
Joint counts in inflammatory arthritis

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ABSTRACT

Objective. *Counting the number of tender and swollen joints is an important aspect of assessing patients with an inflammatory arthritis. We provide a comprehensive overview of joint counts in inflammatory arthritis. This spans how they are undertaken, their use in clinical and research settings, their limitations and standardisation and who can perform them.*

Methods. *We reviewed the literature surrounding joint counts in inflammatory arthropathies, with a specific focus on rheumatoid arthritis (RA).*

Results. *The current widely used joint count assesses 28 peripheral joints. In RA these are usually incorporated in a composite score of disease activity, termed the disease activity score on a 28-joint count (DAS28). Assessing 28 joints has a strong "floor-effect" with most patients in routine practice having low swollen and tender joint counts. Marked between-observer variation exists in joint count scores; although the variation in tender joint counts can be reduced by standardised training its impact on swollen joint counts is uncertain. Fibromyalgia can have a marked impact on tender joint count scores, resulting in a disproportionately high tender joint count to swollen joint count ratio. Although there is evidence that patient-assessed tender joint counts correlate well with those undertaken by physicians, patients are limited assessors of synovitis.*

Conclusion. *Although joint counts provide an important objective measure of disease activity in clinical practice, they have a number of limitations. Future research may provide a more robust clinical assessment for disease activity in inflammatory arthropathies, which overcomes these issues.*

Background

In the 1950s, Lansbury highlighted the importance of counting the number of active joints when assessing rheuma-

toid arthritis (RA) patients. He advocated undertaking joint counts, whilst appreciating the complexity of counting joints of differing sizes alongside the challenges of integrating these counts with other features of RA to inform clinical care (1-3). These considerations are also applicable to other inflammatory arthropathies such as psoriatic arthritis. In this review we provide a comprehensive overview of joint counts in inflammatory arthritis; this spans how they are undertaken, their use in different clinical and research settings, their limitations, how they can be standardised and who can perform them.

Assessing joint swelling and tenderness

The two characteristic features of inflamed joints comprise swelling and tenderness. Joint swelling is soft tissue swelling detected along joint margins. When there is a synovial effusion, a joint is inevitably swollen. Effusions are not however mandatory features of a swollen joint. The most characteristic feature of a swollen joint is fluctuation, in which fluid can be displaced by pressure in two planes.

Bony swelling and joint deformities often complicate the counting of swollen joints. Neither of these indicates the presence of joint swelling, although they can be present when joints are swollen. In late disease it is often difficult to differentiate swollen from deformed inactive joints.

Joint tenderness is indicated by inducing pain in a joint at rest with pressure. Judging the correct amount of pressure to elicit tenderness depends on both the examiner and the patient. Generally sufficient pressure should be exerted by the examiner's thumb and index finger to cause 'whitening' of the examiner's nail bed; this equates with a pressure of approximately 4kg/cm² (4). In some joints, like the hip, tenderness is best identified through movement.

Which joints to count

Many joints can be involved in inflammatory arthritis. Their size and distribution varies substantially, making it difficult to know how best to summate counts. A number of different joint counts have been devised. Initially developed counts assessed all 86 peripheral joints; currently used counts assess 28 peripheral joints and exclude those in the feet. Irrespective of how many joints are formally counted, all joints should be assessed in clinical practice.

86 joint counts

Lansbury assessed 86 peripheral joints; each was scored with a weighting derived from their relative surface area (3). He also recommended assessing five domains – tenderness, pain on motion, swelling, limited motion, and deformity. His approach has not stood the test of time and is not used in contemporary practice.

66/68 joint counts

The most important initiative, which has achieved lasting consensus, was led by the American Rheumatism Association in the 1960s (5). Eleven collaborative clinics agreed uniform methods of measuring disease activity, which included joint counts. They devised the 66/68 joint count for swollen and tender joints; this count includes all peripheral synovial joints.

Ritchie articular index

As tenderness is more readily assessed than swelling, this way was used to develop an index by Ritchie *et al.* (6). Their index scored 53 joint groups on a scale of 0-3; it was widely used in clinical trials for several decades, though it is now rarely considered.

36 joint counts

Undertaking 66/68 joint counts is time consuming, particularly as it involves a detailed assessment of the feet. Its use in a routine clinical setting is therefore limited and there have always been pressures to develop counts that involve fewer joints. The first attempt to simplify joint counts was made by Egger *et al.*, who recommended counting 36 joints (7). Although this concept

attracted considerable interest, it was not widely adopted.

28 joint counts

The next development was the introduction of the 28 joint count by Fuchs *et al.* in 1989 (8). This involved assessing 10 proximal interphalangeal joints of the fingers, 10 metacarpophalangeal joints, the wrists, elbows, shoulders and knees. Subsequently Fuchs and Pincus (9) evaluated whether the reduced number of joints counted provided information equivalent to traditional 66/68 joint counts in detecting changes in RA patients in clinical trials. Analyses of three published trials showed reduced counts gave similar findings to 66/68 joint counts. The reduced joint count showed significant changes in trials involving as few as 15 patients. They recommended using 28 joint counts in place of more extensive assessments; this advice has been widely adopted. It represents a simple and pragmatic approach to assessment that has stood the test of time. It delivers results that are as good as using more extended counts. Studies by Prevo *et al.* (10) and by Smolen *et al.* (11) replicated these findings and showed 28 joint counts had sufficient validity and reliability for widespread use. Whilst reduced joint counts are useful in RA, in other forms of inflammatory arthritis, particularly psoriatic arthritis, they may be less relevant and the focus continues to remain on 66/68 joint counts (12). This is mainly because in psoriatic oligoarthritis only a few joints may be involved and often these are in the lower limbs and would not feature in 28 joint counts.

Additional research by Prevo *et al.* (13) incorporated the 28 joint count within the Disease Activity Score (DAS). This variant, termed the DAS28 score, combines 28 counts for tender and swollen joints with patient global assessments and the erythrocyte sedimentation rate (ESR) in a composite score designed to capture an RA patient's overall disease activity.

Which variables to measure

Although it is conventional to assess joint tenderness and joint swelling in joint counts, several other changes can

also be reliably assessed on clinical examination. Fuchs *et al.* (8) showed that 28 joint counts could also assess pain on motion, limited motion and deformity. Other experts have devised methods of counting the number of damaged joints (14, 15), though these measures have not been widely adopted. Most emphasis continues to be placed on tenderness and swelling, which are considered to capture disease activity. One unresolved problem is how to deal with surgically replaced joints. Although their presence can be noted, they cannot readily be incorporated into counts of tender and swollen joints.

Joint counts in routine practice

Historically many clinicians did not record objective assessments of their RA patients during clinic visits. However, expert groups now recommend regularly recording joint counts as a measure of disease activity. The American College of Rheumatology (ACR) recommended recording 28 joint counts in 2012 (16). In England and Wales current National Institute for Health and Care Excellence (NICE) guidelines advocate measuring the DAS28 regularly to inform decision-making (17).

We follow this practice. Figure 1 shows tender and swollen joint counts in 307 consecutive RA patients seen in South London Rheumatology clinics between 2010 and 2011. This routine clinic data shows a strong “floor effect”; 197 (64%) patients had swollen joint counts of ≤ 2 and 175 (57%) had similarly low tender joint counts. Few patients had ≥ 6 swollen or tender joints; 53 (17%) and 76 (25%), respectively. Therefore, when patients have active disease the reduced 28 joint count is clearly appropriate. However, as more patients achieve low disease activity states or remission the benefits of these reduced joint counts are less clear. The relatively low joint counts encountered in routine clinical practice mean that only a minority of current clinic attendees meet the criteria to be enrolled in clinical trials of anti-rheumatic drugs (18, 19). This creates challenges in applying the current evidence base of RA treatments to routine practice.

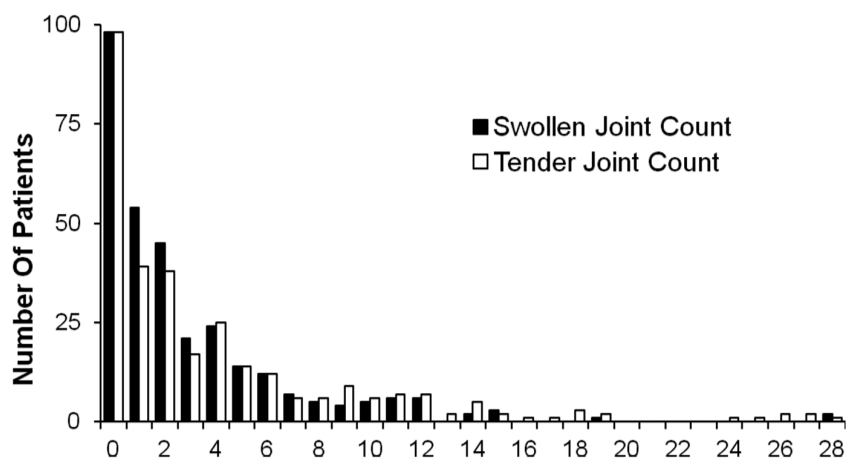


Fig. 1. Tender and swollen joint counts in 307 consecutive clinic patients with rheumatoid arthritis seen in 2010-11.

Joint counts in clinical trials

Classically patients enrolled in trials of anti-rheumatic drugs needed to have active RA with 6 or more swollen joints and 6 or more tender joints assessed on the 66/68 extended joint count (18). However, the more widespread use of 28 joint counts has changed perceptions. A recent report from Canada recommended that patients should have three or more swollen and tender joints on the 28 joint counts (20). The fall in the number of active joints observed in routine practice reported by Pincus *et al.* (21), who showed these were halved between 1985 and 2001, suggests that the criteria for active RA patients enrolled in trials needs reconsideration.

Most trials and systematic reviews report summary response measures rather than changes in individual measures such as joint counts. However, an analysis of the leflunomide trials data from studies reported more than 10 years ago shows the reductions in joint counts were in the region of 20% of the initial value (22). If a patient had 6 swollen joints this would mean a reduction of 1-2 swollen joints.

Clinically important differences

Although joint counts are central to clinical assessments, there is limited information about what constitutes a clinically meaningful improvement. Studies from Lassere *et al.* (23) and Tubach *et al.* (24) outlined the central issues involved without drawing any def-

inite conclusions. More recently, Ward *et al.* (25) highlighted the complexities involved and suggested that in patients with >30 swollen joints on first assessment a meaningful improvement would occur if this was reduced by 22 joints; this is larger than the improvements reported in most studies. Often changes in swollen joint counts were not strongly associated with clinical improvements. As previously discussed current practice often incorporates 28 joint counts within the composite DAS28 score; a reduction in the DAS28 score of ≥ 1.2 units is generally considered to be a clinically important difference (26).

Standardisation

It has been known for many years that there is substantial between-observer variation in joint count scores. An early study, which compared the assessment of 28 joint counts by eight different observers, found extensive variability in swollen and tender joint counts (27). Training resulted in higher joint counts, increasing the numbers of swollen and tender joints by 32% and 41%, respectively. More recently, Grunke *et al.* (28) evaluated the impact of joint count training in 553 examiners from a variety of countries. Examiners included a variety of health professionals, although they mainly comprised physicians and nurses. Substantial variation between examiners was present prior to training in a standardised joint count method; this variability was con-

siderably reduced by training, which also resulted in fewer joints being considered active. Based on these findings, Stamp *et al.* recommended training and calibration for the New Zealand treat-to-target initiative (29). They found that even brief and informal training resulted in a reduction in the between-observer variability of joint counts. They considered that joint count calibration exercises should teach a standardised examination method to minimise variation. A recent systematic review evaluated the reliability of joint counts in RA in 28 studies involving health care professionals and 20 studies involving patients (30). Intra-observer reliability for tender and swollen joint counts was good for health care professionals and patients. Nine studies assessed the impact of consensus or training on joint counts; they demonstrated improvement in the reliability of tender joint counts but the evidence for a beneficial effect on swollen joint count reliability was inconclusive.

Who should assess joint counts?

Most clinical assessments are undertaken by specialist rheumatologists. However, there is a long history of specialist nurses and other healthcare professionals assessing joint counts. Cheung *et al.* (31) found that a training day followed by additional practice with 20 patients under the guidance of a rheumatologist was sufficient for nurses to be able to accurately assess tender and swollen joints. Often highly trained specialist nurses perform joint counts more consistently than physicians.

The role of physicians in undertaking joint counts has come under increasing scrutiny. Keystone (32) has questioned whether it should continue, mainly due to the variation between observers in deciding whether or not a joint is active. After carefully weighing the arguments he recommended the practice continues, though caution is needed in interpreting joint counts.

Fibromyalgic rheumatoid

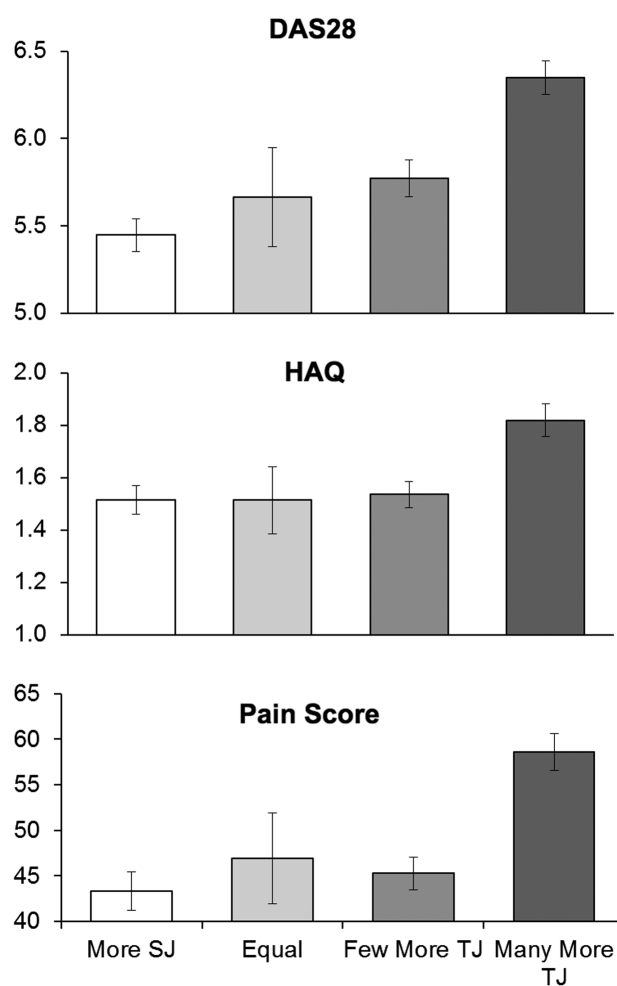
Tender joint counts provide somewhat different information from swollen joint counts. The difference between them is critical when patients have high

pain levels. This situation is conventionally termed “fibromyalgic rheumatoid”. It is characterised by high tender point counts and an excess of 7 or more tender joints over swollen joints (33). The negative impact of the presence of fibromyalgia in RA has been known for more than a decade (34); it is associated with higher levels of disability and reductions in quality of life scores. Fibromyalgic rheumatoid also increases disease activity scores (35). The impact of fibromyalgic rheumatoid on assessments of disease activity, disability and pain in a group of patients with early active RA in a previously published trial – the Combination Anti-Rheumatic Drugs in Early RA (CARD-ERA) trial (36) – is shown in Figure 2. Patients with an excess of tender joints had substantially higher DAS28, HAQ and pain scores. Some patients with fibromyalgia can have high tender joint counts and patient global assessments but low swollen joint counts and ESRs; these patients can have misleadingly high DAS28 scores.

Patient self-assessment

An alternative to clinician assessments is for patients to assess their own joints. Over two decades ago, Abraham *et al.* (37) reported that in 32 RA patients there was adequate inter-rater reliability among the patients’ and clinicians’ joint counts. There was also reasonable convergent validity based on correlations with pain, helplessness, and the joint alignment and motion scale. There have been many subsequent studies of self-assessed joint counts. Houssien *et al.* (38) showed that whilst physician and patient joint count assessments were sufficiently correlated to be used in research, they were not directly interchangeable and patient joint count assessments should not replace physician assessments in routine clinical practice. There is evidence that patient-derived measures need to be used in different ways to deliver disease activity scores (39). Differences between patients’ and clinicians’ joint counts in an observational study of 472 RA patients are shown in Figure 3 (39), which shows a reasonable relationship between patient and assessor measures of tender joint

Fig. 2. Impact of disproportionately high tender joint counts in 465 early active RA patients enrolled to a clinical trial (36). Patients with an excess of tender joint counts of ≥ 7 at study baseline had higher DAS28, HAQ and pain scores. Data are from trial baseline; SJ: swollen joint; TJ: tender joint; few more TJ: 1-6 tender joints; many more TJ: ≥ 7 tender joints.



counts but little relationship for swollen joint counts.

An alternative to counting specific joints is to use an instrument like the RA disease activity index (RADAI) (40), which uses rating scales to assess joint activity. In 55 RA patients the RADAI had a high internal consistency and significantly correlated with physician disease activity assessments and swollen joint counts (40).

Cheung *et al.* undertook a detailed comparison of patient- and clinician-assessed joint counts together with ultrasound assessments (41). They showed that self-assessments of tender joint counts were reproducible and correlated well with those derived by physicians and nurses; in contrast patients were poor assessors of synovitis and swollen joint counts. Despite large inter-observer differences in swollen joint counts, disease activity scores derived by patients correlated well with both ultrasound and physician-derived disease

activity scores. There is increasing evidence that including patient self-assessments is valuable in guiding treatment decisions, though whether or not joint counts need to form part of this assessment is less certain (42).

The problem of variability between assessors remains a major challenge in interpreting joint counts. In clinical trials and other clinical research, joint counts are directed to be undertaken by the same person in each individual patient to achieve the most accurate assessment of change (43). Inclusion of self-assessment joint counts may be helpful in the future.

Conclusions

Joint counts form the cornerstone of assessing disease activity in patients with an inflammatory arthritis, particularly RA. In clinical practice joint counts are mainly undertaken in 28 joints as part of the composite DAS28 score. Reviews of joint counts in the assessment of RA

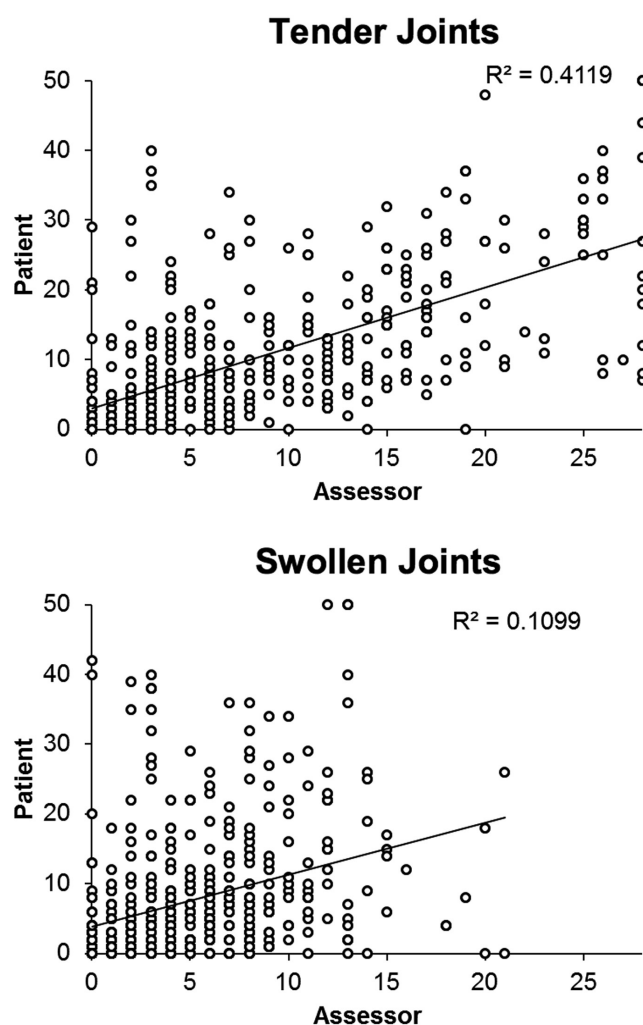


Fig. 3. Comparison of patient and assessor joint count data from 472 RA patients in an observational study (39). Patients assessed 50 joints and assessors assessed 28 joints.

Maastricht Ankylosing Spondylitis Enthesis Score (MASES), Leeds Dactylitis Index (LDI), Patient Global for Psoriatic Arthritis, Dermatology Life Quality Index (DLQI), Psoriatic Arthritis Quality of Life (PsAQOL), Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F), Psoriatic Arthritis Response Criteria (PsARC), Psoriatic Arthritis Joint Activity Index (PsAJAI), Disease Activity in Psoriatic Arthritis (DAPSA), and Composite Psoriatic Disease Activity Index (CPDAI). *Arthritis Care Res* 2011; 63 (Suppl. 11): S64-85.

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patients invariably recommend their continued use (44, 45) and it is difficult to envisage this changing in the foreseeable future. However joint counts have a number of limitations including inter-observer variability (although there is some evidence this is reduced through training) alongside the fact they are affected by processes separate to inflammatory arthritis activity (such as fibromyalgia). Item response theory has confirmed the validity of 28 joint counts but has highlighted one potential limitation, which is that they have a "floor effect" (46); this is also identified in clinical practice studies. Future research may provide alternative approaches for assessing RA disease activity clinically, which overcome these issues; in the fullness of time our use of joint counts may change. A survey of the use of joint counts in routine practice by Pincus and Segurado (47)

found that only a minority of specialist consultations included a formal joint count; this needs to improve substantially to ensure patients receive high quality care.

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