Orthopaedic Manifestations of Systemic Lupus Erythematosus

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Abstract
Systemic lupus erythematosus (SLE) is a chronic inflammatory autoimmune disease of unknown origin. It affects multiple organ systems, but most frequently the musculoskeletal system. Highly variable manifestations include small and large joint involvement, spinal involvement, periarticular tissue symptoms, and complications associated with chronic steroid use such as osteonecrosis, osteoporosis, and stress fractures. The following review summarizes the common orthopaedic manifestations of SLE.

Systemic lupus erythematosus (SLE) is a multisystem, autoimmune disease of unknown etiology characterized by the production of autoantibodies, notably anti-nuclear antibodies (ANAs). Circulating complexes of ANAs and their antigens may be responsible for pathologic changes seen in multiorgan systems. The deposition of these immune complexes is followed by activation of complement and subsequent inflammatory reaction. Pathogenesis of the disease is apparently multifactorial with genetics, environmental, hormonal, and possibly viral influences playing a role.1

Diagnosis of the disease is based on the fulfillment, simultaneously or serially, of four of eleven criteria including: malar rash, discoid rash, photosensitivity, oral ulcers, arthritis, serositis, renal disorder, neurologic disorder, hematological disorder, immunologic disorder, and presence of an abnormal titer of anti-nuclear antibody. The overall incidence of SLE in the general population is 4.6 per 100,000. SLE predominately affects women, with females affected 9:1 in some series. Often the disease is diagnosed between the ages of 15 and 35.1

The prognosis of patients with SLE has dramatically improved over the last 40 years. Much of this is due to better diagnostic capabilities and improved medical therapies, including salicylates, non-steroidal anti-inflammatory drugs (NSAIDs), antimalarial drugs, and systemic corticosteroid treatments. Recent studies have shown survival rates of 97% at 5 years, which is much improved from the 50% seen 30 to 40 years ago.2

Joints, muscles, ligaments, and tendons are the most commonly involved structures in SLE, with these structures affected in 53% to 95% of patients. Orthopaedic symptoms are often the chief complaint in lupus, and articular pain is the initial symptom in 50% of patients.3 All small and large joints may be affected, along with spinal involvement and non-articular manifestations such as lupus myositis, enthesopathy, and tendinopathy. Furthermore, continuous corticosteroid treatment is often associated with osteoporosis and avascular necrosis can affect the musculoskeletal system. In this paper, the effects of SLE on the joints, spine, muscles, and bones will be reviewed.

Hands and Wrists
Swelling of the proximal interphalangeal (IP) and metacarpophalangeal (MP) joints is the predominant manifestation of SLE in the hand. Generally it has been demonstrated that soft tissue laxity, swan neck deformities, and hyperextension of the IP joint occur in 50%, 38%, and 30% of all patients, respectively. Joint deformities are rare, but may be the presenting complaint. These deformities are secondary to volar plate and ligamentous laxity as well as tendon...
subluxation, which lead to joint imbalance. The joint deformities occur without the erosive destruction of articular cartilage that is seen in rheumatoid arthritis. These joint subluxations that are both nonerosive and reducible are positive indicators of patients who have a longer history of joint involvement. Most often these are caused by capsular pressure and the changes in the mechanics of normal joint action (Fig. 1).

In the fingers, the characteristic deformity at the metacarpophalangeal (MP) joint is volar subluxation and ulnar deviation. These patients demonstrate full finger flexion, with a loss of active finger extension. This initial change is often followed by ulnar subluxation of the extensor tendon and volar subluxation of the proximal phalanx with intrinsic contracture and preservation. However the articular surface is preserved with no changes in the cartilage or bone. Treatment of the deformities include intrinsic lengthening, release, transfer, and metacarpal “step-cut” osteotomies and Swanson MP arthroplasties. At the IP joints, the stretching of supporting structures leads to hyperextension, flexion, and lateral deformities. If the deformity is supple, then rebalancing procedures are indicated; however, if the deformity is fixed, fusion is the treatment of choice. The restoration of IP joint alignment is essential to maintain MP joint realignment.

The thumb is often the first place where hand deformities occur, where lateral subluxation of the IP joint is frequent. Patients note a painless loss of pinching ability, but the articular surfaces are preserved. Treatment is usually comprised of thumb IP joint fusion, which restores stability and function.

The MP joint can also be the site of deformity. With extensor pollicis longus (EPL) subluxation, the joint assumes a flexed position, and lateral subluxation may occur secondary to collateral ligament attenuation. Treatment at this level may consist of EPL rerouting if the IP joint requires fusion, or MP fusion when the deformity cannot be corrected passively. Primary subluxation or dislocation can occur at the carpometacarpal (CM) joint. If the thumb MP and IP joints are well aligned and functioning, a CM fusion with the thumb metacarpal slightly abducted can be performed. An alternative procedure is soft tissue stabilization with rerouting of the flexor carpi radialis as a sling with or without resection arthroplasty.

The ligamentous support of the wrist is not exempt from the devastating effects of SLE. Subluxation can occur at the midcarpal joint or at the radiocarpal joint. The most common carpal dislocation involves the lunate. In these cases, the treatment is limited to total wrist fusion. Another common wrist problem in these patients is dorsal subluxation of the ulna, characterized by wrist pain and limited pronation and supination. Untreated dorsal subluxation can lead to extensor tendon rupture by attrition. Nalebuff recommends a Darrach procedure in these cases.

Large Joints

As with the smaller joints of the hands, the shoulders, hips, and knees can be involved in SLE. Jaccoud’s arthropathy has been used to describe large joint involvement in these patients as well. The arthritis may be migratory or persistent and chronic, with swelling usually due to soft tissue thickening with small effusions. The subluxations associated with this condition are initially reversible, but with time become fixed. Jaccoud’s arthropathy has been reported to occur in both the shoulders and the knees (Fig. 2). As with rheu-
matoid patients, those with SLE are prone to develop popliteal or Baker’s cysts. In addition, SLE patients with antiphospholipid antibodies are at increased risk for the development of deep venous thrombosis. Differentiation between rheumatoid and SLE patients may be difficult.3

Synovitis about the hips is rare. Therefore any hip or groin pain in a patient with SLE should initially be considered to be osteonecrosis. Osteonecrosis occurs in 5% to 10% of patients with SLE, with the femoral head involved in 80% of those cases. The etiology is either primary to the disease state due to small vessel vasculitis or secondary to treatment of the condition with systemic corticosteroids. Prior to 1960, there was no incidence of osteonecrosis in SLE patients; however, steroid intervention did not begin until the late 1950’s, suggesting a strong correlation between these factors.9,10 Associations also exist between osteonecrosis and presence of Raynaud’s phenomenon and fat emboli.3

The clinical course of patients with osteonecrosis is unpredictable, but usually they will progress to painful, arthritic joints. Treatment options for symptomatic osteonecrosis of the femoral head include: protected weightbearing, core decompression, bone grafting, femoral osteotomy, and prosthetic arthroplasty.11 Hanssen and colleagues reported the results of 43 hip reconstructions over a 12 year period.12 Patients who had total hip replacements did much better than those who underwent bipolar replacement at a mean follow-up of 57 months.

Sacroiliac Joint, Feet, and Spine

Sacroiliitis typically affects patients with seronegative arthritis, but it has also been reported in patients with SLE.13 Asymptomatic sacroiliitis is demonstrated on the plain film radiographs and the bone scans of some patients. The prevalence of sacroiliitis has been reported to be higher in males than females with SLE.14,15 Nassanova and associates reported that males who had radiologic evidence of sacroiliitis were asymptomatic and were HLA B-27 negative. Cases of symptomatic sacroiliitis may include lower back pain aggravated by movement.13,14 It is important to rule out infective causes of joint effusion because the clinician should be aware of the possible development of septic arthritis for all SLE patients. Antibiotic treatment is indicated because of the
decreased immune response capability of these patients.\textsuperscript{16,17} Jaccoud’s arthropathy can be seen in the small joints of the foot. The presence of metatarsophalangeal subluxation, hallux valgus, hammertoes, and forefoot widening without erosions or cystic lesions is termed “lupus foot.”\textsuperscript{18} These deformities can result in painful bunions and callosities. Proper shoe wear and meticulous foot care are essential to prevent serious complications.\textsuperscript{3}

As in other areas of the musculoskeletal system, the spine of the patient with lupus can also be involved. Pathologic lesions may involve the osseous structure, the ligamentous complexes, or the neural elements of the spine. The majority of spinal involvement in patients with SLE occurs in the upper cervical spine, but can involve the subaxial spine as well.

The frequency of atlantoaxial instability in association with rheumatoid arthritis has been well established. Although joint involvement is a major manifestation of SLE, cervical involvement is sparsely reported in the literature. Babini and coworkers determined the frequency of atlantoaxial instability in a prospective group of patients with SLE and analyzed its relationship with tendinous laxity.\textsuperscript{19} In their series, 8.5% of patients were found to have atlantoaxial instability based on flexion-extension films. The mechanism by which this instability occurs is unknown, but it has been attributed to tendinous laxity that also affects the cervical ligaments. Atlantoaxial instability is associated with a longer disease duration and those who demonstrate Jaccoud’s syndrome, articular hypermobility, chronic renal failure, and elevated PTH levels.

Thoracolumbar compression fractures are seen in patients on chronic corticosteroid therapy. These patients will usually present with mid-thoracic or lower back pain. Treadwell and colleagues reported the case of an elderly patient treated with chronic steroids for SLE who presented with T8 and L4 compression fractures and an acute abdomen.\textsuperscript{20} They postulated the cause of the acute abdomen to be a neurogenic ileus.

Another rare complication of chronic steroid use is epidural lipomatosis. This condition is characterized by abnormal accumulations of white fat on or outside the dura. Crayton and associates reported the case of an SLE patient with epidural lipomatosis who developed a cauda equina syndrome secondary to chronic steroid use.\textsuperscript{21} Differential diagnosis includes vertebral fracture, herniated disk, hematoma, abscess, or stenosis. Surgical decompression is often indicated and can result in rapid or slow recovery over a period of several months. This diagnosis should be considered in any patient on chronic steroids who presents with an atraumatic onset of cauda equina syndrome.

**Myopathy and Avascular Necrosis**

Muscle tenderness and generalized myalgia in the proximal limb musculature is common in patients with lupus flares and has been observed in 40% to 48% of patients. Creatinine phosphokinase levels, electromyography, and muscle biopsy can predict inflammatory myositis involving the proximal musculature.\textsuperscript{3}

In patients with SLE, the EMG findings are similar to those found in dermatomyositis-polymyositis. Those findings include spontaneous fibrillations-polymyositis. Those findings include spontaneous fibrillations, positive potentials, small amplitude, polyphasic potentials, and re-

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petitive high frequency potentials. Interstitial inflammation, fibrillar necrosis, and degeneration are all seen in muscle biopsies. 22

Myalgias without myositis may respond to salicylates, non-steroidal anti-inflammatories, antimalarials, or 20 mg per day of prednisone. If the diagnostic criteria for SLE and dermatomyositis is present, treatment with 1 mg per kilogram of body weight per day of prednisone should be initiated. 3

Avascular necrosis has long been associated with SLE. 23 The incidence of AVN has been reported anywhere from 4% to 16%. 24 Most cases are due to corticosteroid treatment with the remainder probably induced by fat emboli, Raynaud’s phenomenon, small vessel vasculitis, or the antiphospholipid antibody syndrome. 3 Multiple sites can be affected including the femoral head, femoral condyles, tibial plateaus, and proximal humerus (Fig. 4). 25-28

Magnetic resonance imaging (MRI) allows many clinically and radiographically silent cases to be identified. There seems to be a greater prevalence of AVN among patients who have received higher doses of steroids and were treated for extended periods of time. 25 MRI is the diagnostic method of choice; computerized tomography and scintigraphy are less accurate and do not pick up the pre-radiographic lesions.27

Avascular necrosis is a risk factor for septic arthritis. 29,30 Markov and coworkers reported the case of a 32-year-old Asian female with SLE who was hospitalized with an acutely swollen knee. MRI demonstrated AVN of both femoral condyles. In addition she was diagnosed with septic enterococcal arthritis on the basis of the joint aspirate culture. The patient was successfully treated with antibiotics and systemic corticosteroids. 30

Osteoporosis

There are many factors associated with the development of clinically significant osteoporosis in patients who have SLE. Prolonged glucocorticoid therapy, sunlight avoidance, chronic induction of inflammatory cytokines, renal failure, amenorrhea, and early menopause are risk factors for the development of osteoporosis. Houssiau and colleagues measured lumbar spine, hip, and total body bone mineral densities by dual energy x-ray absorptiometry (DEXA) in 47 premenopausal females with SLE. 31 As compared to healthy controls, SLE patients had lower bone mineral densities (BMD) at all trabecular and cortical sites. Comparison between patients who had received glucocorticoids sometime in their lives and those who never received glucocorticoids showed that those patients who had received glucocorticoids had significantly lower spine BMDs than the latter group. Patients who had never taken glucocorticoids had lower hip BMDs compared to healthy non-lupus patients which suggests other etiologic agents in the development of osteoporosis in SLE patients. These results were supported by a study by Pons and associates, which demonstrated an association between corticosteroid use and osteoporosis in a control population of premenopausal females with SLE. 32

Since SLE patients are living longer, the complications of osteoporosis are increasing. With loss of BMD there is an increased risk for spinal compression fractures as well as other fractures associated with bone loss, such as distal radius and proximal humerus fractures. 19 Buskilla and Gladman 33 reported a case involving bilateral distal tibia stress fractures. Osteoporosis is a known risk factor in the development of insufficient stress fractures. This case posed a diagnostic dilemma because the associated ankle swelling mimicked acute lupus synovitis versus osteomyelitis. 33 Treatment includes limiting glucocorticoids, maintenance of physical activity, and bisphosphonates.

Tendon Degeneration and Soft Tissue Calcification

Tendon degeneration and rupture is also associated with chronic corticosteroid use and extended disease duration.34 Pritchard and Berney identified the frequency of patellar tendon rupture in patients with SLE.35 They reported patella tendon rupture in 4 of 180 patients seen over a 10 year period, and highlighted 17 other cases in the literature. All patients had been taking prednisone for 7 to 15 years and had other complications associated with chronic steroid use such as osteonecrosis and vertebral compression fractures.

Soft tissue calcification can be seen in any of the collagen-vascular diseases such as progressive systemic sclerosis, dermatomyositis, polymyositis, and SLE. In most cases, the soft tissue calcifications seen radiographically are clinically asymptomatic. Minami and coworkers reported two cases of subcutaneous calcification of the forearm in patients with SLE; these were excised and demonstrated to be pure calcium phosphate crystals. Both cases were treated with surgical excision secondary to failure of nonoperative measures. Patients were placed on etidronate postoperatively and no recurrences were noted at two years follow-up.36

Calcinosis universalis, deposits of calcium phosphate in muscle, subcutaneous nodules, and periarticular can occur in discoid or systemic lupus.37 Approximately 30 cases of soft tissue calcification in patients with SLE have been reported in the literature to date.38 Currently nonoperative treatment with diltiazem, a calcium channel blocker, is the therapy of choice.3

Conclusion

It is important for the orthopaedic surgeon to be familiar with the spectrum of musculoskeletal manifestations in SLE, including those that result directly from the dis-
ease process itself and those secondary to its treatment modalities. With a thorough understanding of the potentially devastating complications associated with this disease, patients at risk can be identified and preventative treatment initiated when appropriate.

References