Quantitative joint assessment in rheumatoid arthritis

T. Sokka[1,2], T. Pincus[1]

[1]Vanderbilt University Medical Center, Nashville, Tennessee, USA; [2]Jyväskylä Central Hospital, Jyväskylä, Finland.
Tuulikki Sokka, MD, PhD; Theodore Pincus, MD.

Please address correspondence to: Tuulikki Sokka, MD, PhD, Vanderbilt University School of Medicine, 203 Oxford House, Box 5, Nashville, TN 37232-4500, USA.
E-mail: t.sokka@vanderbilt.edu

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ABSTRACT

A count of swollen and tender joints is the most specific quantitative clinical measure to assess and monitor the status of patients with rheumatoid arthritis. Many methods have been described to quantitate joint abnormalities, including scoring various numbers of joints (with or without grading of abnormality) for different types of abnormalities, including swelling, tenderness, pain on motion, limited motion, and deformity. This article reviews selected methods for the performance of joint counts, with discussion of their advantages and limitations in the assessment of patients with rheumatoid arthritis.

Introduction

A joint count is the most specific clinical method to quantify abnormalities in patients with rheumatoid arthritis (RA). The swollen joint count reflects the amount of inflamed synovial tissue and the tender joint count is associated more with the level of pain. Formal joint counts have been described with the evaluation of 28 to 80 joints, with or without grading of severity of abnormality, and sometimes weighting larger joints. Joint counts are included in historical indices of disease activity, such as “a therapeutic scorecard in rheumatoid arthritis” (1) and the Lansbury Index (2). Joint counts are a major component of the disease activity score (DAS) (3,4) and similar indices (5), the American College of Rheumatology (ACR) Core Data Set for clinical trials in RA(6), and the ACR remission criteria (7). Improvement in joint scores is required to meet ACR improvement criteria (8). Clinically detectable inflammation antedates structural damage of joints (9), and rheumatologists are urged to include a joint count at each visit of each patient (10).

This essay presents a brief description and discussion of the development of the joint count over the last half century.

Description of abnormalities in a quantitative joint evaluation

Abnormalities assessed in formal joint counts include swelling, tenderness, pain on motion, limited motion, and deformity. Joint swelling is defined as soft tissue swelling of the joint which is detectable along the joint margins. A synovial effusion invariably means that the joint is swollen. Fluctuance is a characteristic feature of swollen joints; neither bony enlargement nor deformity of the joint constitutes “swelling”. Joint swelling may influence the range of joint motion, which can be useful to recognize the presence of swelling. Examples include decreased dorsiflexion of the wrist and decreased elbow extension when joint swelling is present.

Joint tenderness is defined as pain at rest that is induced by pressure at examination of some joints such as the metacarpophalangeal (MCP) and wrist joints. The examiner uses his/her thumb and index finger to exert pressure that is sufficient to cause whitening in the examiner’s nailbed, which is called the “rule of thumb”. Joint tenderness is correlated significantly with pain on motion (11). Pain on motion may be substituted for pressure at examination for the shoulder, tarsal and hip joints.

Limited motion is of value to be assessed in each joint, rather than a formal assessment of range of motion, which may be useful in orthopedic evaluations, but is not necessary in rheumatologic care. Generally, the assessor may serve as the normal "control" for range of motion. A joint deformity may be reducible or non-reducible; joint deformity is correlated significantly with joint limited motion. In view of the fact that joint swelling and tenderness may improve over five years while joint limited motion deformity may progress (see below) (12,13), it may be of value to include assessment of limited motion or deformity in any database which is projected to be analyzed over periods longer than a year.

Table I. Comparison of joints included in various standard joint counts.

Joint	66/68 joints (15)	Ritchie Index (16)	44 joints (22)	36 joints (23)	28 joints (19)	42 joints (24)
Temporomandibular	+	+*				
Sternoclavicular	+	+*	+			
Acromioclavicular	+	+*	+			
Shoulder	+	+	+		+	+
Elbow	+	+	+	+	+	+
Wrist	+	+	+	+	+	+
Metacarpophalangeal		+				
First	+		+		+	+
Second	+		+	+	+	+
Third	+		+	+	+	+
Fourth	+		+	+	+	+
Fifth	+		+	+	+	+
Proximal interphalangeal		+				
First	+		+	+	+	+
Second	+		+	+	+	+
Third	+		+	+	+	+
Fourth	+		+	+	+	+
Fifth	+		+	+	+	+
Distal interphalangeal						
Second	+					
Third	+					
Fourth	+					
Fifth	+					
Hip	+#	+				+
Knee	+	+	+	+	+	+
Ankle	+	+	+	+		+
Talocalcaneal		+				
Tarsus	+	+				
Metatarsophalangeal		+				
First	+		+	+		+
Second	+		+	+		+
Third	+		+	+		+
Fourth	+		+	+		+
Fifth	+		+	+		+
Proximal interphalangeal (toe)						
First	+					
Second	+					
Third	+					
Fourth	+					
Fifth	+					

#Assessed for tenderness only; *right and left joints assessed together.

One consideration in assessment of joints involves surgical intervention. A joint in which the patient had a synovectomy, total joint replacement or other surgical procedure might be regarded as "normal" if no swelling or tenderness is present, but "abnormal" if surgical intervention is considered. Recording of surgical intervention is desirable for assessment of long-term effects of rheumatoid arthritis (14).

Standard joint counts

The joint count has been described in many formats; some of the most prominent methods are summarized in Table I. A 66/68 joint count includes the MCP, proximal interphalangeal (PIP), and distal interphalangeal joints of the hands, the metatarsal phalangeal (MTP) and distal interphalangeal joints of the feet, and the shoulder, elbow, wrist, hip, knee, ankle, tarsus, and temporomandibular, sternoclavicular, and acromioclavicular joints (15).

The Ritchie Index (16) (Table I) comprises 52 joints, including the shoulder, elbow, wrist, hip, knee, ankle, talocalcaneal, tarsus, and cervical spine, which are assessed only for tenderness. The MCP and PIP joints are assessed in groups and the left and right joints are assessed together in the temporomandibular, sternoclavicular, and acromioclavicular joints. Assessment includes the grading 0 = non-tender, 1 = tender, 2 = tender with wincing and 3 = tender, with wincing and withdrawal, with a total score range from 0 to 78.

The Glossary Committee of the American Rheumatism Association (ARA) presented a joint count involving 80 joints, each of which was analyzed for 5 variables: swelling, tenderness, pain on motion, limited motion, and deformity (17,18). Swelling at the hip, which is difficult to assess, is not included. High correlations were found between tenderness and pain on motion, as well as between deformity and limited motion (19), which has led to the practice of assessing only 3 variables: 1) swelling, 2) tenderness or pain on motion: and 3) limited motion or deformity.

The Thompson Index (20) counts tenderness and swelling in 38 joints which are weighted according to their surface area, with a total score of 0-534. The knee is weighted more than the other joints; other joints included are the PIP, MCP and MTP joints, elbows, wrists, and ankles. Feasibility of a weighted index in clinical practice is a concern (21).

A 44 swollen joint count (Table I) is included in the DAS (4,22) and includes the sternoclavicular and acromioclavicular joints, the shoulders, elbows, wrists, knees, ankles, and MCP, PIP, and MTP joints. A 36 joint count (Table I) includes second to fifth MCP joints, the PIP and MTP joints, wrists, elbows, knees, and ankles (23). A 28 joint count (Table I) includes MCP and PIP joints, wrists, elbows, shoulders and knees (19), and excludes the joints of the feet. Some recent studies have used a 42 joint count (Table I), in which MTP joints, hips and ankles are added to the 28 joint count (24). A 42 joint count is currently included in a standard protocol for the evaluation of RA (SPERA) (25). These counts calculate the number of abnormal joints, without grading the extent of swelling or ten-

derness, which has not been found to add useful information (19), perhaps because of intra-observer variation.

Self-report joint counts

A "rapid assessment of disease activity in rheumatology" (RADAR) questionnaire was reported as a patient self-report joint count in 1992 (26). Further development of a self-report joint count is seen as a "rheumatoid arthritis disease activity index" (RADAI) (27). The RADAI joint list queries pain "today" in 16 joints or joint groups including left and right shoulders, elbows, wrists, fingers, hips, knees, ankles, and toes. The level of pain is rated from 0 to 3, with 0 = none, 1 = mild, 2 = moderate, 3 = severe, and a total score of 0-48. The RADAI also includes three 10-cm VAS scales concerning global disease activity in the last 6 months, disease activity in terms of current swollen and tender joints, and arthritis pain. Duration of morning stiffness includes six response alternatives from 0 = none to 6 = all day. Scores are transformed to a scale of 0-10. The RADAI score is the mean of the scores of items to which the patient has responded.

The course of joint involvement in RA: Improvement in inflammatory activity over 5 to 10 years, and progression of damage

Joint tenderness, joint swelling, and the erythrocyte sedimentation rate (ESR) are measures of inflammatory activity that are included in the Core Data Set of measures and DAS for use in clinical trials and clinical research (4, 6, 28-30). Control of inflammatory activity according to these measures is regarded as an effective strategy to prevent long-term damage, although no studies are available in which inflammatory activity was completely suppressed and joint damage was prevented over the long-term.

Several reports document that joint tenderness and joint swelling, which are measures of inflammatory activity, may be stable or even somewhat improved over periods of 5-10 years, even while patients experience disease progression according to measures of damage. Hawley and Wolfe (31) reported improvement or unchanged joint tenderness scores, grip strength, global severity, morning stiffness, ESR, and hemoglobin, but significant progression of functional disability according to health assessment questionnaire (HAQ) scores. Egsmose *et al.* (32) reported improvement in the tender and swollen joint counts, morning stiffness, functional capacity, pain and grip strength over 5 years in patients who were treated with auranofin early in the disease course, and improvement or no change in the same measures over 5 years in patients with delayed treatments as well. Radiographic progression was seen in both groups, but was less in patients who were treated early in the disease. Mulherin *et al*. (33) reported improvement in morning stiffness, pain scores, grip strength, the Ritchie Articular Index, ESR and hemoglobin over 6 years, while radiographic scores indicated progression. Fex *et al.* (34) reported that values for morning stiffness, pain scores, general health, Ritchie Articular Index, HAQ scores, ESR, and hemoglobin were similar to baseline after 5 to 6 years, while radiographic scores indicated significant progression. Callahan *et al*. (13) reported that joint tenderness, swelling, ESR, hemoglobin, morning stiffness, pain and modified HAQ (MHAQ) were unchanged or improved, while scores for joint limited motion, joint deformity, radiographic damage, grip strength, and walking time indicated progression. Leirisalo-Repo *et al*. (35) reported stable joint swelling scores and better joint tenderness scores over 13 years, while functional capacity, pain, and radiographic scores progressed. Graudal *et al.* (36) observed patients for 4-22 years and showed improvements in ESR, hemoglobin and swollen and tender joints counts while radiographic scores deteriorated. In this study, radiographic scores were greater in patients with greater inflammatory activity over time (36). Although inflammatory activity in these studies was the same or better over time, residual inflammation remained in most patients.

These data indicate that partial control of inflammation is often inadequate to prevent the progression of structural damage. It has also been suggested that anti-tumor necrosis factor (TNF) therapies may slow or prevent radiographic damage without control of inflammation (37). However, concerns have been raised about this suggestion, which remains to be confirmed in long-term studies (38).

Limitations of assessment of joints

As is the case with all measures, certain limitations have been observed in the application of joint counts in clinical research. Intra-observer and inter-observer reliability (reproducibility) of joint counts is far from perfect (39). In a study of leflunomide compared to methotrexate and placebo, joint swelling and tenderness improved more from baseline to endpoint in patients who received placebo than patient questionnaire and laboratory measures in the Core Data Set (40). Although assessor measures are regarded as "objective" parameters of disease activity, this finding suggests that the assessor's desire to influence disease activity may influence measures such as joint counts (40, 41).

Joint inflammation may be silent to palpation and even to the patient. In several studies, histologic features of synovitis have been found in clinically uninvolved joints of patients with RA (42-44). Magnetic resonance imaging (MRI) studies indicate that bone damage is associated with preceding synovitis (45), and that erosions do not develop randomly in uninvolved joints (9). Although regarded as an "objective" measure, the joint count is only a surrogate of inflammation in the joint.

Finally, joint counts are time-consuming and tedious in clinical practice. Although most visits to rheumatologists include a careful joint examination, formal quantitative joint counts are generally not performed in standard clinical practice, despite their being regarded by clinicians as the most important measure to assess patients with RA(46). A survey of 600 European rheumatologists concerning likelihood of performing a joint count at visits of patients with RA showed that the majority of visits do not include a formal joint count (47).

Conclusions

Formal joint counts remain the most specific measure to assess RA, and it appears desirable to maintain these specific measures in clinical trials and clinical care. Nonetheless, patient questionnaires provide a stronger capacity than joint counts to predict severe outcomes such as work disability and premature mortality in patients with RA (48). The intuition of many rheumatologists that formal joint counts may not be needed in standard clinical care may be valid. Collection of quantitative data from patient questionnaires, including patient self-report joint counts might add to optimal monitoring and management of patients with RA.

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