PATELLAR HEIGHT: COMPARISON OF MEASUREMENT TECHNIQUES AND CORRELATION WITH OTHER PATHOANATOMIC MEASURES OF PATELLAR INSTABILITY

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BACKGROUND

- Patellar instability (PI) can be a debilitating knee condition for children and adolescents. Excessive patellar height (PH), also called patella alta, is a described anatomic risk factor for PI
- Caton-Deschamps (CD) ratio is widely used to quantify PH across all age groups
- Patellotrochlear index (PTI) also quantifies PH by measuring patellar and trochlear chondral overlap on sagittal MRI images. It is proposed as a more accurate representation of clinically meaningful PH

OBJECTIVES

- Evaluate inter- and intra-rater reliability of CD ratio and PTI in a cohort of children and adolescent patients with PI
- Compare patella alta classification of PH based on CD ratio and PTI in the same cohort of PI patients
- Evaluate correlation between PTI and lateral trochlear inclination (LTI) and lateral patellar inclination (LPI) – two additional risk factor measurements of PI

METHODS AND MATERIALS

- Patient cohort: aged 9 – 18 years, treated for PI between 2014 – 2017
- CD ratio measured on lateral radiographs, with patella alta defined as >1.2
- PTI measured on sagittal MRI images (Figure 1), with patella alta defined as <12.5%
- LTI and LPI measured on axial MRI
- Two independent observers for all measurements in the entire cohort
  - Regression analyses performed on entire cohort
- Three independent observers for a randomly selected cohort of 30 patients for reliability analysis

Figure 1. Patellotrochlear index (PTI). The sagittal image with the longest section of the patella and the thickest patellar cartilage is selected. The length of the patellar chondral surface is measured – here it is 32.6 mm. Then the length of the trochlea overlapping with the patellar chondral surface is measured in parallel by referencing a perpendicular subtended from a patellar chondral surface measurement – here the length of overlapping trochlear chondral surface is 12.1 mm. The PTI is calculated with diving the trochlear chondral length by the patellar chondral length and converting to a percentage: (12.1 / 32.6) x 100 = 37%

RESULTS

	PTI vs CD	PTI vs LTI	PTI vs LPI	CD vs LTI	CD vs LPI
Average 1st Variable	41.8 ± 17.6	41.8 ± 17.6	41.8 ± 17.6	1.3 ± 0.3	1.3 ± 0.3
Average 2nd Variable	1.3 ± 0.3	4.2 ± 11.9°	19.6 ± 9.4°	4.2 ± 11.9°	19.6 ± 9.4°
r	-0.30	-0.013	0.092	0.19	0.162
β	-0.004	---	---	---	---
p	0.016	0.91	0.47	0.14	0.20

- 65 patients met inclusion criteria
- PTI measurements had less variability and near perfect agreement between observers and within observers
- CD ratio had moderate agreement between observers and high agreement within observers
- 71% of patients had an LTI <11° classifying them as having trochlear dysplasia
- 73% of patients had an LPI >13.5° classifying them as having excessive patellar tilt

	Interrater ICC (95%CI)	Within Rater ICC (95% CI)	Average
PTI	**0.92** (0.83-0.96)	**0.98** (0.97-0.99)	41.8 ± 17.6
CD ratio	**0.62** (0.34-0.8)	**0.817** (0.65-0.91)	1.3 ± 0.3
LTI	**0.97** (0.88 – 0.97)	**0.96** (0.91-0.98)	4.2 ±11.9°
LPI	**0.89** (0.77 – 0.95)	**0.98** (0.95-0.99)	19.6 ± 9.4°

CD ratio Classification		PTI Classification	
CD > 1.2 (i.e. alta)	62.5 %	PTI<12.5% (i.e.alta)	3.1 %
CD < 0.8 (i.e. baja)	4.6 %	PTI>50% (i.e. baja)	32.8 %

CONCLUSIONS

- PTI was a more reliable and more reproducible measure of patellar height than CD ratio
- PTI categorized a smaller proportion of this patellar instability cohort of patients as having patella alta than did CD ratio
- A small, but weak, correlation was found between PTI and CD ratio
- No significant correlation was found between PTI or CD ratio with LTI or LPI, despite the majority of patients in the cohort having these risk factors for patellar instability – trochlear dysplasia and excessive patellar tilt
- The role of patellar height in patellar instability warrants renewed investigation to determine what is clinically significant patella alta

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