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Research Article

Prevalence of Compartmental Osteoarthritis of the Knee in an Adult Patient Population: A Retrospective Observational Study

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Abstract

Objective: The aim of this study is to observe the prevalence of OA within the various compartments of the knee in an adult patient population at two centres in the UK to help inform future treatment strategies.

Design: A retrospective observational study included analysis of 3524 knee arthroscopies performed at a teaching hospital (TH) and a District General Hospital (DGH) in the UK between 1999 and 2010. Inclusion criteria included arthroscopies performed for mechanical reasons by two orthopaedic surgeons. Exclusion criteria included knee washouts and diagnostic arthroscopies. The degree of OA was documented for each patient by a single orthopaedic surgeon as per the Bauer M., Jackson RW classification [1].

Results: 3524 knee arthroscopies were included for analysis with a mean age of 38.3 years (SD = 13.15 years) and a male to female ratio of approximately 3:1. 2626 arthroscopies (74.5%) were performed at the TH and 898 (25.5%) at the DGH. 2.8% of cases undertaken were bilateral arthroscopies. There was evidence of degenerative changes in 1048 knees (29.7%). The prevalence of unicompartmental OA was 4.5% medially, 1.4% laterally, 4.9% patello-femoral joint (PFJ), 10.8% combined medial and PFJ, 4.5% combined lateral and PFJ, 2.1% combined medial and lateral, and 1.5% tricompartmental involvement.

Conclusion: The prevalence of tricompartmental OA is low and hence the role of total knee replacement for all cases with knee arthritis is questionable. Arthroscopic assessment can help identify the presence of single compartment degenerative changes and help guide the role of other treatment options such as unicompartmental knee replacement.

Keywords: *Knee Joint; Arthroscopy; Osteoarthritis; Compartmental; Prevalence*

Introduction

Knee pain is a well recognised patient symptom with approximately 1 in 4 over the age of 55 years experiencing this on most days of the month [2]. Although almost 50% of these patients may have radiographic features of arthritis, it may be difficult to establish whether changes affect all three compartments [2]. Clinical history and examination may be helpful in identifying the extent of disease process, but there is no imaging modality that has 100 percent sensitivity and specificity in identifying compartmental OA. Magnetic resonance imaging (MRI) is more sensitive than radiographs and computed tomography (CT) for assessing the severity of early arthritic changes

in the knee [3]. However, arthroscopy remains the gold standard for assessing established compartmental arthritis which can influence surgical treatment options [3].

Management of knee OA includes conservative and surgical options. Conservative options include analgesia, physiotherapy, weight loss, use of walking aids, compartment off-load braces, and therapeutic intra-articular steroid injections. Surgical management options include total knee arthroplasty, unicompartmental knee replacement, and the possibility of tibial/femoral osteotomy where concerns with lower limb mechanical axis co-exist [4]. Unicompartmental knee replacements have a role in single compartment OA with reported good outcomes (16% revision risk at 13 years) [5] and can be a good option in the younger patient population to delay the need for a total knee replacement. The UK National Joint Registry (NJR) has quoted a total knee replacement revision risk of approximately 10% at 13 years for patients under 55 years of age [5]. This highlights the need for accurate assessment of compartmental arthritis in ensuring the best treatment option is selected.

Methods

This was a retrospective observational study performed at two centres in the UK. 3524 knee arthroscopies were performed between 1999 and 2010 by two consultant orthopaedic surgeons. These comprise of 2626 cases (74.5%) performed at Northern General Hospital in Sheffield and 898 cases (25.5%) performed at Walsall Manor Hospital in Walsall during the study period. Inclusion criteria also included arthroscopies that were performed for mechanical symptoms. Mechanical symptoms included knee locking, or giving way. Patients had an MRI of the knee prior to their arthroscopy which suggested a structural cause for their symptoms. Exclusion criteria included knee washouts for infection and diagnostic arthroscopies.

Data was collected from a central database of patients retained by a single surgeon across both centres that met the above inclusion criteria. The degree of OA was documented for each patient as per the Bauer M, Jackson RW classification [1]. This is a classification system describing the type of chondral lesions ranging from type 1 to type 6 as described in table 1.

Type	Configuration
1	Linear
2	Stellate
3	Flap
4	Crater
5	Fibrillation
6	Degrading

Table 1: *Bauer and Jackson classification of chondral lesions of the knee.*

Statistical analysis

A Pearson's chi-square test was performed to test whether the observed prevalence of OA in the different compartments differs from our null hypothesis. A p-value of less than 0.05 was considered significant.

Results

A total of 3524 knee arthroscopies were analysed with 2.8% of cases (n = 99) being bilateral. The mean age of patients was 38.3 years (SD = 13.15 years, range 14 - 80 years) with a male to female ratio of approximately 3:1. This demographic information is summarised in table 2.

		Number (%)
Centre	Northern General Hospital (Teaching Hospital)	2626 (74.5)
	Walsall Manor Hospital (District General Hospital)	898 (25.5)
Knee arthroscopies	Unilateral	3425 (97.2)
	Bilateral	99 (2.8)
	Total	3524
Gender	Male	2195 (62.3)
	Female	1325 (37.7)

Table 2: *Basic demographic information in the study.*

The grade of OA was recorded using the Bauer M, Jackson RW classification [1]. There was direct evidence of degenerative changes on arthroscopy in 1048 knees (29.7%). The prevalence of isolated OA was 4.5% medially (n = 159), 1.4% laterally (n = 49), and 4.9% in the patellofemoral joint (n = 173). The medial compartment and PFJ was involved in 10.8% of cases (n = 381), lateral compartment and PFJ was involved in 4.5% (n = 159), and both medial and lateral compartments in 2.1% (n = 74). The prevalence of tricompartment OA was 1.5% (n = 53). This data is summarised in table 3.

Compartment	Number of cases (%)
Medial	159 (4.5)
Lateral	49 (1.39)
Patellofemoral	173 (4.9)
Medial and patellofemoral	381 (10.8)
Lateral and patellofemoral	159 (4.5)
Medial and lateral	74 (2.1)
Tricompartmental	53 (1.5)

Table 3: *Prevalence of compartmental arthritis of the knee (n = 3524).*

A chi-square test was performed (Table 4) which shows there is a significant variation in the prevalence of osteoarthritis in the knees in our patient population ($\chi 2$ with 5 degrees of freedom = 594.56, p = < 0.001).

	Value	Df	P-value
Pearson Chi-Square	594.56	5	< 0.001

Table 4: *Chi-Square statistical analysis.*

Discussion

The provision of joint replacement surgery in English NHS hospitals has increased substantially over the past decade [6]. 4.71 million people in the UK have sought treatment for their knee arthritis [7]. The number of people with OA of the knee is estimated to increase to 6.5 million by 2020 factoring in the ageing population and increasing obesity [7]. The National Joint Registry (2017 14th edition) quoted revision risk of approximately 10% at 13 years for primary total knee arthroplasty for patients under 55 years of age [5]. These figures suggest that in the younger cohort of patients, conservative or other intermediate surgical options such as unicompartmental knee replacement or tibial/femoral osteotomy where alignment problems co-exist, may be favoured prior to proceeding to total knee arthroplasty. This highlights the need for accurate assessment of compartmental arthritis where the gold standard remains arthroscopy [3]. In our study, patients had an MRI scan of their knee prior to being listed for their arthroscopy. Only patients with confirmed structural abnormalities (for example meniscal tear) were offered an arthroscopy.

The incidence of OA of the knee remains on the rise with the ageing population and increasing levels of obesity globally [2,7]. Progressive cartilage degeneration can result in malalignment of the joint [2]. Consequently, unbalanced mechanical loading leads to deterioration of the joint [2]. The knee joint is made up of three compartments: The medial tibiofemoral, lateral tibiofemoral, and the patellofemoral. Any of these compartments can be a source of pain in patients with osteoarthritis [2]. Radiological studies have demonstrated that approximately 90% of OA of the knee showed initial changes in the medial compartment [8]. Our study has shown that the medial and patellofemoral joint are the most prevalent compartments. Although uncommon, unicompartmental arthritis is a well recognised occurrence.

Clinically, patellofemoral joint arthritis contributes to the initial knee pain and functional limitation in arthritis [9]. Progression to the lateral compartment is often associated with rupture of the anterior crucial ligament [6,10]. As previously iterated, the resultant instability and abnormal kinematics from the progressive arthritis leads to eventual development of tricompartmental arthritis. However, our study has shown that true tricompartmental arthritis is a rare occurrence in comparison to unicompartmental and bicompartmental arthritis.

Our study shows that the medial and patellofemoral compartments have the highest prevalence of OA (4.5% and 4.9% respectively). Their combined prevalence in the same patient population is 10.8%. In contrast, the prevalence of tricompartmental arthritis was only 1.5%. Our data shows that isolated compartment osteoarthritis does occur which may suggest a role for unicompartmental knee replacements in a select group of patients. The ideal clinical indication would be for single compartmental arthritis and subject to meeting essential criteria. These criteria include having a knee mechanical axis that deviates no more than 5 degrees for a valgus knee and no more than 10 degrees for a varus knee [11]. The knee should be passively correctable and the ACL must be intact [11]. Additionally, there should be no signs of subluxation of the femur on the tibia [11].

Total knee arthroplasty is successful in managing end-stage arthritis but is associated with significant complications [12]. This includes post-operative pain, prolonged rehabilitation period, and other systematic complications [12]. According to Brown., *et al.* total knee arthroplasties are associated with significantly higher complication rates in comparison to unicompartmental knee arthroplasties [12]. This includes high risk of requiring ITU admission, higher transfusion risk, and higher risk of being discharged to a rehabilitation

facility post-operatively [12]. In contrast, patients who undergo unicompartmental knee arthroplasty have less complication rates and shorter hospital length of stay [12]. A study by Naal., *et al.* demonstrated that patients treated by unicompartmental knee arthroplasty had a superior rate of return to activity in comparison to total knee arthroplasty [13]. Unicompartmental knee arthroplasty has seen a resurgence in the 1990s with quoted implant survival of over 10 years [14,15]. The NJR reports outcomes following unicompartmental knee replacements with a 16% revision risk at 13 years [5]. This can be a good option in the younger patient population to prolong the need for a total knee replacement where the 13-year revision risk can be in the region of 10% [5].

Our study has a number of limitations. Firstly, the study is based on a region that may not reflect environmental strains on the knee joint compared to other geographical areas. For example, one would expect a more active patient population in a region that allows for more physical activities. Secondly, only patients with mechanical knee symptoms were included for analysis. There are a proportion of patients who may only have pain as a symptom of their knee arthritis with no mechanical symptoms which would have not been reflected in this study. It is important to note that the factors causing pain in arthritis are not well understood [16]. Hunter., *et al*. conclude that the pain is best understood in a biopsychosocial model [16]. Many nociceptive fibres are contained within the knee soft tissue structures which can have significant contribution to the symptomology of arthritis [16]. 91% of patients with symptomatic arthritis have been found to have an associated meniscal tear [16]. However, 67% of asymptomatic patients were also found to have a meniscal tear [16]. A study by Maly., *et al*. suggests that mechanical symptoms could be contributing to the pain in arthritic knees but it is difficult to ascertain the direct contribution [17]. A study by Raynauld., et al. concluded that there are common attributes which lead to quick progression of OA in patients, such as; older age, and high BMI [18]. However, there is still uncertainty regarding patients with a slow disease progress and these patients have very subtle signs and symptoms [18]. Therefore, there is variation in knee symptoms related to OA which may be attributed to factors not directly related to the knee itself [19]. A study by Neogi., *et al*. suggest that the variability in knee pain in OA can be related to the patient's adaptation to that level of pain over time [20]. We believe our study adds valuable prevalence data that can help inform future treatment strategies.

Conclusion

In our retrospective observational study, we have shown that isolated compartmental osteoarthritis does occur. The prevalence of tricompartmental osteoarthritis is very low which suggests that total knee arthroplasty may not have a role for every patient with knee arthritis. We believe that in a select group of patients, unicompartmental knee arthroplasty can be a good management option.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical Approval

No ethical approval was required for this study as this was a retrospective observational study which relied on the normal clinical practices in the United Kingdom.

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