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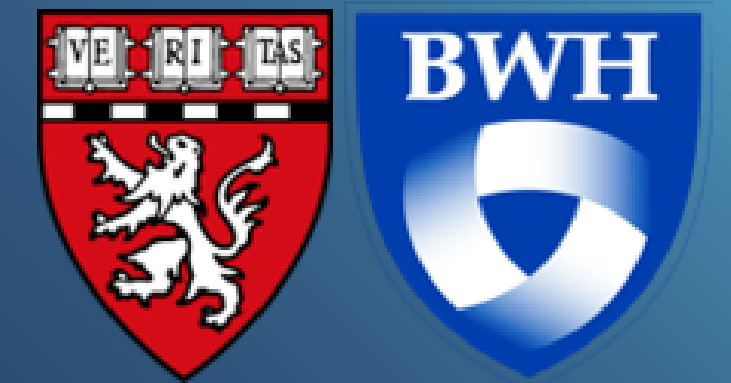
BACKGROUND

Problem Statement:
- Arthroscopic partial meniscectomy (APM) has been shown to be the most common meniscal surgical treatment in the United States
- Pre-op risk factors known to contribute to poor outcomes after APM:
  - Symptom duration and radiographic OA at baseline
- Factors with no conclusive effect on post-op outcomes:
  - Baseline knee functional score, location of meniscal tear, BMI, activity level, age, sex, and chondral damage on MRI

Project AIM: To create an index score using easily available preoperative risk factors such as Kellgren-Lawrence (KL) grade, age, duration of symptoms, BMI, activity level, and preoperative outcome scores to predict the likelihood of favorable outcomes after APM.

METRICS AND METHODOLOGY

- Retrospective review of consecutive cohort of patients who underwent primary APM at single academic medical center over 8 years
- Exclusion criteria:
  - <18yrs, concomitant ligamentous procedure, incomplete PROMs, did not have pre-op XR in EPIC
  - Complete Pre- and post-op PROMs (KOOS, VR-12, MARS)
- XR grading:
  - Kellgren-Lawrence Grading Scale (4 independent reviewers, 2 per XR independently)
- Multivariable logistic regression models:
  - Evaluate independent predictors of KOOS Subscales
  - Achievement of minimal clinically important difference (MCID) and substantial clinical benefit (SCB)
- Index Score Generation:
  - Points assigned to each variable proportional to its odds ratio rounded to the nearest integer
- This study had 80% power to detect a 13% absolute difference (70% vs 57%) in the proportion of patients achieving clinical improvement between any 2 groups with a 2-sided significance level of .05, when the sample sizes are relatively equal between the 2 groups.

RESULTS – Cohort Demographics

- 468 subjects (42% male) eligible for analysis
- Average age: 49 ± 10.4 years
- Race: 89% White
- BMI Category: 48.3% either overweight or obese
- Smoking Status: 94% non-smokers

RESULTS – Index Score Generation

- Primary outcome: KOOS Pain – 1 year
  - 84% of patients achieved MCID
  - 69% achieved SCB
  - Lower KL grade, lower pre-op KOOS Pain value, and lower VR-12 Physical score associated with a higher likelihood of clinical improvement with MCID or SCB at 1 year

- Multivariable model for clinical improvement with MCID: (Table 1)
  - Sx duration: (<3 months: OR, 3.00; 3-6 months: OR, 2.03, compared with >6 months)
  - KL grade: (grade 0: OR, 3.54; grade 1: OR, 3.04; grade 2: OR, 2.31, compared with grade 3)
  - Preoperative KOOS Pain: (score <45: OR, 3.00; score of 45-60: OR, 2.80, compared with score >60)

- Abbreviated model also developed to be used in a clinical setting to evaluate a patient's likelihood of achieving the MCID when pre-op KOOS is not readily available

Table 1. Logistic Regression Model Effects and Scoring Algorithm for Achieving Clinical Improvement in KOOS Pain[a]

	OR	LCL	UCL	P Value	Points
Full model					
Symptom duration, mo					
<3	3.00	1.45	6.19	.003	1
3-6	2.03	1.10	3.72	.023	1
>6	Ref				0
Kellgren-Lawrence grade					
0	3.54	1.66	7.54	.001	2
1	3.04	1.48	6.26	.003	1
2	2.31	1.02	5.27	.046	1
3	Ref				0
Preoperative KOOS Pain value					
<45	3.00	1.57	5.76	<.001	1
45-60	2.80	1.47	5.35	.002	1
>60	Ref				0
Total possible points					4
Score	n	Likelihood of Achieving CI[b]			
0	5	40.0%			
1	62	67.7%			
2	142	79.6%			
3	180	89.4%			
4	79	96.2%			
	OR	LCL	UCL	P Value	Points
Abbreviated model					
Symptom duration, mo					
<3	3.10	1.52	6.31	.002	2
3-6	2.04	1.13	3.70	.019	1
>6	Ref				0
Kellgren-Lawrence grade					
0	2.69	1.30	5.53	.007	2
1	2.31	1.17	4.58	.016	2
2	1.99	0.90	4.39	.089	1
3	Ref				0
Total possible points					4
Score	n	Likelihood of Achieving CI[b]			
0	28	64.3%			
1	52	67.3%			
2	149	83.9%			
3	123	90.2%			
4	116	90.5%			

[a]CI, clinical improvement; KOOS, Knee injury and Osteoarthritis Outcome Score; LCL, lower confidence level; Ref, reference; UCL, upper confidence level
[b]Clinical improvement is defined as (1) an increase of at least 10 points (minimal clinically important difference) or (2) the 1-year postoperative score improved and reached 90.

CONCLUSION

This study found that preoperative factors, including shorter symptom duration, lower KL grade, and decreased preoperative pain, are predictors of clinically important improvement after APM.

- APM index score is a simple tool to use in real time to inform patients with a symptomatic meniscal tear of their probability for improvement after APM
- Further research should be conducted to determine how this scoring algorithm performs in a clinical setting and whether it can be used to inform physician and patient discussions regarding APM to treat symptomatic meniscal tears

Clinical Application

The APM Index Score instrument is for use in a clinical setting to engage in shared decision-making with patients regarding knee arthroscopy for treating symptomatic meniscal tears.
This model has found that shorter symptom duration, lower baseline KL grade, and lower pretreatment KOOS Pain value were the strongest predictors of achieving the respective MCIDs at 1-year postop.

KL GRADE

Highest Joint Space Narrowing Score	Highest Osteophyte Score	KL Grade
0 or 1 (No or mild narrowing)	0 (No osteophyte)	0
0 or 1	1 (Mild osteophyte(s))	1
0 or 1	>2 (>Moderate osteophyte(s))	2
2 (Moderate narrowing)	Not considered	3
3 or 4 (Severe narrowing or bone-on-bone)	Not considered	4

APM INDEX SCORE

	Full Model	Abbreviated Model (No pre-op KOOS)
Pre-treatment score		
< 45	1	
45-60	1	
>60	0	
Symptom duration		
< 3m	1	2
3-6m	1	1
> 6m	0	0
KL_Grade		
0	2	2
1	1	2
2	1	1
3	0	0
Total Possible Points	4	4

	Likelihood of Achieving KOOS MCID	
SCORE	Full Model	Abbreviated model
0	40%	64%
1	68%	67%
2	80%	84%
3	89%	90%
>=4	96%	91%

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