OSTEOARTHRITIS OF KNEE

Version 2 Final

Document control

Version history

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Changes since last version

General Information

The knee is a complex joint consisting of three major compartments - the medial and lateral tibiofemoral joints and the patellofemoral joint.

Osteoarthritis can affect each of these areas separately or in combination.

Aetiology

The classification system dividing osteoarthritis into primary and secondary forms and its shortcomings have already been discussed (see Osteoarthritis - General). The knee joint is most often affected by secondary causes, particularly trauma.

The two major pathogenic mechanisms in the aetiology of osteoarthritis are:

1. Those factors influencing a generalised predisposition and
2. Those affecting biomechanical loading.

The knee joint is particularly susceptible to biomechanical forces (loading) and in a normal knee the load line passes through the centre of the tibiofemoral joint.

The menisci of the knee are important structures for maintaining a healthy joint because they absorb shock and prevent rotatory instability. Their composition and shape allow the tibial plateau contact area to be increased three-fold thereby decreasing the stress on this area by up to seven times [1].

During activity the medial compartment takes the maximum force with loading of the patellofemoral joint when the knee is in flexion.

Any subtle alteration in load bearing can be a major predisposing cause of osteoarthritis of the knee; the commonest cause of such an alteration is trauma either as a single episode or multiple minor repetitive insults to the articular cartilage.

The risk for knee osteoarthritis increases with increasing body weight, long-term occupational joint stresses (particularly occupations involving regular knee bending and heavy lifting [2, 3]) and trauma. [4]

Trauma to the articular surface can be due to instability due to ligamentous ruptures, incongruity of the articular surfaces following intra-articular fracture, the presence of meniscal fragments or loose bodies, malalignment due to congenital tibia vara, trauma from overuse and obesity.

Iatrogenic traumatic causes include the degenerative changes that occur after removal of menisci, non-isometric placement of an artificial knee joint and even prolonged immobilisation.

Patellofemoral and tibiofemoral osteoarthritis appear to have different associations and consequences and muscle strength and psychosocial factors seem to be the key determinants of pain and disability. [5]

In Great Britain one in four people over the age of 55 years have knee pain and by the age of 65 years 30% of men and 40% of women have the radiographic changes (of all grades 1-4) associated with osteoarthritis of the knee.

Among U.S adults 30 years of age or older, symptomatic disease in the knee occurs in 6% and by the age of 65 over 9.5% of adults have osteoarthritis of the knee. [6]

A recent study from Kuwait showed that 5% of the population had radiological grade 4 osteoarthritis at a mean age of 53 years.

Radiological Appearance of Osteoarthritis (Kellgren and Lawrence)

Normal (no signs of osteoarthritis)	0
Doubtful change (uncertain)	1
Definite, minimal to mild	2
Definite, moderate	3
Definite, severe	4

A recent analysis [7] of 29 studies from 14 countries and 4 ethnic groups found a prevalence of between 0.5% to 36%; this wide reported variation is in part due to the differences in study design and populations but also in the basic definition of what clinical and/or radiographic signs are used in the diagnosis of osteoarthritis of the knee.

Despite some of these shortcomings this analysis confirmed the increasing incidence and prevalence of OA of the knee with age [8] and there was a sharp increase in the incidence in women over the age of 50 years suggesting a hormonal influence.

Because of its prevalence and the frequent disability that accompanies disease in the knee and hip, osteoarthritis accounts for more trouble with climbing stairs and walking than any other disease. [6]

Diagnosis

Osteoarthritis of the knee presents in two major categories of people:

1. Young people (usually men) with isolated knee disease often related to previous injury or operation.
2. Middle aged and older people, predominantly women, with osteoarthritis in several (or many) joints especially the hands.

For many years it was unclear whether being over-weight preceded or was a consequence of osteoarthritis due to immobility and reduced activity. It has now been proved that being over weight antedates the development of the disease and the increased risk of developing osteoarthritis of the knee is stronger in women than in men (by a factor of almost 2). [6]

The correlation is less strong in osteoarthritis of the hip. Unilateral disease in the hip is not clearly associated with being over-weight whereas bilateral disease is.

Pain in walking, stiffness and difficulty negotiating stairs, rising from sitting, bending and sleep are the major symptoms or presenting complaints.

Signs

Crepitus, swelling (bony and soft tissue), tenderness around the joint margin with wasting of quadriceps muscles, and pain limiting full flexion are the most common signs.

Pain limiting full extension (by 5% or more) leaves the knee unstable when weight bearing.

It is generally accepted that quadriceps wasting is the sign most closely related to functional impairment. [9]

Varus (bow legged) or less commonly valgus (knock – kneed) deformity may be present. A fixed flexion deformity may also occur, preventing knee lock out in full extension. This leads to rapid quadriceps fatigue and instability when weight bearing.

Differential Diagnosis

Hip osteoarthritis.

Pain in the knee is frequently referred from the hip and the hip movement must always be assessed.

Meniscal pathology.

A degenerate tear of the meniscus can present with medial joint line pain and tenderness, swelling and reduced movement. If suspected, MRI may confirm a meniscal lesion, but there is a high rate of false positives, as there of asymptomatic degenerate meniscal tears in the general population.

Crystal arthropathy

Gout is the result of crystal deposition in the joint. The meniscal cartilage shows calcification on x-ray. Although loss of joint space is a late feature, OA can eventually develop

Patello femoral instability

Pain felt anteriorly is most commonly from the patellofemoral joint. The exact cause of "anterior knee syndrome" is unclear and most likely incorporates a number of abnormalities. Pain worsened by descending stairs is most often patellofemoral in origin.

Osteonecrosis

This can occur in either the distal femur or the proximal tibia and may be idiopathic or secondary to another cause, most frequently steroid use. X-rays may be normal and MRI is the best investigation.

Treatment

In the future the management of osteoarthritis of the knee will probably change considerably. Initially there is likely to be a significant reduction in the incidence of osteoarthritis in this joint due to earlier diagnosis and rapid appropriate treatment of trauma using arthroscopy for the repair or replacement of menisci, the repair of torn ligaments and the restoration of congruous joint surfaces following trauma.

Conservative

Non-surgical treatment has concentrated on three basic areas to change the weight bearing forces acting through the knee joint and maintain associated muscle power and tone. In patients where obesity is an issue, weight loss can be useful in alleviating symptoms.

Physiotherapy

To maintain muscle power and joint mobility and the provision of orthoses e.g. heel wedges or braces to change or minimise the loads transmitted through the compartments of the knee [10].

Short-term studies indicate that exercise training increases physical capacity and decreases pain and disability reported by patients with OA of the knee. In the elderly the single most important recommendation for the prevention of disability has been shown to be regular exercise. Immobility is to be avoided. Even when the joint is swollen and painful and weight bearing is not recommended chair exercises should be continued. [9]

Pharmacological

Simple analgesics e.g. Paracetamol have been shown to be comparable to low-dose naproxen and ibuprofen. Long-acting corticosteroid injection is indicated for flare up of knee pain particularly if associated with effusion but it gives relatively short benefit.

Injections of hyaluronic acid or orally administered chondroitin sulphate or glucosamine have been advocated by some practitioners, however the evidence is sparse and meta-analysis have failed to show any convincing benefit [11]

While Cox-2-specific inhibitors may have a place in those with the potential for gastro-intestinal problems, concerns remain as to the (slightly) increased thrombotic risk. However there is no clear data on the relative thrombotic risk between Cox-2 inhibitors and Ibuprofen or diclofenac. Current advice is that all patients should take the lowest effective dose of NSAIDs or Cox-2 inhibitors for the shortest time necessary to control symptoms. [12, 13]

Surgical

Surgical intervention is indicated when there is persistent pain not relieved by conservative methods.

Arthroscopy

The benefits of this form of minimally invasive surgery were first noted in the early 1930s when Burman et al [14] first performed arthoscopic lavage in patients with osteoarthritis of the knee.

This method allows any or all of the following procedures in combination. Joint debridement, resection of the synovium, removal of osteophytes and shaving of the cartilage down to subchondral bone.

It is thought that the benefits of lavage involves the removal of enzymes and debris from the joint, thus minimising the irritative effects of these substances on the synovium, however a recent study measuring the effect of this procedure on thigh (quadriceps) function found that it did not significantly relieve patient's symptoms [15].

Arthroscopic debridement with the removal of osteophytes, cartilage fragments and meniscal tears gives significant relief. [16] However, the evidence is not convincing and many investigators feel there is no significant benefit. [17, 18] Certain predictors of a good outcome following arthroscopy have been suggested and these include, short duration of pre-operative pain, mechanical symptoms are present, radiographic changes are minimal and there is normal mechanical axis alignment. [19]

Arthroscopic attempts to resurface joints have not as yet realised their expected potential.

Currently arthroscopy is confined mostly as a tool to deliver treatment in osteoarthritis; however newly developed needle arthroscopes, which delineate intra-articular anatomical abnormalities now make this technique available as an 'outpatient' procedure particularly to aid the differential diagnosis in unusual presentations.

High tibial osteotomy

The rationale of high tibial osteotomy is to alter the position of the weight bearing axis across the knee joint with a varus deformity, increasing the proportion of body weight pass through the medial compartment. By creating a slight valgus angulation of the proximal tibia this imbalance can be compensated and more force can pass through the less commonly and usually less severely affected lateral compartment. This can lead to some symptom relief in the short to medium term, with 97% satisfied with the outcome at 2 years, 85% at 5 years and only 63% at 9 years. [20] In some younger patients this form of surgery may be used to delay the need for total knee replacement for a few years.

Replacement

An individuals 'quality of life' can be markedly improved by relieving pain and improving function.

Surgery can be a very cost effective way of achieving this aim but several factors need to be considered before surgery is contemplated. These include failure of conservative measures as outlined previously, the physiological age of the patient and their activity level and the severity of symptoms.

The ultimate goal of surgical procedures is to return the patient to near normal function e.g. the participation in everyday activities such as walking, climbing stairs, standing and sitting [21].

Surgical procedures for osteoarthritis include arthrodesis, high tibial osteotomy and arthroplasty.

Modern knee arthroplasty began in the early 1970's with the development of the condylar knee prosthesis, which remains a successful procedure.

Over the past three decades many changes have occurred in the design of these prostheses to improve stability (particularly when climbing stairs and to prevent subluxation) and prevent component loosening and breakage.

Follow up studies based on radiographic and clinical assessments indicate that the long-term results are good.

A recent study [22] comparing overall success and failure rates of these cemented total knee arthoplasties during a 22 year period demonstrated that the overall success rate was in excess of 85% at 18 years and was not influenced by diagnosis, gender, age or percentage ideal body weight.

Postoperative complications occur in about 10% of cases, with loosening of the prosthesis in 5%, while the primary cause of failure was infection in the joint in 2%. [23]

In cases where osteoarthritis is confined to the medial compartment, unicondylar arthroplasty (UKA) may be contemplated. User results suggest 92% satisfaction at 10 years in patients younger than 60[20]. UKA is therefore another option to delay the need for TKR in younger patients. Some orthopaedic surgeons claim revision from UKA to TKR is demanding, others disagree, and the Swedish athroplasty study shows a 93% satisfaction (UKR-TKR) at 5 years [24] as opposed to 83% survivorship of revised TKR-TKR at 8 years. [25]

Main Disabling Effects

Problems with locomotion particularly rising from sitting, walking and climbing stairs are the most common complaints.

Although radiographic changes have previously been reported as predictive of the later development of disability the relationship between osteoarthritis of the knee and locomotor impairment has never been quantified.

It is now known that concordance of radiographic findings with the description of pain and clinical findings is poor particularly at the knee.

Between 1947 and 1994 twenty-four clinical rating systems were developed to measure the outcome of treatment in OA of knee. Most were introduced as comprehensive methods (instruments) to assess patients with any disorder affecting the knee and only five were established especially for the assessment of osteoarthritis of the knee (and hip). Most of these scoring systems are "subjective" i.e. symptoms are self reported by patients and little is know about their reliability or validity [26].

Lequesene's scores [Appendix 1] (of functional indices) and WOMAC [Appendix 2] are both responsive measurements of outcome following surgical or medical treatment and the consensus opinion (WHO) is that these scoring systems should now be used as measures of treatment efficacy.

A study in 1993 of patients with a mean age of 70 years investigated a number of possible determinants of disability and concluded that three variables exerted important and independent effects on functional ability. These were quadriceps weakness, presence of knee pain and increasing age. However, quadriceps weakness was the most important factor while radiographic score '*made no significant independent contribution to disability*'. [27]

A study of the relationship between articular, kinesiological and psychological characteristics of pain and disability in patients with OA of the knee concluded that decreased muscle strength (when flexing and extending the knee) and the range of joint motion were the factors most strongly associated with disability. Pain was suggested as an intervening variable in the causal chain from articular status to disability in the more anxious patients.

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Appendix A -

Overview :

Lequesne et al developed an index of severity for osteoarthritis for the knee (ISK). This can be used to assess the effectiveness of therapeutic interventions.

 Sections for index:

(1) Pain or discomfort

(2) Maximum distance walked

(3) Activities of daily living

I Pain or Discomfort

Parameter	Finding	Points
Pain or discomfort during nocturnal bed rest	None	0
	Only on movement or in certain positions	1
	Without movement	2
Duration of morning stiffness or pain after getting up	None	0
	< 15 minutes	1
	>= 15 minutes	2
Remaining standing for 30 minutes increases pain	No	0
	Yes	1
Pain on walking	None	0
	Only after walking some distance	1
	Early after starting	2
Pain or discomfort after getting up from sitting without use of arms	No	0
	Yes	1

where:

A change in a 1991 version was to have the duration of morning stiffness scored 0 if it was 1 minute or less and 1 if it was from 1 to less than 15 minutes.

Pain on walking in a 1991 version expanded "early after starting" to "after initial ambulation and increasingly with continued ambulation"

Medical Services

II. Maximum Distance Walked

Parameter	Finding	Points
Maximum distance walked	Unlimited	0
	> 1 kilometer but limited	1
	About 1 kilometer (about 15 minutes)	2
	About 500 - 900 meters (about 8-15 minutes)	3
	From 300 - 500 meters	4
	From 100 - 300 meters	5
	< 100 meters	6
Walking aids required	None	0
	1 walking stick or crutch	1
	2 walking sticks or crutches	2

III. Activities of Daily Living

Parameter	Finding	Points
Able to climb up a standard flight of stairs	Easily	0
	With mild difficulty	0.5
	With moderate difficulty	1.0
	With marked difficulty	1.5
	Impossible	2.0
Able to climb down a standard flight of stairs	Easily	0
	With mild difficulty	0.5
	With moderate difficulty	1.0
	With marked difficulty	1.5
	Impossible	2.0
Able to squat or bend at the knee	Easily	0
	With mild difficulty	0.5
	With moderate difficulty	1.0
	With marked difficulty	1.5
	Impossible	2.0
Able to walk on uneven ground	Easily	0
	With mild difficulty	0.5
	With moderate difficulty	1.0
	With marked difficulty	1.5
	Impossible	2.0

Index of severity =

= SUM (points for all parameters)

Interpretation:

Minimum points for each section: 0

Maximum points for each section: 8

Minimum index score: 0

Maximum index score: 24

Index Score	Handicap
0	None
1 - 4	Mild
5 - 7	Moderate
8 - 10	Severe
11 - 13	Very severe
>= 14	Extremely severe

Modifications

The index was modified in 1997 with some minor changes to morning stiffness and termed the "algofunctional index".

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Appendix B -

Overview :

The WOMAC (Western Ontario and McMaster Universities) index is used to assess patients with osteoarthritis of the hip or knee using 24 parameters. It can be used to monitor the course of the disease or to determine the effectiveness of anti-rheumatic medications.

Pain:

(1) Walking

(2) Stair climbing

(3) Nocturnal

(4) Rest

(5) Weight bearing

Stiffness:

(1) Morning stiffness

(2) Stiffness occurring later in the day

Physical function:

(1) Descending stairs

(2) Ascending stairs

(3) Rising from sitting

(4) Standing

(5) Bending to floor

(6) Walking on flat

(7) Getting in or out of car

(8) Going shopping

(9) Putting on socks

(10) Rising from bed

(11) Taking off socks

(12) Lying in bed

(13) Sitting

(14) Sitting

(15) Getting on or off toilet

(16) Heavy domestic duties

(17) Light domestic duties

While the index was being developed, performance of social functions and the status of emotional function were also included. These were not included in the final instrument.

Social function:

(1) Leisure activities

(2) Community events

(3) Church attendance

(4) With spouse

(5) With family

(6) With friends

(7) With others

Emotional function:

(1) Anxiety

(2) Irritability

(3) Frustration

(4) Depression

(5) Relaxation

(6) Insomnia

(7) Boredom

(8) Loneliness

(9) Stress

(10) Well-being

Scoring and Interpretation

Response	Points
None	0
Slight	1
Moderate	2
Severe	3
Extreme	4

Alternatively, a visual analogue scale (VAS) may be used, ranging from 0 to 10.

Score =

= SUM (points for relevant items)

Average score =

= (Total score) / (number of items)

Interpretation:

Minimum total score: 0

Maximum total score: 96

Minimum pain subscore: 0

Maximum pain subscore: 20

Minimum stiffness subscore: 0

Maximum stiffness subscore: 8

Minimum physical function subscore: 0

Maximum physical function subscore: 68

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