

Surgical Management of the Elderly Elbow

Ms V. N. Gibbs ^a, Mr R. Middleton ^b, Professor J.L. Rees ^b

^a Nuffield Orthopaedic Centre, Windmill Road, Headington, Oxford OX3 7HE, United Kingdom

^b Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Science, The Botnar Research Institute, University of Oxford, Old Road, Headington, Oxford OX3 7LD, United Kingdom

Abstract:

The elbow has a major role in helping with the positioning of the hand in space. Any pathology of the joint can result in pain, loss of function and difficulties with activities of daily living. With an increasingly elderly population the degenerative conditions affecting the elbow are becoming more prevalent. Besides traumatic injury, osteoarthritis, inflammatory arthritis, nerve compression, and stiffness are the more commonly encountered problems. An awareness of these conditions is important for those who provide care to this patient group. Whilst many of these conditions can be managed conservatively in primary care, some patients are referred to secondary and elect for surgical treatments. This review considers the surgical treatments for the common elbow pathologies in the elderly population including the potential complications associated with such treatments.

Introduction:

The elbow is a complex synovial hinge joint consisting of the radio-capitellar, ulno-humeral and radio-ulnar articulations, surrounded by ligaments, joint capsule and muscles. As a consequence, the elbow is at risk of a number of disorders. Considering these disorders as either intra-articular or extra-articular is a useful pragmatic approach to clinic diagnosis and management. This review does not deal with fracture treatments, but aims to help inform the readers about the common orthopaedic elbow problems seen in the elderly and reviews current surgical treatments. (Table 1).

Table 1. Common Elbow Problems in the Elderly

- Primary osteoarthritis of the elbow
- Post- traumatic and secondary osteoarthritis
- Nerve compression
- Elbow stiffness
- Rheumatoid and Inflammatory arthritis

Primary osteoarthritis of the elbow is probably the most common elbow problem and is estimated to affect 2% of the population, with an average age at presentation of 50 years (ranging from 20 to over 70 years of age).¹ The exact aetiology is not fully understood but is thought to involve processes separate to those of normal aging.² For example, repetitive loading of the elbow joint in male manual labourers seems to increase the risk of osteoarthritis.³ Degenerative changes also occur more frequently in the radio-capitellar joint than the ulna-trochlear joint.⁴

Post-traumatic and secondary osteoarthritis results from elbow injury or cartilage derangement or damage from another cause. Damaged articular cartilage or joint incongruity results in secondarily

accelerated cartilage wear. Fractures of the distal humerus, olecranon and radial head are common and because they are often intra-articular these also directly disrupt the articular cartilage.

The elbow joint is also a common site of *nerve compression*, with the ulnar nerve being the second most common compression neuropathy (after the median nerve at the wrist) resulting in cubital tunnel syndrome.⁵ In the majority of patients, the aetiology of cubital tunnel syndrome remains unclear but anatomical causes have been commonly implicated (Table 2).

Table 2. Common causes of cubital tunnel syndrome

- Osteophytes from osteoarthritis
- Malunion elbow fractures resulting in cubitus valgus⁶

Another common complaint is *Elbow Stiffness*. The causes of elbow stiffness may be classified as either intrinsic or extrinsic.⁷ Intrinsic causes are commonly a result of trauma resulting in some derangement within the joint, osteoarthritis, loose bodies, loss of joint congruity and articular adhesions. Extrinsic causes include capsular, ligamentous or musculotendinous contractures and heterotopic bone formation.⁸ While rarer, heterotopic bone formation is the formation of aberrant bone in the soft tissues around the elbow, most commonly due to direct trauma and haematoma formation but also seen after head injuries and in burns patients. It can occur at any age.^{9,10}

Rheumatoid and other inflammatory arthritis of the elbow can cause many of the problems detailed above and these patients are usually managed through a multi-disciplinary approach involving rheumatology and orthopaedic specialties.

In managing elderly elbow problems, the focus initially should be conservative and medical treatments. Activity modification, analgesia and physiotherapy are often all that is required, although a correct diagnosis is important. When surgery is considered, it must be remembered that the elbow is an unforgiving joint regarding injury (including surgery). The suitability of elbow surgery for a patient needs to be assessed on an individual basis with the clear aims and risks being understood by the patient. One of the key concepts of successful surgical elbow intervention revolves around rehabilitation potential.

Osteoarthritis

Clinical presentation: Osteoarthritis of the elbow is characterised predominantly by discomfort and a reduction in the range of elbow movement, although can present with locking and ulnar nerve symptoms. The patient tends to report an inability to fully extend the elbow and experiences dull aching pains which may be worse at night. In addition, patients may report being unable to perform activities of daily living such as opening doors, using a telephone or eating, particularly if flexion falls below a functional arc of 30-130°.¹¹ If osteoarthritic changes are present in the radio-capitellar joint, forearm rotation may be limited or exacerbate any symptoms.

Investigations: Generally anteroposterior (AP) and lateral radiographs are sufficient to make the diagnosis. These typically show osteophytes, along with joint space narrowing, sclerosis, subchondral cysts and loose bodies. Loose bodies can be difficult to visualise on standard radiographs; up to 30% of loose bodies are not detected on plain radiograph.^{12,13} In these circumstances, further imaging such as Magnetic Resonance Imaging (MRI) or Computed Tomography (CT) may be helpful.

Surgical Treatments: Arthroscopic (keyhole surgery) debridement has been commonly performed for elbow osteoarthritis. Surgery has typically involved osteophyte resection, removal of loose bodies and capsular release, however evidence for its use has been mainly limited to several small retrospective studies, although positive results and improvements in range of motion and patient reported outcome measures have generally been reported.^{14,15} One trial assessing arthroscopic treatment for elbow arthritis compared arthroscopic treatment with open debridement.¹⁶ The study reported a greater reduction in pain with arthroscopy compared to the Outerbridge-Kashiwagi (OK) open procedure at 35 months, but with greater improvements in elbow motion seen with the OK procedure. The authors concluded that in patients where pain is the main symptom, arthroscopy is preferred, whereas if loss of range of motion is the main symptom, the OK procedure could be considered.¹⁶

Radial Head Excision: In patients who have predominant radio-capitellar joint pain and restriction of movement, arthroscopic or open radial head excision may provide relief and improve range of motion. There remains some degree of controversy as to specific indications for radial head excision and its intended benefits.^{17,18,19,20, 26} Evidence again is only retrospective or from small case series.

Radio-capitellar and Radial Head replacement: Radio-capitellar replacement (lateral compartment) offers an alternative treatment for degenerative and inflammatory arthritis of the elbow. As previously noted, degeneration commonly begins in the radio-capitellar joint.⁴ The aim of surgery is to preserve lateral compartment function and avoid ulno-humeral compartment overload by replacing the problematic radio-capitellar half of the joint. One case series reported moderate functional recovery, with 85% of patients demonstrating a reduction in pain and an improvement in range of movement post-operatively by 35°.²¹ Initial results are therefore encouraging, however further studies are required to fully evaluate this treatment. Radial head replacement is more commonly used and indicated for complex fractures which are not amenable to reconstruction.²² Evidence for use of radial head replacement in inflammatory arthritis or osteoarthritis is limited and radio-capitellar replacement is thought to be superior to radial head replacement alone as it additionally addresses capitellum arthritis.²³

Total elbow replacement (TER): This is indicated in patients who have significant ongoing arthritic pain and functional loss not controlled by other means. It is also indicated in some elderly patients who have an un-reconstructable distal humeral fracture. The most common reason to perform a TER is inflammatory arthritis; however it is also performed for severe osteoarthritis.²⁴ TER is most appropriate for patients with low functional demands because of concerns about the longevity and survival of these types of replacements. The numbers of TER performed have decreased to a degree because of the better medical treatments now available for rheumatoid arthritis. These have prevented the progression of elbows arthritis to the very destroyed elbow joints that have been seen in the past and that were only treatable with TER. One study reports that patients with severe rheumatoid arthritis were the best group to treat with TER as they had significantly better outcomes than those who had TER for primary or secondary osteoarthritis.²⁵ Data from the UK national joint registry highlights the current situation which is that elbow replacements are not as commonly performed as other types of joint replacement such as hip and knee with only 383 elbow replacements being performed in 2014.²⁶ The average age for replacement for women was 68.7 and for men 65.3. Outcomes following TER are less predictable than in other major joint replacements. This is likely to be a multifactorial issue that includes patient factors, disease factors and the

difficulty in designing a replacement that replicates the complex elbow joint.²⁷ There are several different implants available which can be broadly grouped as fixed hinged (constrained) or sloppy hinged (semi-constrained) or non-constrained (unhinged). Functionally the semi-constrained and non-constrained prostheses seem to have better outcomes than the fixed hinged prostheses.²⁸ Revision rate at 5 years following replacement is much higher than other joint replacements and has been reported as approximately 13%.^{28,29} Revision surgery is very difficult and outcomes will demonstrate diminishing returns and so decision to proceed with a primary TER needs to be very carefully considered by patient and surgeon with many surgeons now suggesting to patients they should avoid TER unless absolutely necessary.

Nerve entrapment

Clinical presentation: Cubital tunnel syndrome classically presents with worsening loss of sensation or paraesthesia in the ulnar nerve sensory distribution (little finger and ring finger). These symptoms may be intermittent or constant, worse at night or when the elbow is held in flexion. In more established cases motor symptoms (weakness) can develop, with patients often reporting clumsiness of the hand, with wasting of the intrinsic hand muscles on examination.³⁰

Investigations: Nerve conduction studies are very helpful, usually recommended and help to identify the level of compression including assessment for the double crush syndrome (compression at both Guyon's canal (wrist) and cubital tunnel (elbow)). AP and lateral elbow radiographs should also be performed.

Surgical Treatment: In the majority of patients, simple nerve decompression through a surgical incision over the medial elbow will improve symptoms. During ulnar nerve decompression any obvious or potential sites for compression are released. Decompression is usually performed under general anaesthesia. Reported outcomes from simple decompression are good with up to 90% of patients reporting improved function along with objective improved neurophysiology.^{31,32} Alternative and additional techniques performed include anterior transposition and medial epicondylectomy. Several randomised studies suggest there is no significant difference in outcome between anterior transposition and simple decompression.³³ It has been suggested that where nerve subluxation or failure of simple decompression occurs then anterior transposition may improve outcomes.³⁴ Medial epicondylectomy is no longer commonly performed although the post-operative results are said to be good, with some studies reporting over 80% excellent or good response to surgery.^{35,36,37}

Elbow stiffness

Clinical presentation: Patients with stiffness present with a reduction in elbow movement which can be significantly disabling and may be associated with discomfort or pain. Loss of the functional arc of 100° can cause substantial difficulty with activities of daily living.

Investigations: Patients presenting with stiffness should have AP and lateral radiographs. In cases where stiffness is severe and radiographs are unsatisfactory, CT may assist in assessing elbow architecture. Where plain radiographs look normal, magnetic resonance imaging (MRI) may help to assess for soft tissue or cartilage problems.

Surgical Treatment: Conservative management is the mainstay of treatment of the stiff elbow in the elderly. Physiotherapists are often able to provide advice for improving range of motion and function. Static splints, particularly at night are sometimes used to help maintain the elbow in maximally flexed or extended positions. The splint is positioned such that it applies torque to the arm to stretch the contracted elbow capsule and can be repositioned after a period of time stepwise, as pain allows. Elbows with significant internal derangement and osteoarthritis don't usually respond to such splinting. Surgical intervention is reserved for select cases after specialist assessment and when the main problem is significant loss of functional range.¹¹ Where surgery is indicated the aim is to address capsular contractures and this can be achieved with either arthroscopic or open capsular release procedures. Arthroscopic treatment is preferred by some surgeons when stiffness is secondary to capsular contracture alone, but in patients with severe joint incongruity, muscle contracture and cartilage loss, open procedures tend to be favoured and recommended.³⁸

Outcomes following arthroscopic release are generally good and appear most optimal in patients with moderate post-traumatic stiffness with good joint congruity.^{38,39,40} Open surgical techniques also appear to have good outcomes although direct comparison between studies is difficult due to differing operative techniques and pathology. Studies report improvement in range of motion in nearly all patients with open surgery.⁴¹ A mean arc of movement gain of 86.8° at 5.2 years follow up has been reported if a twin incision with radical arthrolisis supplemented by a hinged external fixator.⁴² A 40° improvement at 16 months is reported with single incision procedures.⁴³ Most surgeons advocate early mobilisation of the elbow for achieving the best outcome, along with adequate pain control, however post-operative splinting helps maintain extension and therefore improves the arc achieved through surgery. A recent review has even concluded that splints should be worn for 12 months after the procedure or until improvement in elbow motion ceases.⁴⁴

Complications in elbow surgery

Complications relating to elbow surgery can be both general and specific to the procedure type. Differences have been observed between open surgery and arthroscopic surgery. The more common general complications are highlighted in Table 2 but it must be remembered that different rates are seen in different patient groups (e.g. infection is more common in diabetic or immunosuppressed patients) and different procedure types (e.g. open and arthroscopic procedures)

Open surgery of the elbow can utilise a number of surgical approaches. The literature suggests that between 12% to 19% of patients will experience a complication or require further surgery.^{45,46} This again highlights the unforgiving nature of the elbow and the difficulty in operating on it. Arthroscopic surgery is said to be a more technically demanding procedure. An overall complication rate of 8.9-14% has been described for arthroscopic elbow surgery.⁴⁷⁻⁵⁰ Major complications are said to be relatively uncommon at 0.5-0.8% but such definitions and distinctions are open to interpretation.^{48,50}

Table 2.

- Elbow Stiffness
- Neurovascular injury (Ulnar nerve dysfunction commonest complication of open elbow surgery.⁴¹)
- Infection
- Bleeding/haematoma
- Wound break down/dehiscence
- Heterotopic ossification
- Complex Regional Pain Syndrome (CRPS)

Elbow stiffness is probably the most common complication and can develop rapidly after injury and surgery even with short periods of immobilisation. It can occur both after open and arthroscopic surgery. Such stiffness is largely the result of capsular contraction, increased cellularity and adhesions.⁵¹ Early physiotherapy is usually a vital component of the post-surgical rehabilitation programme but even with appropriate therapy the elbow can still stiffen.

Elbow Arthroscopy complications include prolonged portal drainage, infection and nerve injury. Persistent portal site drainage has been reported as 5%.⁴⁸ Superficial infection (not involving the elbow joint) occurs in 2-6.7% depending on diagnostic criteria, and most cases respond to short antibiotic regimens.^{48,49} Serious deep joint infections (septic arthritis) occur in 0.8-2.2% and require irrigation and debridement, often followed by prolonged antibiotic therapy and long term negative impacts on functional outcomes.^{48,49} Multiple nerves cross the elbow joint, and are at risk during portal site placement and during the procedure. Minor nerve injuries (transient and not requiring intervention) occur in 1.7-4%, with the ulnar nerve again the most commonly affected followed by the radial, posterior interosseous, median, anterior interosseous and medial antebrachial cutaneous nerves.^{47-49,52} Major nerve injuries (permanent or requiring intervention) are less common (~0.5%) but there are concerns regarding under-reporting.^{50,52} Rarer complications of elbow arthroscopy include compartment syndrome, vascular injury and heterotopic ossification (<0.02%).^{49,53,54}

Joint Replacement complications rates are mainly in relation to TER, with figures quoted from mid-to long-term reports and reviews. The implantation of prosthetic components is associated with an overall complication rate of 20-45% in TER.^{28,55} Deep infection rates have been reported as being as high as 3-8%, and result in significant morbidity with repeat surgeries and prolonged antibiotic regimes.^{28,55-57} Aseptic loosening of the elbow components is a significant problem with TER, and is the most frequent cause of failure.^{28,55-57} The type of prosthesis implanted (hinged vs unhinged) has an impact on these rates. Some hinged designs have a reported failure rate of ~14% at 4 years.⁵⁸ Unhinged prostheses have variable reported outcomes; one study reporting loosening as ~4% at 4 years⁵⁹ and another reporting up to ~11% at ~5 years.⁶⁰ The stability of a TER is inherently linked with its design, with unhinged prostheses demonstrating higher overall rates of instability and dislocation compared to hinged prostheses (4.9% vs. 1.4%).^{55,56}

Component failure can occur by way of component fracture (rare) or polyethylene bushing wear.^{55,57} Peri-prosthetic fractures are more common and rates have been reported as 1.6% at 6 years.⁶¹ In the United Kingdom in 2014 a total of 154 revision total elbow procedures were performed, with peri-prosthetic fracture the indication in 20 (13%). As with all open surgery several nerves are at risk

during TER surgery and this becomes a greater problem with complex revision TER surgery. Finally, approaches for TER can disturb the triceps extensor mechanism, with consequences ranging from weakness of the extensor mechanism to full dehiscence, with rates reported at 0.5-11% depending on surgical technique.^{55-57,62}

Radial head excision complications are usually a consequence of altering the normal kinematics of the elbow joint.⁶³ If the patient has a pre-existing deficiency in any stabilising elbow ligaments these can increase the subsequent risk of elbow instability or pain.⁶⁴ In some patients the loss of the radial head can also result in migration of the radius proximally, resulting in a positive ulnar variance at the wrist also causing wrist pain.⁶⁵

Ulnar nerve decompression/transposition. Direct injury to the ulnar nerve during these procedures can result in transient or permanent functional loss in the ulnar nerve distribution in the hand depending on the nature of the injury. This can be both sensory loss and weakness. While meta-analyses have shown no significant difference in symptom improvement between decompression and transposition techniques,^{66,67} decompression without transposition can however risk subsequent ulnar nerve instability (translation of the ulnar nerve across the medial epicondyle during flexion/extension. Matzon *et al.* identified 21% of patients as having an unstable nerve post ulnar nerve decompression and were converted to transposition procedures.⁶⁸ Both simple decompression and transposition procedures risk neuroma formation secondary to injury to local cutaneous nerves, such neuromas can result in recurrent symptoms.⁶⁹ The most common complications for medial epicondylectomy include medial elbow tenderness, flexor/pronator weakness and medial elbow instability. Medial elbow tenderness is estimated to affect 44% of patients at 11 months after surgery, however it is noted that patients often presented pre-operatively with medial elbow tenderness.⁷⁰ Deficits in grip and pinch strength are reported as 10-11%.⁷⁰ The incidence of symptomatic medial elbow instability post-operatively is disputed, with figures of between 1-20% being suggested.^{71,72}

Conclusions

It must also be remembered that a large proportion of elbow problems in the elderly are treated successfully with life-style modifications, analgesia and physiotherapy. Where this treatment fails, operative management remains an important option. While elbow surgery is common, evidence for optimum surgical treatment for the elderly elbow remains limited. The majority of evidence quoted in this article is the best available, but remains level III/IV evidence in most cases, originating from small case series or retrospective studies. There is also a mixture of age groups in most publications. National audit projects such as the UK National Joint Register will help inform with regard joint replacement, but elbow replacement data is still in its infancy with data collection only commencing in 2012.⁷³

Large scale trials investigating the non-operative and operative treatments are required to clarify the optimum treatment pathways for this patient population. Generally, surgery for the elderly elbow is based mainly on surgical consensus. There is also a growing preference on utilising arthroscopic or minimally invasive approaches where possible. Complication rates, particularly for elbow replacement surgery are higher than for other joint replacements²⁸ and should be considered when referring a patient for consideration of surgery. Otherwise, the success of elbow surgery in the elderly requires appropriate patient selection, a comprehensive discussion between patient and

surgeon to address the realistic benefits, expectations and complications. The patient's compliance, motivation and ability to comply with rehabilitation regimes post-operatively remains important in maximising the outcomes.

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