

Epidemiology of Patellofemoral joint pathologies, our experience at King Hussein Medical center

Jameel S.Shawaqfeh MD, Maysoon AR.Banihani MD, Muhammad H.Smadi MD, Hajem Abudalo MD, Saleh M.Shurafat MD*

ABSTRACT

Background: Patellofemoral joint malconfiguration is noticed in patients with patellofemoral pain and can be correlated with magnetic resonance imaging picture of osteoarthritis.

Aim: To evaluate if patellofemoral joint configuration is correlated with irregularities seen on magnetic resonance imaging in patients with patellofemoral pain.

Methods: Our prospective investigation included 105 patients, aged 18-54 yrs, of both sexes and who were scheduled for MRI scan of the most painful knee ,at King Hussein hospital, King Hussein medical center, Amman, JORDAN, during the period Jan 2018-Sep 2018. Patients were grouped into two groups. Group I included (n= 50,47.6%) younger patients aged 18-26 yrs and group II included (n=55,52.4%) older patients aged 46-55 yrs. Knee pain intensity was scored on a 10 verbal analog scale and anterior Knee Pain Scale. Magnetic resonance imaging irregularities were recorded according to the Magnetic Resonance Imaging Osteoarthritis Knee Score, including patellar cartilage irregularities, patellar osteophytes and Hoffa synovitis and correlated with Insall-Salvati ratio; Trochlear angle ; Patellar tilt angle; Lateral patellar tilt angle and Sulcus angle. Statistics: Pearson χ^2 and Student t tests were used to assess discrepancies between the groups. Correlations between Magnetic Resonance Imaging Osteoarthritis Knee Score and patellofemoral pain were assessed using regression analysis. P- values less than 0.05 were considered statistically significant.

Results: Cartilage patellar irregularities were found in 24% and 10.9%, patellar osteophytes in 70% and 58.2% and Hoffa synovitis in 56% and 63.6% of patients, in groups I and II, respectively. An increased Insall-Salvati ratio was remarkably seen in patellar osteophytes and Hoffa synovitis. An increased patellar tilt angle was remarkably found in cartilage patellar irregularities and patellar osteophytes.

Conclusion: Magnetic Resonance Imaging irregularities are correlated with patellofemoral configuration recordings, as increased Insall-Salvati ratio and increased patellar tilt angle in patients with patellofemoral pain. Some patellofemoral pain patients are more liable to experience patellofemoral osteoarthritis, because some recordings are correlated with patellar osteophytes.

Keywords: knee, configuration, MRI, patellofemoral: joint, pain.

JRMS December 2020; 27(3): 10.12816/0057185

Introduction

Patellofemoral pain (PFP) is a frequent knee disorder of 11% - 17% of total knee pain disorders ⁽¹⁾. PFP is featured by peri-patellar pain induced by patellofemoral joint exertion, or by lengthened flexed knee

sitting ⁽²⁾. Although PFP is noticed in all age groups, it is noticed mainly in active aged less than 40 yrs patients ⁽³⁾.

The causes of PFP have multiple factors. Increased patellofemoral joint exhaustion may be the cause of pain ⁽²⁾. Pathological configuration of the patellofemoral joint is incriminated in increased joint exhaustion. Different patellofemoral and bony configurations are correlated with PFP, such as increased quadriceps angle, increased sulcus angle, increased patellar tilt angle and increased lateral displacement ⁽²⁾. Patellofemoral configuration characteristics are potentially changeable ⁽²⁾.

Modifications in patellofemoral force induced by patellofemoral malconfiguration can be more than tissue force and lead to chondral insults and patellofemoral osteoarthritis (bone marrow insults, osteophytes, synovitis) ⁽²⁾. There were discrepancies in cartilage texture in females aged 18 - 45 yrs with PFP and patellar malconfiguration ⁽⁴⁾. T1 rho measurements were remarkably more in the lateral patellar facet in PFP with patellar tilt, having more proteoglycan loss ⁽⁴⁾. T1 rho measurements were almost equal to early OA ⁽⁴⁾. There is an association between trochlear bony configuration and patellofemoral OA ⁽²⁾. Patellofemoral malconfiguration is the cause of clinical features intensity in aged patients with knee OA ⁽⁵⁾. Patellofemoral malconfiguration can be associated with magnetic resonance imaging- textural characteristics of patellofemoral OA (osteophytes and cartilage defects) in PFP.

The goal of our investigation was to evaluate if patellofemoral joint and bony configurations are correlated with cartilage, bone and soft tissue irregularities featured by MRI and with clinical patients features in PFP.

Methods

This prospective investigation enrolled 105 patients with PFP, aged 18-55 yrs, of both genders (Table I) and who were assigned for MRI scan of the most painful knee, at King Hussein hospital, King Hussein medical center, Amman, JORDAN, during the period Jan 2018-Sep 2018 ,after obtaining approval from our local ethical and research board review committee of the Jordanian Royal medical services. Patients were grouped into two groups. Group I included (n= 50,47.6%)younger patients aged 18-26yrs and group II included (n=55,52.4%)older patients aged 46-55 yrs. Magnetic resonance imaging irregularities were recorded according to the Magnetic Resonance Imaging Osteoarthritis Knee Score.

Knee pain intensity was scored on a 10 verbal analog scale (usual pain included resting pain and worst pain included activity-induced pain) ⁽⁶⁾. Anterior Knee Pain Scale (AKPS; 0-10)⁽⁷⁾ showed lengthened sitting with knees flexed ⁽⁸⁾. All patients were assigned for MRI scan of the most painful knee, positioned supine with the knee in 20° - 30° of flexion. All MRI scans were scored using the Magnetic Resonance Imaging Osteoarthritis Knee Score ⁽⁹⁾. Scores of the most important elements included patellar cartilage irregularities, patellar osteophytes and Hoffa synovitis ⁽¹⁰⁾.

Insall-Salvati ratio (is the ratio of patellar tendon length to oblique patellar length) ^(7,11-13);Trochlear angle is the angle between the posterior condylar line and a line along the most anterior margins of the medial and lateral trochlear facets; Patellar tilt angle is the angle between the posterior condylar line and the line via the maximal width of the patella; Lateral patellar tilt angle is the angle between the line

parallel to the lateral patellar facet and the line connecting the most anterior points of the medial and lateral condyles and Sulcus angle is located between the condylar outsets.

Statistics

Pearson χ^2 and Student t tests were used to assess discrepancies between the groups. Associations between Magnetic Resonance Imaging Osteoarthritis Knee Score items and patellofemoral pain were assessed using regression analysis. Differences regarding age, gender and bilateral PFP were analyzed using linear regression, while ANOVA for period of PFP. P- values less than 0.05 were considered statistically significant.

Results

The median age of group I patients was 21 yrs and of group II patients was 47 yrs, with preponderance of females (in group I: 27(54%) in group II: 35(63.6%)). Table I. Bilateral clinical knee picture was seen in 26(52%) of patients in group I and in 38(69.1%) of patients in group II. Sixteen patients (32%) and 4 patients (7.3%) experienced a minimum clinical picture period of less than 6 months, in group I and II, respectively. Table I. Compared with the group II, group I showed remarkably younger PFP patients, less clinical picture period of less than 2 yrs and less bilateral features. Table I. Patients from group II had less intense features on the verbal analog scale for pain and AKPS.

Patellar cartilage irregularities were seen in 24 % and 10.9% of patients, with more irregularities in GI compared to GII. Table II. Patellar osteophytes were more commonly seen in GI (70%) in comparison to GII (58.2%). Hoffa synovitis was seen in 56%% and 63.6% of patients, in groups I and II, respectively. An increased IS ratio (patella alta) was correlated with patellar osteophytes and Hoffa synovitis. An increased patellar tilt angle (increased lateral tilt) was correlated with patellar cartilage irregularities and patellar osteophytes. Table III. There was a remarkable correlation between an increased sulcus angle (a shallower trochlea) and patellar osteophytes.

Sulcus angle was correlated with usual pain during running. Table IV. Aged patients were correlated with a smaller patellar tilt angle ($P < 0.05$) and smaller sulcus angle ($P < 0.05$). Females were correlated with larger patellar tilt angle ($P < 0.05$) and increased IS ratio ($P < 0.05$). Clinical features period more than 2 years was correlated with increased IS ratio ($P < 0.05$), smaller sulcus angle ($P < 0.05$) and smaller trochlear angle ($P < 0.05$). Bilateral PFP was correlated with a larger patellar tilt angle ($P < 0.05$), increased IS ratio ($P < 0.05$) and smaller trochlear angle ($P < 0.05$).

Table I. Patients characteristics.

		GI	GII	P
NO.		50	55	
Age(yrs)median(range)		21 (18-26)	47 (46-55)	<0.05
Gender	M	23(46%)	20(36.4%)	
	F	27(54%)	35(63.6%)	
Knee pain		Peri or retropatellar induced by activity or lengthened flexed knee sitting PFP period more than 60 days and less than 24 months	Ant or retropatellar induced by activity during most days within the previous 30 days Intensity of 3 on verbal analog scale during activity PFP period more than 90 days	
AKPS(0-10)		6.04	5.31	<0.05
Pain period				<0.05
	< 6 months	16(32%)	4(7.3%)	
	6 months - <2 yrs	32(64%)	15(27.3%)	
	> 2yrs	2(4%)	36(65%)	
Pain Site:	Bilateral	26(52%)	38(69.1%)	<0.05
	unilateral	24(48%)	17(30.9%)	
Pain intensity (median)0-10				
	Usual	2.80	1.43	<0.05
	worst	5.46	2.74	<0.05

AKPS, Anterior Knee Pain Scale.

Table II. Anatomical configuration irregularities on MRI.

	GI	GII	P
MOAKS score			
Patellar cartilage irregularities	12(24%)	6(10.9%)	<0.05
Patellar osteophytes	35(70%)	32(58.2%)	<0.05
Hoffa synovitis	28(56%)	35(63.6%)	
Configuration recordings			
Insall-Salvati ratio	1.10	1.13	<0.05
Patellar tilt angle	7.2	7.6	
Sulcus angle	115.2	110.6	<0.05
Lateral patellar tilt angle	10.34	9.46	
Trochlear angle	1.04	-0.10	<0.05

MOAKS, Magnetic Resonance Imaging Osteoarthritis Knee Score.

Table III. Correlation between configuration MRI irregularities and anatomical configuration recordings.

	Patella cartilage irregularities	Patellar osteophytes	Hoffa synovitis
Patellar tilt angle	0.8	0.82	0.74
Insall Salvati ratio	9.4	49.6	58.1
Sulcus angle	0.76	0.88	0.82

Trochlear angle	1.02	0.85	1.05
------------------------	------	------	------

Table IV. Correlations between PFP pain and anatomical configurations.

	AKPS(lengthened sitting)		AKPS
	Usual pain 0-10	Pain after exercise	Pain on running
Patellar tilt angle	0.03	0.85	0.86
Insall salvati ratio	-7.34	0.24	10.26
Sulcus angle	0.67	0.86	1.01
Trochlear angle	-0.70	0.95	0.98

Discussion

There is a clear correlation between patellofemoral joint configuration and anatomical irregularities of the patellofemoral joint in patients with PFP. Increased IS ratio (patella alta), increased patellar tilt angle (increased lateral tilt) and increased sulcus angle (a shallow trochlea) had increased signs of patellofemoral osteoarthritis on MRI, as patellar osteophytes and cartilage irregularities. Age, gender, period of PFP and bilateral PFP were correlated with malconfiguration of the patellofemoral joint.

An increased IS ratio(patella alta) had the most correlation with configuration irregularities of the patellofemoral joint, as patellar osteophytes and Hoffa synovitis. IS ratio as a recording of configuration in aged patients is correlated with patellofemoral joint abnormality ⁽¹¹⁾. Abnormal lateral patellar is more common in patients with PFP with patella alta in comparison to patients having PFP with normal patellar height ⁽¹⁴⁾. An increased IS ratio was a risk factor for patellofemoral cartilage distruction and bone marrow insults over 2.5 years ⁽⁵⁾. There is a positive correlation between an increased IS ratio and Hoffa synovitis . Fat pad is an active joint tissue which modulates inflammatory and destructive reactions in knee osteoarthritis ⁽⁵⁾. Markers of patellar instability were correlated with superolateral Hoffa fat pad edema in patients with knee pain ⁽¹⁴⁾. Abnormal configuration can lead to increased signal intensity of the fat pad, meaning fat pad edema and synovitis.

Increased lateral patellar location (tilt displacement) was correlated with increased configuration irregularities on MRI in the patellofemoral joint. Abnormal patellar configuration may decrease the contact area between the patella and trochlea, increasing patellofemoral joint stress in the lateral patellofemoral joint ⁽¹⁵⁾. Increased stress of the patellofemoral joint may decrease patellar cartilage thickness ⁽¹⁶⁾. Patellofemoral joint configuration can increase patellofemoral joint stress, as increased lateral patellar tilt angle was correlated with cartilage irregularities of the patella. In patellofemoral osteoarthritis patients, there were correlations between knee configuration and MRI findings of patellofemoral OA ⁽¹⁷⁾. Patellofemoral malconfiguration can cause increase patellofemoral joint stress, with structural configuration modifications in the joint (early OA signs). Patients with increased clinical features period and bilateral PFP had an increased IS ratio and increased sulcus angle in comparison to patients with reduced clinical features period and unilateral knee pain. There is subgroup of PFP patients liable to delayed patellofemoral osteoarthritis, because these configuration recordings are correlated with patellar osteophytes.

PFP patients with patella alta or a shallow trochlea can develop more continuous clinical features ⁽¹⁸⁾. Patella alta and lateral patellar tilt can benefit from nonoperative techniques ⁽¹⁹⁾. Patients recruited in group I were younger with less clinical features period, but with worse pain in comparison to patients in group II. There was strong correlations between configuration recordings and shape irregularities ^(20,21).

In Conclusion

For patients with PFP, some configuration recordings—as increased IS ratio (patella alta) and increased patellar tilt angle (increased lateral tilt) are correlated with patellar osteophytes, cartilage irregularities or Hoffa synovitis.

References

1. **Wood L, Muller S, Peat G.** The epidemiology of patellofemoral disorders in adulthood: a review of routine general practice morbidity recording. *Prim Health Care Res Dev.* 2011;12(2):157-64
2. **Berna DM , Merve G , Hikmet K.** Magnetic Resonance Imaging of the Patellofemoral Joint. *Turk J Phys Med Rehab* 2015;61:261-71.
3. **Crossley KM, Callaghan MJ, van Linschoten R.** Patellofemoral pain. *BMJ.* 2015;351:H3939.
4. **Thuillier DU, Souza RB, Wu S, et al.** T1rho imaging demonstrates early changes in the lateral patella in patients with patellofemoral pain and maltracking. *Am J Sports Med.* 2013; 41(8):1813-8.
5. **Hadeer SF ,Nivan HK ,Nahed MN ,et al.** Role of MRI in assessment of patello-femoral derangement in patients with anterior knee pain. *The Egyptian Journal of Radiology and Nuclear Medicine* 2016; 47(4) : 1485-92.
6. **Collins NJ, Bierma-Zeinstra SM, Crossley KM,et al.** Prognostic factors for patellofemoral pain: a multicentre observational analysis. *Br J Sports Med.* 2013;47(4):227-33.

- 7. Marienke VM, Erin MM, Joost FE, et al.** Are Patellofemoral Joint Alignment and Shape Associated With Structural Magnetic Resonance Imaging Abnormalities and Symptoms Among People With Patellofemoral Pain? *Am J Sports Med.* 2018 Nov; 46(13): 3217–26.
- 8. Collins NJ, Vicenzino B, van der Heijden RA, et al.** Pain during prolonged sitting is a common problem in persons with patellofemoral pain. *J Orthop Sports Phys Ther.* 2016;46(8):658-63.
- 9. Hunter DJ, Guermazi A, Lo GH, et al.** Evolution of semi-quantitative whole joint assessment of knee OA: MOAKS (MRI Osteoarthritis Knee Score). *Osteoarthritis Cartilage.* 2011;19(8):990-1002.
- 10. van der Heijden RA, de Kanter JL, Bierma-Zeinstra SM, et al.** Structural abnormalities on magnetic resonance imaging in patients with patellofemoral pain: a cross-sectional case-control study. *Am J Sports Med.* 2016;44(9):2339-46.
- 11. Stefanik JJ, Zumwalt AC, Segal NA, et al.** Association between measures of patella height, morphologic features of the trochlea, and patellofemoral joint alignment: the MOST study. *Clin Orthop Relat Res.* 2013;471(8):2641-8.
- 12. Wittstein JR, Bartlett EC, Easterbrook J, et al.** Magnetic resonance imaging evaluation of patellofemoral malalignment. *Arthroscopy.* 2006;22(6):643-9.
- 13. Munch JL, Sullivan JP, Nguyen JT, et al.** Patellar articular overlap on MRI is a simple alternative to conventional measurements of patellar height. *Orthop J Sports Med.* 2016;4(7).
- 14. Eijkenboom JFA, Waarsing JH, Oei EHG, et al.** Is patellofemoral pain a precursor to osteoarthritis?: Patellofemoral osteoarthritis and patellofemoral pain patients share aberrant patellar shape compared with healthy controls. *Bone Joint Res.* 2018; 3;7(9):541-7.
- 15. Macri EM, Felson DT, Zhang Y, et al.** Patellofemoral morphology and alignment: reference values and dose–response patterns for the relation to MRI features of patellofemoral osteoarthritis. *Osteoarthritis and Cartilage* 2017;25(10): 1690-7.
- 16. Callaghan MJ, Guney H, Reeves ND, et al.** A knee brace alters patella position in patellofemoral osteoarthritis: a study using weight bearing magnetic resonance imaging. *Osteoarthritis Cartilage.* 2016;24(12):2055-60.
- 17. Chang CB, Han I, Kim SJ, et al.** Association between radiological findings and symptoms at the patellofemoral joint in advanced knee osteoarthritis. *J Bone Joint Surg Br.* 2007;89(10):1324-8.
- 18. Kalichman L, Zhu Y, Zhang Y, et al.** The association between patella alignment and knee pain and function: an MRI study in persons with symptomatic knee osteoarthritis. *Osteoarthritis Cartilage.* 2007;15(11):1235-40.
- 19. Chhabra A, Subhawong TK, Carrino JA .** A systematised MRI approach to evaluating the patellofemoral joint. *Skeletal Radiol.* 2011;40(4):375-87.
- 20. Pal S, Besier TF, Beaupre GS, et al.** Patellar maltracking is prevalent among patellofemoral pain subjects with patella alta: an upright, weightbearing MRI study. *J Orthop Res.* 2013;31(3):448-57.
- 21. Ty K. S, John E, John AC et al.** Superolateral Hoffa's Fat Pad Edema: Association With Patellofemoral Maltracking and Impingement. *American J of Roentgenology.* 2010; 195 (5):1367-73.