisions pertaining to early operative intervention[2]

Exact combination of anatomical risk factors most associated with recurrence is controversial and no gold standard exists[3]

- Tibia Tubercle –Trochlea Groove (TT-TG) distance
- Caton-Deschamps (CD)
- Relative tibia external rotation (rTER)
- Patellar tilt (PT)
- Lateral Trochlea Inclination (LTI) angle
- Sulcus Angle (SA)
- Trochlear Depth (TD)



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Objective

- To determine if there are statistically significant differences in MRI measurements of PD in patients with a confirmed one-time dislocation (OTD) versus those with recurrent patella dislocations (RPDs).

- We hypothesize that RPDs will have significantly higher TT-TG, patella alta , rTER, PT and trochlear dysplasia, represented by SA, LTI, and TD measurements.

Methods

Retrospective case control study
Single Institution (IRB #: 2016-6534)
Inclusion Criteria :
- Treated for PI between 2012- 2023
- Age < 21

Exclusion Criteria:
- Prior surgeries

OTDs
(1 episode only)

RPDs
(>1 episode)

Independent T-tests and Mann-Whitney U tests were conducted to assess differences between sample means. Significance was set at a=.05.

Multiple logistic regression was used to determine the association of anatomical risk factors with likelihood of experiencing RPDs.

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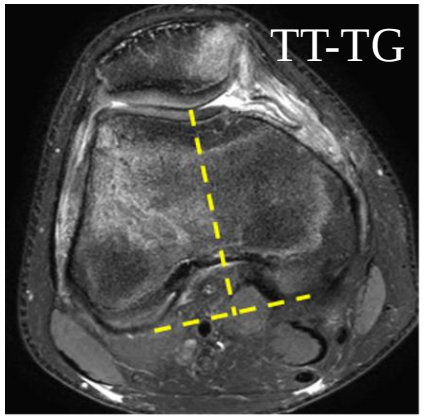
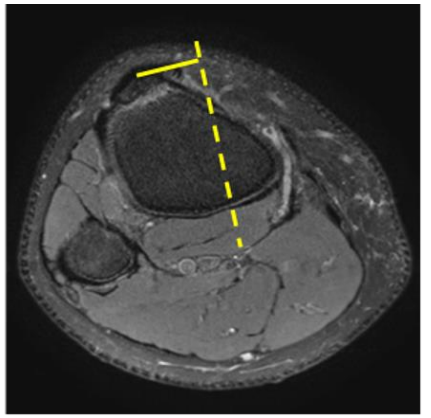
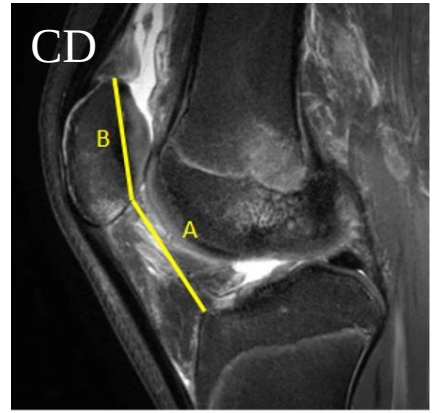
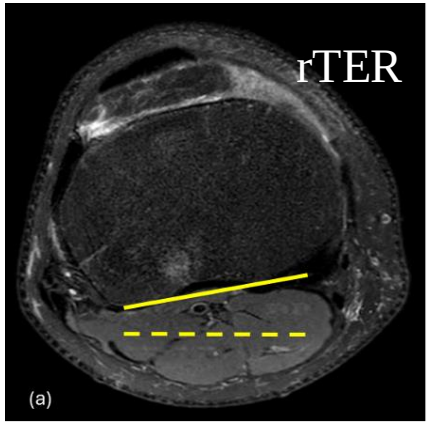
Methods

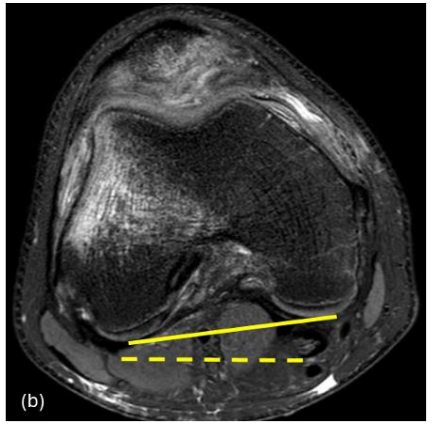
- MRI measurements include:
  - Tibia Tubercle –Trochlea Groove (TT-TG) distance
  - Caton-Deschamps (CD)
  - Relative tibia external rotation (rTER)
  - Patellar tilt (PT)
  - Lateral Trochlea Inclination (LTI) angle
  - Sulcus Angle (SA)
  - Trochlear Depth (TD)

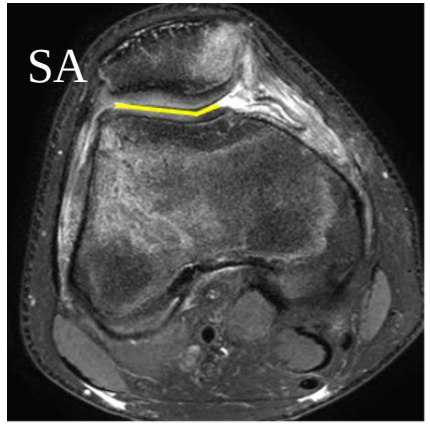


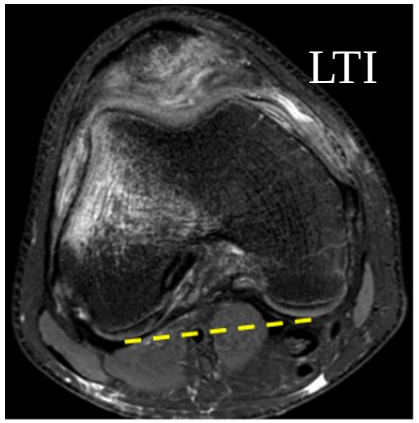


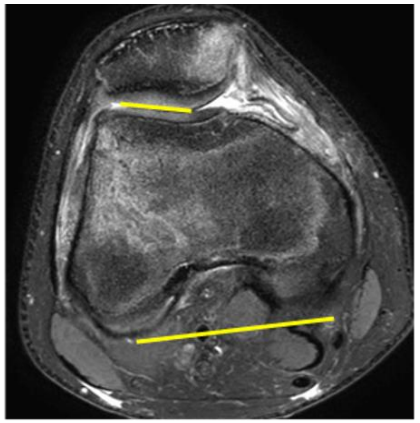


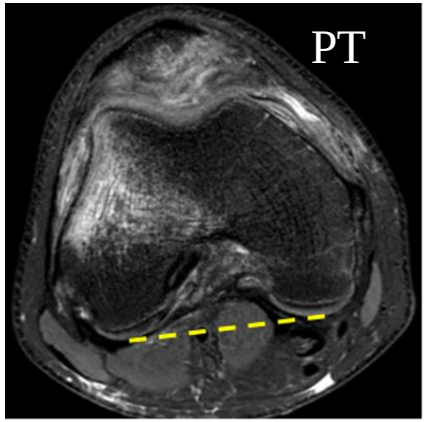


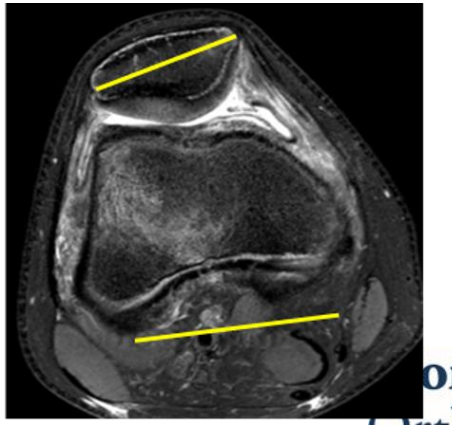


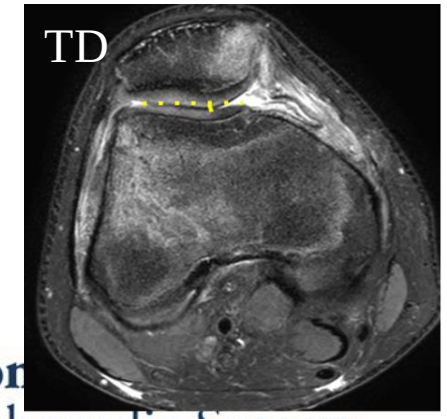












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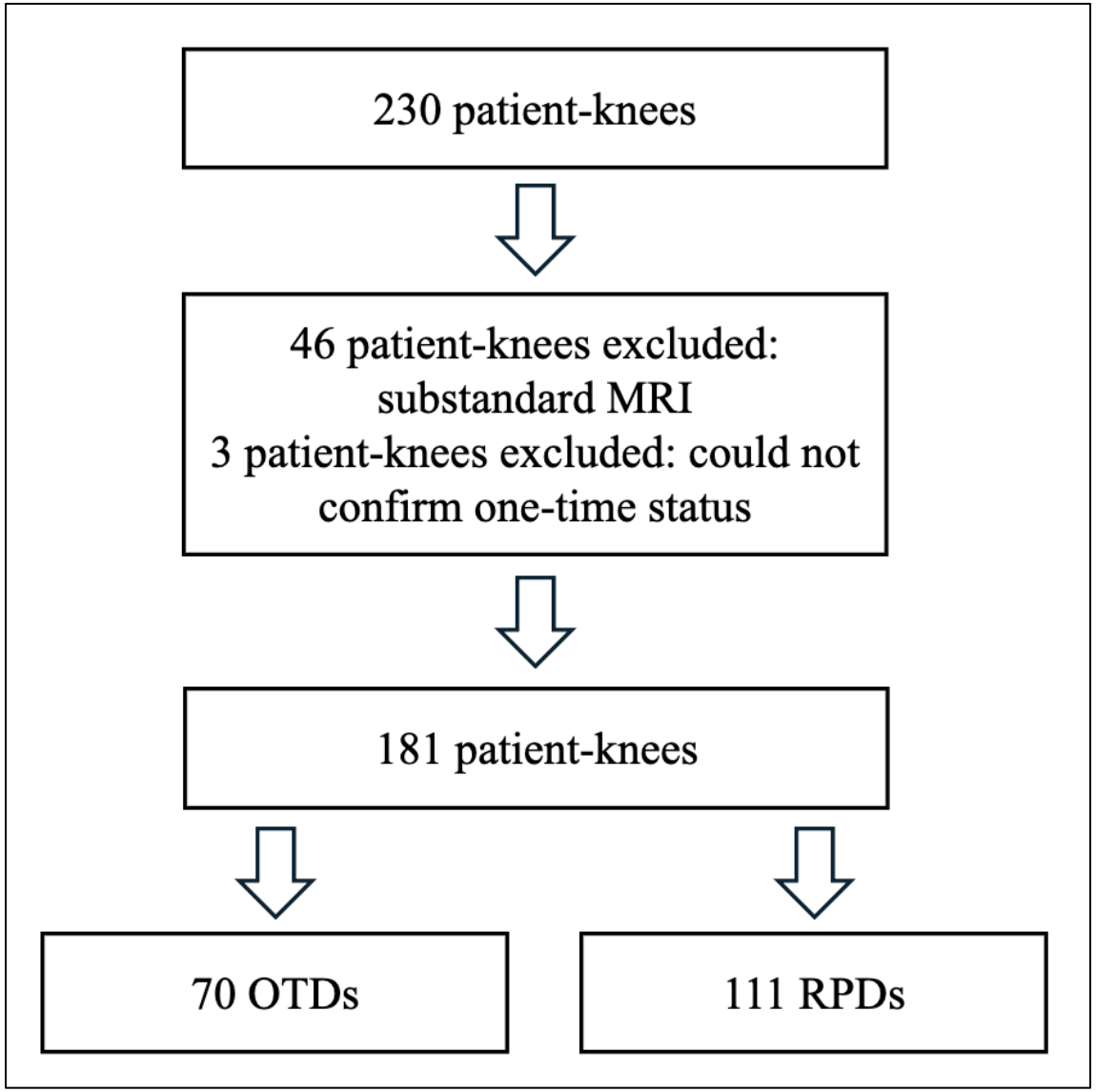
111 RPDs vs. 70 OTDs



Mostly excellent or good inter-rater and intra-rater reliability

	Rater 1	Rater 2
CD	.94 (.88 - .97)	.83 (.64 - .92)
TT-TG	.98 (.97 - .99)	.86 (.71 - .93)
rTER	.96 (.92 - .98)	.97 (.94 - .99)
PT	.96 (.92 - .98)	.96 (.92 - .98)
LTI	.83 (.65 - .92)	.90 (.78 - .95)
TD	.98 (.95 - .99)	.94 (.87 - .97)
SA	.98 (.96 - .99)	.94 (.88 - .97)

CD	.73 (.44 - .88)
pTT-TG	.91 (.48 - .97)
rTER	.96 (.91 - .98)
PT	.95 (.90 - .98)
LTI	.75 (-.09 - .92)
TD	.91 (.39 - .97)
SA	.87 (.25 - .96)

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Significant differences in SA, TD, CD, and PT between cohorts

Overall recurrence rate was 61.33%

	OTD (n=70)	**RPD (n=111)**	**P value**
Age: avg. (SD)	14.8(± 2.7)	15.3(± 2.6)	0.26
TT-TG (c): avg. (SD)	16.5(± 5.0)	17.6(± 4.6)	0.12
rTER: median (IQR)	5.85 (2.8, 8.1)	5.5(2.5, 8.3)	0.72
LTI (c): median (IQR)	8.35 (-1, 16.5)	9.5 (1.6, 14)	0.65
Sulcus Angle (c): median (IQR)	**156.6 (148.65, 167.9)**	**166.6 (160.4, 171.8)**	**<0.001**
Trochlear Depth (c): median (IQR)	**1.7 (0.9, 2.8)**	**1.2 (0.7, 1.7)**	**<0.001**
Caton-Deschamps (CD): avg. (SD)	**1.3 (± 0.2)**	**1.4 (± 0.2)**	**0.03**
Patella tilt (PT): avg. (SD)	**17.75 (± 9.5)**	**22.66 (± 9.7)**	**0.001**

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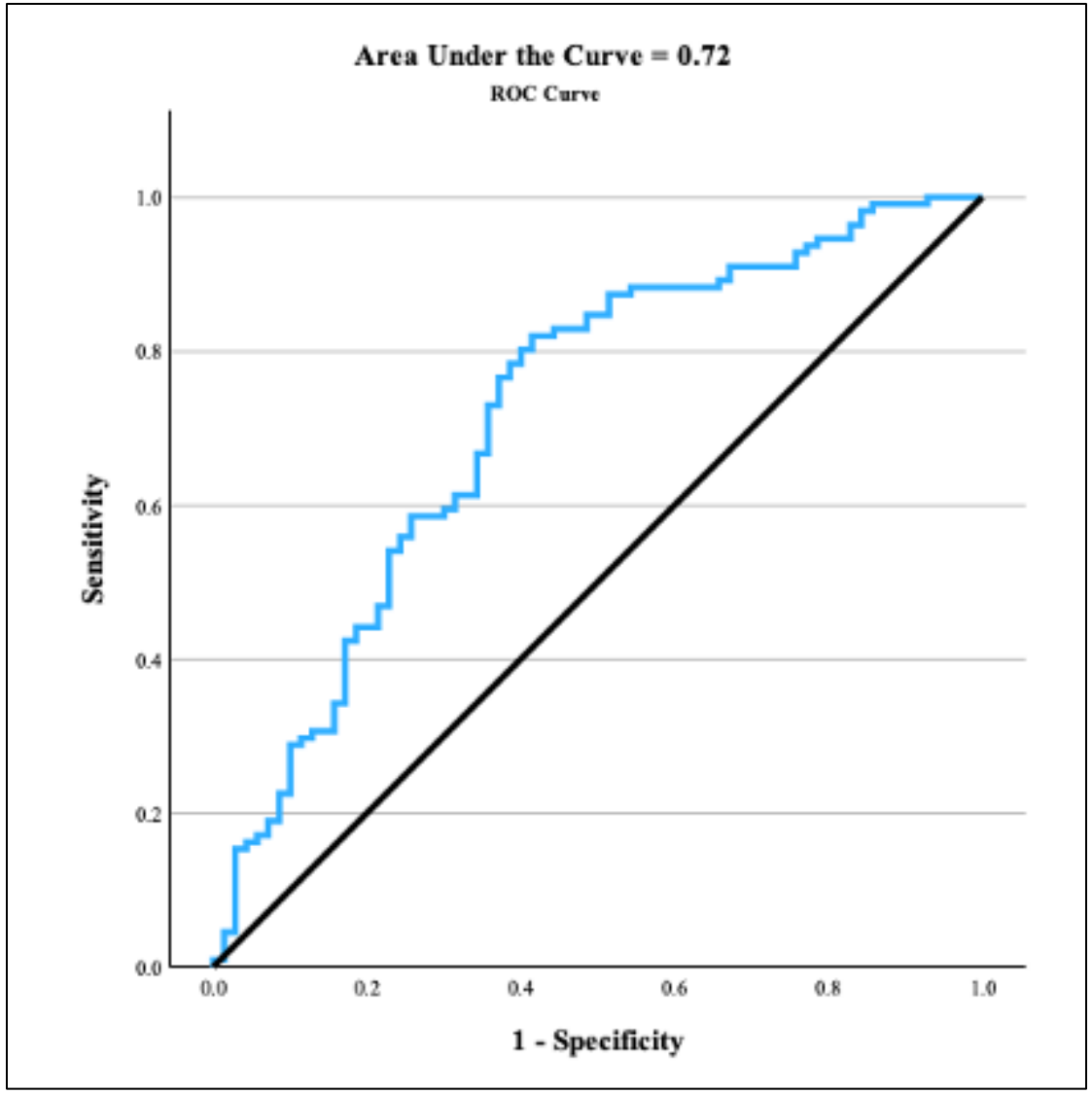
The combination of SA and patella alta (CD) distinguished between RPDs and OTDs with reasonable accuracy (AUC .72).



Applying this model, the probability of having RPDs with examples of combinations of SA and CD estimated from the formula 1/(1+exp-(-12.2022 + 0.0635(SA) + 1.770(CD))).

SA (°)	CD value	Probability of being an RPD
150	1.4	.45
150	1.5	.49
160	1.4	.61
160	1.5	.65
170	1.4	.74
170	1.5	.78

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Discussion/Conclusions

- Patella alta (CD), PT and measures of trochlear dysplasia (SA and TD) may be useful to distinguish between patients with RPDs and an OTD

- TT-TG and LTI were not different between cohorts

- The combination of SA and CD distinguished between the cohorts with reasonable accuracy (AUC .72)

- Example patient with a SA of 170° and CD of 1.5 would have a .78 probability of experiencing RPDs. May help counseling after initial event.

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Limitations

46 substandard MRIs and 3 loss to follow up

Retrospective study

– selection bias

Future Directions

Subsequent analyses would be directed towards establishing a predictive model for first-time dislocators.

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References

1.Gravesen KS, et al. High incidence of acute and recurrent patellar dislocations: a retrospective nationwide epidemiological study involving 24.154 primary dislocations. *Knee Surg Sports Traumatol Arthrosc*. Apr 2018.

2.Parikh SN, et al. Predicting Risk of Recurrent Patellar Dislocation. *Curr Rev Musculoskelet Med*. Jun 2018.

3.Rund JM, et al. Acute Patellofemoral Dislocation: Controversial Decision-Making. *Curr Rev Musculoskelet Med*. Feb 2021.

4.Sanders TL, et al. High rate of recurrent patellar dislocation in skeletally immature patients: a long-term population-based study. *Knee Surg Sports Traumatol Arthrosc*. Apr 2018.

5.Tan SHS, et al. Predictive Scoring for Recurrent Patellar Instability After a First-time Patellar Dislocation. *J Pediatr Orthop*. Sep 1 2022.

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