Methods: from a large database of 40.351 pelvic radiograms and CT scans, we selected 988 individuals aged between 15 and 60 years which underwent both AP radiographs and CT scans of the pelvis. Eligibility criteria were applied in order to achieve a sample as more representative as possible of adult general population without any hip disease: in particular advanced OA or joint line narrowing < 2mm, avascular necrosis of the femoral head, fractures, tumors, rheumatic patologies, classic dysplasia (L-CEA < 20°), clinical diagnosis of FAI or groin pain, were excluded from the present study. We also excluded patients in which open growth plates, osteopenia, hardwares or evidence of prior surgery were present. This left an overall population of 118 individuals (56 females, 62 males; mean age 33 years; 236 hips) available for the study. All plain radiographs were assessed for pelvic tilt, based on Siebenrock criteria: radiographs that met these criteria were included for analysis of radiographic signs of acetabular version (cross-over sign, prominence of the ischial spine sign, posterior wall sign). L-CEA and presence of coxa profunda or protrusio were assessed in all cases. On CT scans central and cranial anteversions (AV) were evaluated and the relationship between these parameters was investigated. In addition, a note was made on the presence of radiological signs of labral or chondral degeneration.
Results: Mean central acetabular AV was 18.3° ± 5.0°, while mean cranial acetabular AV was 9.8° ± 7.8°. Central and cranial acetabular AV were found to be higher in women (P<0.0005 and P<0.006 respectively) and significantly increased with age (P<0.001), together with L-CEA. We found a linear correlation between central and cranial AV and we developed a mathematical model to discriminate between global RV and isolated OH. According to our calculations, pincer-type deformities were found in 55 hips (23.3%). CP was found in 10.5% of cases, PA in 2.1% OH in 5,5%, RV in 5.1%. No correlation were found between presence of pincer-type deformities and presence of early radiological signs of labral or chondral degeneration. Radiographic signs of acetabular version showed good sensitivity but poor specificity in detecting central or cranial RV.
Conclusions: Pincer-type deformities seem to be common among general population. Relationship with radiological signs of chondral and labral degeneration is poor, suggesting that other factors are more important in determining the early onset of hip OA. Age-related changes in acetabular morphology could imply that pincer-deformities are involved in late onset of hip OA.

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THE ASSOCIATION BETWEEN MENISCAL DAMAGE OF THE POSTERIOR HORNS AND POSTERIOR LOCALIZED SYNOVITIS DETECTED ON T1-WEIGHTED CONTRAST-ENHANCED MRI: THE MOST STUDY

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Purpose: Synovitis in OA is thought to be a secondary phenomenon related to intraarticular tissue damage. An association between MRI-detected meniscal damage and increased prevalence of whole-knee synovial activation has been described using non-enhanced MRI but it is unknown whether local structural damage triggers synovitis nearby. The most frequent location of meniscal damage is the posterior horn of the medial meniscus, and nearby anatomical synovitis locations include perimeniscal synovitis and synovitis posterior to the posterior cruciate ligament (PCL). The latter is the most prevalent site of synovitis in OA knees. Posterior horn meniscal damage could be associated with synovitis posterior to the PCL or with perimeniscal synovitis.
Aim was to assess the cross-sectional associations between posterior horn meniscal damage with posterior perimeniscal synovitis, and with synovitis posterior to the PCL/predominantly posterior whole knee synovitis using contrast enhanced (CE) MRI as only assessment of synovitis on CE MRI correlates with microscopically proven synovitis.
Methods: The Multicenter Osteoarthritis (MOST) Study is a longitudinal observational study of subjects with or at risk for knee OA. Subjects are a subset of MOST who were examined with CE MRI at the 30 months visit and had whole-knee synovitis and meniscal readings available. Synovitis was assessed semiquantitatively from 0-2 at 11 different locations according to a validated scoring system including the sites around the medial and lateral posterior horns (=perimeniscal medial/lateral) and posterior to the PCL. A synovitis score ≥1 was defined as synovitis presence. A separate analysis was performed looking at severe synovitis only. Synovitis was defined as predominantly posterior in location when any of the three posterior locations had a synovial thickness score of grade 2 and no other sites had scores of grade 2. Meniscal damage of the posterior horns was scored according to WORMS from 0-4.
Logistic regression was used to assess the association of perimeniscal synovitis (outcome) and posterior meniscal damage in the same compartment (predictor). In addition we examined the association between synovitis posterior to the PCL and predominantly posterior whole knee synovitis (outcome) and perimensical damage (predictor). Adjustment was performed for age, gender, radiographic OA and body mass index.
Results: 377 knees (one knee/subject) were included (mean age 61.1 years±6.9, mean BMI 29.6±4.9, 44.3% women). The odds for any ipsi-compartmental perimensical synovitis were increased for knees with medial posterior horn meniscal damage (Table 1), but not for lateral damage (aOR 1.7, 95%CI 0.4,6.6). The odds for severe perimensical synovitis were markedly increased for both, medial (aOR 3.8, 95%CI 1.1,13.0) and lateral (aOR 5.4, 95%CI 1.3,22.7) posterior horn meniscal damage. No positive associations were found for presence of synovitis posterior to the PCL (aOR 0.9, 95%CI 0.6,1.5) and predominantly posterior whole-knee synovitis (aOR 2.1, 95%CI 0.9,5.1) for knees with posterior meniscal damage using knees without posterior meniscal damage as the reference.
Conclusions: Posterior perimeniscal synovitis is associated with ipsi-compartmental damage of the posterior horn suggesting that local structural damage may cause synovitis nearby. No associations were found for posterior horn meniscal tears with synovitis posterior to the PCL and predominantly posterior whole-knee synovitis. This suggests that presence of PCL synovitis is likely to be triggered by different pathomechanisms than meniscal damage.

Table 1A. Cross-sectional association of medial posterior horn meniscal damage and any perimensical synovitis

Medial posterior horn meniscal damage (predictor)		Any medial perimensical synovitis (outcome)		Crude OR[1]	Adjusted OR[2]
	Total number of knees	<2mm (%)	≥2mm (%)	OR (95% CI[3]) p-value	OR (95% CI) p-value
Absence	(N=253)	221 (87.4)	32 (12.7)	1.0 (reference)	1.0 (reference)
Presence	(N=123)	90 (73.2)	33 (26.8)	2.5(1.5,4.3) 0.0009	2.5(1.3,4.8) 0.007
0	(N=253)	221 (87.4)	32 (12.7)	1.0 (reference)	1.0 (reference)
1	(N=18)	13 (72.2)	5 (27.8)	2.6(0.9,7.9) 0.08	2.7(0.8,8.5) 0.095
2	(N=60)	44 (73.3)	16 (26.7)	2.5(1.3,4.9) 0.008	2.6(1.2,5.5) 0.015
3 and 4	(N=45)	33 (73.3)	12 (26.7)	2.5(1.2,5.3) 0.017	2.1(0.8,5.5) 0.133

Table 1B. Cross-sectional association of medial posterior horn meniscal damage and severe perimensical synovitis

Medial posterior horn meniscal damage (predictor)		Medial severe perimensical synovitis (outcome)		Crude OR[1]	Adjusted OR[2]
	Total number of knees	<=4mm (%)	>4mm (%)	OR (95% CI[3]) p-value	OR (95% CI) p-value
Absence	(N=253)	246 (97.2)	7 (2.8)	1.0 (reference)	1.0 (reference)
Presence	(N=123)	114 (92.7)	9 (7.3)	2.8 (1,7.6.0) 0.049	3.8 (1.1,13.0) 0.037
0	(N=253)	246 (97.2)	7 (2.8)	1.0 (reference)	1.0 (reference)
1	(N=18)	17 (94.4)	1 (5.6)	2.1 (0.2,17.7) 0.511	2.2 (0.2,21.1) 0.506
2	(N=60)	55 (91.7)	5 (8.3)	3.2 (1.0,10.4) 0.055	4.9 (1.2,19.5) 0.026
3 and 4	(N=45)	42 (93.3)	3 (6.7)	2.5 (0.6,10.1) 0.197	3.3 (0.5,20.6) 0.205

[2]adjusting for age, sex, BMI, radiographic OA
[1]OR – odds ratio, [3]CI- confidence interval

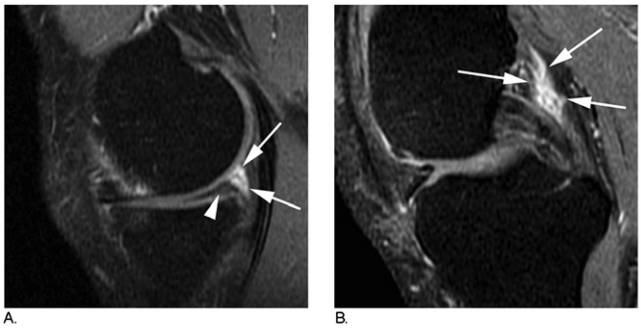

Figure 1. Examples of posterior synovitis. A. Horizontal medial posterior horn meniscal tear (arrow-head) and marked (grade 2) surrounding perimeniscal synovitis (arrows). B. Marked synovitis posterior to the posterior cruciate ligament (arrows).

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MORPHOLOGICAL MEASURES OF FEMUR AND PELVIS ON PLAIN RADIOGRAPHS AS RISK FOR HIP OSTEOARTHRITIS

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Purpose: Variation in morphology in the proximal femur and pelvis (e.g. acetabular dysplasia, non-spherical femoral head) can biomechanically compromise the hip joint and predispose to osteoarthritis (OA). Such morphological variation may in part explain the heritability of hip OA. The objective of this study was to evaluate a range of 2-dimensional morphological measures on standard radiographs to determine: [1] normal range, right: left symmetry, age and gender differences; and [2] whether they are independent risk factors for hip OA.

Method: A nested case control study was undertaken in 566 unilateral hip OA cases and 1108 controls in the established Nottingham Genetics of Osteoarthritis and Lifestyle (GOAL) database. Unaffected hips of hip OA cases were compared to the same side hips of controls. We assumed that the unaffected hip values in cases reflect the original measures on the affected side prior to development of OA. Definition of radiographic hip OA was joint space width (JSW) $\leq$ 2.5 mm. Standardized antero-posterior radiographs of pelvis were used to measure 10 morphological features (Table 1). The measurements were performed by single observer and the reproducibility was evaluated at baseline, mid and end of the study. Normal values, thresholds (mean$\pm$1.96SD) and symmetry of the features were derived from the control subjects. The intra-observer reliability and symmetry between right and left hip were examined using intra-class correlation coefficient (ICC). The relative risk of hip OA associated with each measure was estimated using odds ratio (OR) and 95% confidence interval (CI). Logistic regression was used to adjust for age, gender and body mass index (BMI). Measurements were divided into tertiles to examine dose response.

Results: The ICC for intra-observer reliability was very good for all the measurements (ICC >0.84). In controls all morphological measures were symmetrical between right and left (ICC ranged from 0.80-0.95). Men had greater measures than women, except for neck shaft angle which was bigger in women. Age and BMI were associated with some but not all measures, whereas height was positively associated with all apart from sourcil angle and neck shaft angle.

Between cases and controls, smaller femoral head diameter, neck length, outer shaft diameter, inner shaft diameter and pelvic width were associated with greater risk of hip OA, whereas a larger sourcil angle was associated with increased risk of hip OA (Table 1). The measures with no dose response were re-analysed using tertile 2 as a reference under the assumption of either small or large measures would increase the risk of hip OA - the U curve relationship. However, we did not find any significant U curve association based on the tertile, but the thresholds of mean$\pm$ 1.96SD, where either lower or higher neck shaft angle was a risk factor of hip OA (Fig 1).

Conclusion: All morphological measurements are symmetrical between right and left hips but, as expected, differ between men and women. Several variations in morphology of femoral and pelvic bones that are easily measurable on standard radiographs appear to be risk factors for hip OA. The risk increases as femoral head diameter, neck length, outer shaft diameter, inner shaft diameter and pelvic width decrease and as sourcil angle increase, whereas both extremes of neck shaft angle confer risk. Prospective studies are required to confirm these findings.

Table 1: Morphological features and the risk of hip OA

	Odds ratio (95% confidence interval)			
	Tertile 1	Tertile 2	Tertile 3	p trend
Head diameter (HD)	1	0.53 (0.38-0.74)	0.32 (0.18-0.59)	0.001
Neck width (NW)	1	0.88 (0.64-1.23)	1.01 (0.54-1.89)	0.239
Neck length (NL)	1	0.76 (0.58-0.99)	0.63 (0.48-0.83)	0.001
Outer shaft diameter (OSD)	1	0.64 (0.47- 0.86)	0.50 (0.35- 0.71)	<0.001
Inner shaft diameter (ISD)	1	0.71 (0.55- 0.93)	0.38 (0.28-0.51)	<0.001
Mid-centre distance (MCD)	1	0.92 (0.69-1.19)	1.33 (1.03-1.73)	0.023
Sourcil angle (SA)	1	2.06 (1.52-2.79)	6.86 (5.09-9.26)	<0.001
Neck shaft angle (NSA)	1	0.78 (0.60-1.02)	0.93(0.72-1.22)	0.606
Pelvic width (PW)	1	0.63 (0.48-0.84)	0.57 (0.43-0.76)	<0.001
Pelvic height (PH)	1	0.67 (0.49-0.93)	0.74 (0.49-1.12)	0.05

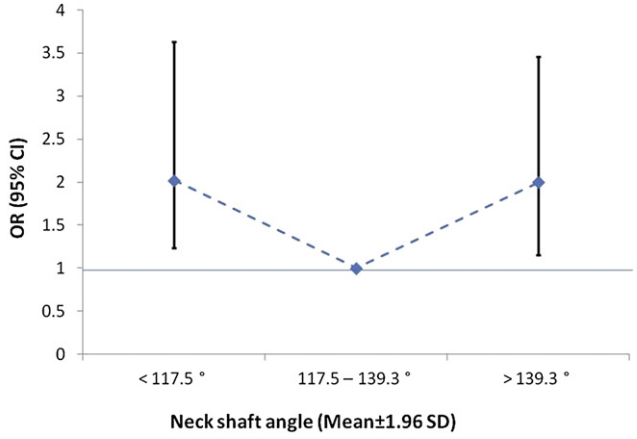

Figure 1 : Neck shaft angle (NSA) and risk of hip OA

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THE ASSOCIATION OF MRI-DETECTED SUBCHONDRAL BONE MARROW SCLEROSIS WITH CARTILAGE LOSS IN A COHORT OF SUBJECTS WITH KNEE PAIN.

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Purpose: The role of subchondral bone marrow edema-like lesions (BMLs) for incidence and progression of adjacent cartilage damage in subjects with or at risk for knee osteoarthritis (OA) is well known, but little information is available regarding the role of subchondral bone marrow sclerosis (SS) in regard to adjacent cartilage, independently of the presence of edema-like BMLs. Histologically, BMLs and SS exhibit similar features including trabecular bone abnormalities, fibrosis and necrosis. Thus, the aim of this study was to assess the association of magnetic resonance imaging (MRI)-detected subchondral sclerosis with cartilage loss over time in the same region of the knee in a cohort of subjects with knee pain.

Methods: A population-based sample 163 subjects (1 knee per subject) with knee pain participated in a longitudinal study to assess knee osteoarthritis progression (KOAP study). Subjects received baseline knee