

Problems of age in rheumatology

The spectrum of rheumatic disease seen in elderly Australians is different to that seen in younger adults. Effective approaches to management require careful consideration of the impact of the ageing process as well as individual patient circumstances.

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With the steady increase in Australia's ageing population, all healthcare professionals need to be attuned to the diagnosis and management of rheumatological problems affecting the elderly (i.e. those aged over 65 years). Musculoskeletal disorders affect 40% of Australians in this age group and are the most common cause of activity limitation. In 2000, the total cost of musculoskeletal disorders was estimated to be almost \$9 billion (this total comprises direct costs, such as hospitalisation and doctor visits, and indirect costs, such as loss of earnings and lost production due to premature retirement from the workforce).¹

The rheumatic conditions that affect the older adults differ from those that affect younger adults. This article discusses two aspects of ageing that affect rheumatology practice: the spectrum of rheumatic disease encountered, and the impact of the ageing process on management. Table 1 lists the common rheumatological disorders seen in the elderly.

The spectrum of rheumatic disease Osteoarthritis

Primary osteoarthritis is uncommon before the age of 40 years, but its prevalence then increases directly with age. Other major risk factors for osteoarthritis include obesity, genetics, muscle weakness and joint injury.

The clinical patterns of osteoarthritis are shown in Table 2, but these are a guide only because there is often overlap between the patterns. Generalised osteoarthritis is very common and usually has a good prognosis, with a minority of patients requiring long term therapy or surgery. Isolated nodal osteoarthritis involving the interphalangeal joints of the hands commonly affects middle-aged women with a positive family history and, although often symptomatic around the time of the menopause, it appears to stabilise in many cases with further time. Isolated unifocal hip or knee osteoarthritis is the other common pattern – if it is truly unifocal, causes of secondary

IN SUMMARY

- Musculoskeletal disorders are common in the elderly and can be more difficult to diagnose and manage than in younger patients.
- The aims of therapy are to relieve symptoms and to maintain or improve functional capacity.
- Treatment needs to be individualised. Comorbid conditions and other drug therapy must be considered prior to prescribing.
- COX-2 selective inhibitors are symptom-modifying drugs that have slightly better upper gastrointestinal safety compared with traditional NSAIDs. However, both traditional NSAIDs and COX-2 selective inhibitors have significant potential problems when used in the elderly.
- Patients should be reviewed at regular intervals while taking therapy to assess effectiveness, identify adverse effects and determine need for continued treatment.
- A variety of nonpharmacological measures can be used to improve symptoms and quality of life.

continued

Table 1. Common rheumatological disorders in the elderly

- Osteoarthritis
- Rotator cuff disease
- Degenerative spinal disease and associated syndromes
- Septic arthritis
- Crystal deposition disease
- Rheumatoid arthritis
- Carcinoma related arthropathies
- Chronic inflammatory illnesses (polymyalgia rheumatica and giant cell arteritis)
- Metabolic bone diseases (osteoporosis, Paget's disease, osteomalacia, hypovitaminosis D, secondary hyperparathyroidism)
- Autoimmune connective tissue diseases

osteoarthritis should be pursued.

Occasionally elderly patients develop a rapidly destructive form of joint disease involving sites that are uncommonly affected by generalised osteoarthritis, such as the shoulder, elbow, ankle or wrist. This is an uncommon subgroup of large joint disease, but it is distinguishable by the clinical presentation and rapidly destructive course. Large, cool effusions are usually seen in this destructive pattern. Aspirates of these effusions are often bloodstained and frequently contain hydroxyapatite or calcium crystals.

Rotator cuff disease

Rotator cuff disease is prevalent in older adults. It has a clinical spectrum that ranges from asymptomatic partial thickness tears to symptomatic rotator cuff arthropathy.

Typical presentations for rotator cuff tears include acute, chronic, and acute-on-

chronic. Symptoms vary from pain on activity only to severe night pain, weakness, and decreased upper limb function secondary to restricted range of movement. Signs include a painful arc on abduction, pain on resisted cuff muscle movement and with chronicity, muscle wasting, scapular rotation and superior migration of the humeral head.

Plain radiography should precede ultrasound, but the latter can show cuff swelling and partial or full thickness tears and can identify local bursal enlargement. Initial treatment may include analgesics, maintenance of range of motion through a prescribed exercise program and subacromial injection of corticosteroids.

Back pain in the elderly

There are many causes of back pain in the elderly (see Table 3). Between 10 and 15% of people over 65 years of age have back pain that either has persisted for at least six months or is expected to do so. In addition, the majority of the older population will have radiographic evidence of degenerative spinal disease, but the correlation between symptoms and x-ray appearances is poor. Hence, a clinical history is essential when evaluating an elderly patient with back pain.

Facet joint osteoarthritis is common, with patients frequently presenting with insidious onset of localised spinal pain, mild stiffness and reduced spinal motion. The levels most commonly affected are the lower lumbar region (L4 to L5) and the lower cervical spine (C5 to C7).

Spinal stenosis syndrome is also common in the elderly, and frequently affects the lumbar region. The most characteristic symptom is pseudoclaudication, which is defined to be discomfort or pain in the buttock, thigh or leg on standing or walking that is relieved by rest and is not produced by peripheral vascular insufficiency. Generally, pseudoclaudication is relieved by lying down, sitting or adopting a posture of

Table 2. Clinical patterns of osteoarthritis

Pattern	Sites	Characteristics
Generalised	Distal and proximal interphalangeal joints, first carpometacarpal, hips, knees, spine, base of the big toe	Most commonly seen in middle-aged to elderly women
Isolated: nodal	Predominantly distal and proximal interphalangeal joints	Usually seen in middle-aged women with a positive family history
Unifocal: large joint	Hip or knee	Common – consider underlying causes, namely, Paget's disease, osteonecrosis, previous meniscectomy or trauma
Multifocal: large joint	Bilateral hips or knees	Usually part of generalised osteoarthritis – suspect underlying cause if unusual site is involved such as the shoulder, elbow, ankle or wrist

flexion at the waist. Spinal stenosis typically affects multiple levels, and 40% of patients have bilateral symptoms.

Sciatica, a form of radicular pain caused by prolapse of an intervertebral disc, produces a different clinical pattern of referred leg pain; this pain tends to be more prominent than the accompanying back pain. Radicular pain can occur at any spinal level but commonly involves the cervical and lumbar regions.

Vertebral crush fractures are a common clinical manifestation of osteoporosis. Patients usually present with acute severe pain in the area of the affected vertebrae; the pain is often exacerbated by movement. Differentiating between osteoporotic and pathological fractures can be difficult, and further investigation is often needed to clarify the cause.

Malignancy is more prevalent in elderly patients so it is important to consider this possibility in the differential diagnosis. Suggestive features include pain that is severe, occurring at night or at rest, or unrelieved by appropriate analgesics, and associated systemic features such as weight loss. Malignant lesions are usually metastases from breast, lung or prostate cancer; the most common primary malignancy is multiple myeloma.

The symptoms of septic spondylitis are often not specific but usually involve insidious onset of new or increased back pain that may radiate to the thorax or abdomen and be accompanied by fever. The infection is often acquired haematogenously and starts as a discitis before the adjacent vertebrae become involved (Figure 1). Occasionally, neurological compromise can occur as a result of local abscess formation.

Back pain in the elderly can occasionally be the predominant symptom of referred visceral pain (such as an enlarging or ruptured abdominal aortic aneurysm). Often the pain is of abrupt onset and has associated symptoms (such as syncope, fever, or gastrointestinal or genitourinary complaints).

Acute monoarthritis

An acute onset of monoarthritis in an elderly patient must be considered infective until proven otherwise, despite the fact that crystal-induced disease is more common (Figure 2). Hence, an acutely inflamed joint requires aspiration so that fluid can be analysed for total cell count and white blood differential count, Gram stain and culture, as well as polarised light microscopy for crystals. A high degree of clinical suspicion is needed because older patients often will not manifest classic signs or symptoms of infection such as fever, local warmth or erythema. It is important to remember

that the finding of crystals in a joint does not exclude sepsis because crystals and infection may coexist in the same joint.

Crystal-associated arthritis

The syndromes associated with arthritis caused by deposition of sodium urate, calcium pyrophosphate dihydrate and basic calcium phosphates are described in Table 4.

Recognition of gout in elderly patients may be complicated by a tendency for this age group to present differently compared with younger patients. Clinical observations indicate that older patients with gout are more likely to have polyarticular

Table 3. Causes of back pain in the elderly

Degenerative

Facet joint osteoarthritis
Disc degeneration
Prolapsed intervertebral disc
Spinal stenosis
Spondylolisthesis

Metabolic

Osteoporosis
Paget's disease
Osteomalacia

Neoplastic

Myeloma
Metastasis
Pancreatic cancer

Infective

Septic discitis
Vertebral osteomyelitis
Epidural or paraspinal abscess

Referred pain

Visceral (peptic ulcer, pancreatitis, aortic aneurysm)
Retroperitoneal (tumours, fibrosis, infection)
Pelvic (infection, malignancy)



Figure 1. Plain radiograph of the lumbar spine showing destruction of L1 and L2 vertebral bodies complicating septic discitis of the L1-L2 intervertebral disc.



Figure 2. Septic arthritis of the shoulder characterised by joint distension and overlying erythema.

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involvement, and a significant proportion are women. In addition, the gout is more likely to involve small finger joints; tophi are more likely to develop early in the course and often in atypical locations, such as the fingers (Figure 3) more often than the elbows. There is a greater association with diuretic use and renal insufficiency in older populations (as opposed to metabolic disturbances in younger populations).²

Calcium pyrophosphate dihydrate deposition disease has a number of clinical



Figure 3. Tophaceous gout involving the hand complicated by skin ulceration.

presentations that mimic other rheumatological disorders (acute gout, rheumatoid arthritis, osteoarthritis and neuropathic joints) as well as systemic illness. The three common clinical patterns are summarised in Table 4. Diagnosis is supported by aspiration and demonstration of calcium pyrophosphate dihydrate crystals from involved joints. The joints most frequently involved in pseudogout are, in descending order: the knee, wrist, shoulder and hip.

Deposits of basic calcium phosphate (predominantly apatites) are often located within various tendons or joints, particularly those affected by osteoarthritis. The deposits are often inert and asymptomatic, but the crystals can occasionally rupture from within the intratendinous site or be shed into the joint, causing a local acute inflammatory presentation. These basic calcium phosphates are responsible for clinical entities such as acute calcific peri-arthritis (seen commonly in the rotator cuff of the shoulder joint) or in older patients who have large

joint destructive arthropathies such as 'Milwaukee shoulder' syndrome.

Inflammatory polyarthritis with elderly onset

The prototypic illness with a presentation of inflammatory polyarthritis is rheumatoid arthritis. Surveys indicate that its incidence in women peaks between 30 and 50 years of age and then reaches a plateau, whereas the incidence in men rises with advancing age into the eighth decade. One-third of all patients who acquire rheumatoid arthritis do so after the age of 60 years.

Late onset rheumatoid arthritis has a different clinical presentation to that seen in younger patients, with:

- a more equal sex distribution (men:women, 1:1)
- a tendency for abrupt onset
- more frequent involvement of large proximal joints (i.e. shoulders, knees, hips), resembling polymyalgia rheumatica
- higher incidence of systemic manifestations (fatigue, weight loss)
- worse outcome (which may be explained by the effect of comorbid conditions).

Seronegative spondyloarthropathies rarely present for the first time in older patients, but conditions other than rheumatoid arthritis need to be considered in a patient presenting with polyarthritis. Crystal-induced arthritis can present with a symmetrical polyarthritis involving the hands and feet; gout has a polyarticular onset in 10% of cases, and tophi may have a similar distribution to rheumatoid nodules. The diagnosis can most readily be made after joint aspiration and demonstration of the appropriate crystal.

A paraneoplastic arthritis should also be considered when an older patient presents with polyarthritis. There is a greater tendency for involvement of the lower limbs compared with the upper limbs; the most frequently associated malignancies are breast and prostate cancer.

Table 4. Features of crystal deposition disease

Crystal and clinical syndrome	Patient characteristics
Sodium urate Acute gout Chronic tophaceous gout (often superimposed on nodal osteoarthritis)	Usually seen in middle-aged men Associated with diuretic use, particularly in elderly women or renal insufficiency
Calcium pyrophosphate dihydrate Asymptomatic chondrocalcinosis Acute pseudogout Chronic pyrophosphate arthropathy	Strongly correlated with increasing age Usually seen in elderly patients; equal gender incidence Seen in patients over 75 years of age; more common in women than men
Basic calcium phosphates Calcification of joints and periarticular tissues (e.g. rotator cuff) Rapidly progressive destructive form of arthritis associated with underlying osteoarthritis	Can occur at any age Has a mean age of 80 years, with a slight preponderance in women

Chronic inflammatory illnesses

Polymyalgia rheumatica and giant cell arteritis are among the most common chronic inflammatory illnesses affecting elderly patients.

Polymyalgia rheumatica is characterised by a constellation of symptoms that are typically associated with an elevated erythrocyte sedimentation rate (that is >40 mm/hour). Aching pain and prominent stiffness (particularly in mornings) affecting the neck, shoulder girdle or pelvic girdle are the hallmarks of this condition; constitutional symptoms such as malaise and fatigue are also usually present. Polymyalgia rheumatica-like symptoms may also occur in other conditions, examples include malignancy, chronic infection, rheumatoid arthritis, myositis and Parkinson's disease – these require consideration prior to initiating treatment with corticosteroids. There are no specific clinical signs or laboratory findings, but alternative diagnoses should be considered if there is failure to obtain a dramatic symptom response (>70% improved) within 48 hours of initiating moderate dose prednisolone ([Panaf-cortelone, Solone], 15 to 20 mg per day).

The symptoms of giant cell arteritis are varied but may include: new onset, persistent and unilateral headache; scalp tenderness; jaw or swallowing claudication; proximal myalgias and visual disturbances. Usually symptoms are present for weeks or longer before the diagnosis is made. However, if giant cell arteritis is suspected, urgent prescription of high dose prednisolone (50 to 60 mg per day) is needed to prevent blindness or other thrombotic events. Following initiation of prednisolone, appropriate investigation can be pursued. Although giant cell arteritis is frequently diagnosed on clinical grounds, temporal artery biopsy should be performed in the majority of cases to aid diagnostic precision (Figure 4).

Metabolic bone diseases

Osteoporosis is a common disease in

older adults, with total financial costs in 2001 from this condition estimated at \$7.4 billion.³ In women, the incidence of vertebral fractures begins to increase near the time of menopause; in men, the incidence increases with age. The incidence of hip fracture accelerates approximately 10 years after menopause in women and after age 70 years in men.

It is important to exclude diseases that may present with fracture or low bone mass in the evaluation of osteoporosis (see Table 5). Measurement of bone mineral density is the best predictor of fracture and is useful in establishing the diagnosis, evaluating severity, and determining the efficacy of therapy.

Other forms of metabolic bone disease, such as Paget's disease and osteomalacia, are also commonly seen. One important clue to the diagnosis of Paget's disease is an isolated elevated serum alkaline phosphatase level. Recent reports show vitamin D deficiency and secondary hyperparathyroidism to be common, occurring in 30 to 80% of older people living in southern parts of Australia who are frail house-bound or institutionalised.⁴ Such vitamin deficiency is associated with significant morbidity, including fractures, falls, myopathy and diffuse pain syndromes.

Autoimmune connective tissue diseases

This group of diseases includes systemic lupus erythematosus, scleroderma and

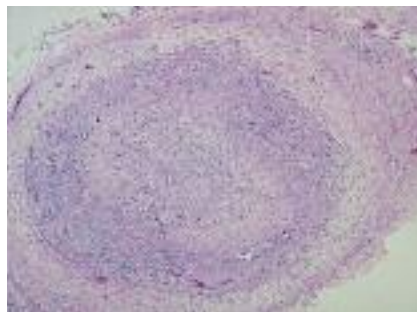


Figure 4. Histology of severe acute giant cell arteritis with almost complete lumen occlusion from arterial wall infiltration by lymphocytes.

Sjögren's syndrome. Autoimmune connective tissue disease typically begins in younger patients but does, on occasion, occur for the first time in older patients.

The clinical manifestations of older onset autoimmune disease tend to be somewhat different from those of a younger population. Consider, for example, late-onset systemic lupus erythematosus, which tends to be a relatively mild disorder occurring equally in men and women. Arthralgia and rash are the most frequent signs with both early and late onset; however, there is an increased incidence of pneumonitis, serositis, haemocytopenias, peripheral neuropathy and sicca symptoms with a late onset.

Table 5. Evaluating patients for secondary causes of osteoporosis

Hypogonadism (men only)

Bioavailable testosterone, prolactin

Hyperparathyroidism

Ionised calcium, intact parathyroid hormone, renal profile

Multiple myeloma

Serum and urinary protein electrophoresis

Paget's disease

Serum alkaline phosphatase

Osteomalacia

Serum alkaline phosphatase, 25-hydroxy-vitamin D

Hyperthyroidism or excess thyroid replacement

Thyroxine (T4), thyroid stimulating hormone (TSH)

Inadequate nutrition (calcium, vitamin D)

History

Medications (glucocorticoids, anticonvulsants, sedatives, alcohol)

History

Malabsorption syndrome

Potential tests: stool for fat or xylose breath test (directed by history of gastrectomy, diarrhoea, etc)

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Management principles for older patients

The aims of managing rheumatic disorders in the elderly are:

- to relieve symptoms, and
- to maintain or improve functional capacity.

It is important to be aware of the support services available in the patient's local community and to understand his or her immediate support environment – for example, whether a home carer is present. Medical comorbidity is common and polypharmacy is prevalent, raising important clinical concerns for management, particularly in relation to potential drug–drug and drug–disease interactions. Consideration of individual patient circumstances is required prior to prescribing.

Pharmacotherapy

Selection of therapy depends on available efficacy and toxicity data. Dose adjustment downward is particularly important if advancing age or illness impairs the primary elimination pathway. In general, 'start low and go slow' when prescribing medications for older patients because therapeutic efficacy is often achieved at lower doses and untoward drug effects can be minimised. In addition, patients should be reviewed at regular intervals while taking therapy to assess effectiveness, identify adverse effects and determine the need for ongoing treatment.

Many drugs used in the management of gout, such as allopurinol, colchicine (Colgout) and various anti-inflammatory agents, require lower doses (or occasionally should be avoided) in the elderly if elimination is diminished by renal insufficiency. For example, prophylactic doses of colchicine should not exceed 0.5 mg/day in the elderly because of the risk of side effects such as gastrointestinal intolerance, pancytopenia and myoneuropathy.

NSAIDs (including COX-2 selective inhibitors)

Traditional NSAIDs have been commonly

used with moderate efficacy to treat older patients who have pain and stiffness, particularly those with inflammatory forms of arthritis such as rheumatoid arthritis. Three COX-2 selective inhibitors are now available: celecoxib (Celebrex), rofecoxib (Vioxx) and, more recently, meloxicam (Mobic). Uptake in the prescribing of this class of drugs has been rapid, with significant financial implications – last financial year, their cost to the PBS was approximately \$300 million.

Following the rapid uptake of COX-2 selective inhibitors, there have been concerns about the quality use of these drugs, which is one of the pillars of the Australian National Medicines Policy. A recent position statement on the use and safe prescribing of COX-2 selective inhibitors has been published in *The Medical Journal of Australia*,⁵ which contains key points that have relevance to prescribing in elderly patients. For example:

- COX-2 selective inhibitors are equally effective as NSAIDs in relieving pain.
- Neither conventional NSAIDs nor COX-2 selective inhibitors alter the underlying course of musculoskeletal disease.
- COX-2 selective inhibitors are associated with fewer peptic ulcers and serious upper gastrointestinal complications such as bleeding, and only slightly fewer upper gastrointestinal symptoms such as dyspepsia.
- Conventional NSAIDs and COX-2 selective inhibitors have similar adverse effects on renal function, fluid retention and blood pressure; both drug classes should be avoided in the presence of significant renal insufficiency, cardiac dysfunction and hypertension.
- It remains unclear whether COX-2 selective inhibitors pose a risk to cardiovascular safety, but there is controversial preliminary evidence of increased myocardial ischaemic events with the use of rofecoxib. Moreover, the gastrointestinal advantages of

COX-2 selective inhibitors appear to be nullified in patients who are taking low dose aspirin.

In summary, COX-2 selective inhibitors offer similar analgesic efficacy to traditional NSAIDs with reduced severe upper gastrointestinal complications. They are available at a substantial pricing premium relative to traditional NSAIDs and have similar relative contraindications, such as congestive cardiac failure, renal impairment, hypertension and concomitant therapies (e.g. combination ACE inhibitor and diuretic therapy). As such, COX-2 selective inhibitors are likely to be of most benefit in patients who have a true need for anti-inflammatory analgesia and who are at high risk of serious upper gastrointestinal complications but have a paucity of other relative contraindications.

With these considerations in mind, prescribers need to make decisions regarding individual patient circumstances. In the management of osteoarthritis, for example, graduations of analgesia from the simple (e.g. paracetamol, topical capsaicin [Zostrix]) to the more potent (e.g. codeine-based preparations, tramadol [Tramal, Zydol]) should be trialled progressively.

Corticosteroids

There is no doubt that oral corticosteroids can be life saving in elderly patients with vasculitis and other systemic connective tissue disease. However, older patients are more susceptible to the complications of treatment, including cataracts, glaucoma, osteoporosis, fragile skin, memory impairment and decreased immune function.

Many of the adverse effects of corticosteroids are dose- and duration-related, and therefore prescribers should use the lowest effective dose for the shortest period and monitor the patient closely for efficacy and toxicity. If the expected duration of corticosteroid therapy is more than one month, consideration should be given to preventing bone loss by measures such

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as optimising calcium and vitamin D intake, obtaining a baseline bone mineral density measurement and recommending lifestyle modifications (e.g. smoking cessation, reducing excess alcohol intake), a home safety evaluation, and antiresorptive therapy (bisphosphonates) as indicated.

Intra-articular corticosteroids are particularly effective in treating localised inflammatory disease (rheumatoid arthritis or crystal deposition disease) and have a low risk of side effects. The use of these agents in osteoarthritis, however, is controversial and should be limited to severe symptoms arising from base of thumb disease and settling a flare of osteoarthritis associated with a joint effusion.

Methotrexate

The preferred agent of choice in rheumatoid arthritis is methotrexate (Ledertrexate, Methoblastin, Methotrexate Injection and Tablets, Methotrexate Injection BP).

Post-hoc analysis of controlled trials using methotrexate concludes that efficacy outcomes and withdrawals due to side effects are not significantly greater in patients over 65 years compared with younger patients.

Many of the side effects of methotrexate are attributed to folate antagonism, so folic acid is often coprescribed to minimise toxicity. Folic acid supplementation (0.5 mg/day) is particularly indicated in older patients taking methotrexate because they are prone to nutritional deficits leading to folate insufficiency and increased homocysteine levels, a risk factor for cardiovascular disease.

Glucosamine

Glucosamine with or without chondroitin sulfate has recently received widespread interest as a therapy for osteoarthritis. Good quality evidence supporting efficacy is controversial, but there are several small

studies reporting short term symptomatic improvement and possibly disease modifying capabilities in this condition.

Surgery

Outcomes following hip and knee replacement surgery are similar in the elderly and younger patients. The major indication for arthroplasty is advanced arthritis causing pain and significant functional limitation that is unresponsive to nonoperative measures. Preoperative evaluation is critical, and must take into account medical comorbidities. Specific concerns in a patient requiring arthroplasty include a history of thromboembolic disease, urinary retention or bleeding dyscrasias and (for knee replacement) poor lower limb vascular status.

Nonpharmacological measures

Mechanical factors aggravating symptoms or functional instability should be

addressed whenever possible. For example, an orthotic arch support to correct flat feet may assist with lower limb pain and instability in a variety of conditions. Obese patients with arthritis (particularly arthritis that involves the lower limbs) should be encouraged to lose weight. Patient education and social support have been shown to improve pain in patients with arthritis. There are many aids available to compensate for loss of function, such as tap turners for patients with hand arthritis. A stick or other walking aid often provides more safety for patients who have arthritis with gait or posture instability.

Several randomised controlled trials have shown that regular exercise does not exacerbate pain or accelerate disease progression. Moreover, these studies suggest that exercise training reduces functional dependency in older adults with joint disease. For example, exercise

programs aimed at improving quadriceps strength have been shown to reduce symptoms and functional incapacity in relation to knee osteoarthritis. (For comprehensive details regarding exercise programs in the elderly, refer to O'Grady and colleagues.⁶)

Conclusion

Rheumatic disorders are common in the elderly, and can be more difficult to diagnose and manage than those in younger patients. Management must be individualised to meet a patient's circumstances and should be undertaken with the view to minimising symptoms and improving quality of life. MT

References

1. The prevalence, cost and disease burden of arthritis in Australia. Canberra: Access Economics, 2001.

2. Agudelo CA, Wise CM. Crystal-associated arthritis in the elderly. *Rheum Dis Clin North Am* 2000; 26: 527-546, vii.

3. Sambrook PN, Seeman E, Phillips SR, Ebeling PR. Preventing osteoporosis: outcomes of the Australian Fracture Prevention Summit. *Med J Aust* 2002; 176 Suppl: S1-S16.

4. Inderjeeth CA, Nicklason F, Al-Lahham Y, et al. Vitamin D deficiency and secondary hyperparathyroidism: clinical and biochemical associations in older non-institutionalised Southern Tasmanians. *Aust N Z J Med* 2000; 30: 209-214.

5. The Australian COX-2 Specific Inhibitor Prescribing Group. Considerations for the safe prescribing and use of COX-2 specific inhibitors. *Med J Aust* 2002; 176: 328-331.

6. O'Grady M, Fletcher J, Ortiz S. Therapeutic and physical fitness exercise prescription for older adults with joint disease: an evidence-based approach. *Rheum Dis Clin North Am* 2000; 26: 617-641.