A New Approach to Defining Functional Ability in Ankylosing Spondylitis: The Development of the Bath Ankylosing Spondylitis Functional Index

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ABSTRACT. Objective. After pain and stiffness, one of the most important complaints of patients with ankylosing spondylitis (AS) is disability. The main aims of treatment are to control pain but also to improve function. Various methods of assessing function exist but are either not specific for the disease or have not been adequately validated. As a result of this deficiency we developed the Bath Ankylosing Spondylitis Functional Index (BASFI) as a new approach to defining and monitoring functional ability in patients with AS.

Methods. This self-assessment instrument was designed by a team of medical professionals in conjunction with patients, and consists of 8 specific questions regarding function in AS and 2 questions reflecting the patient’s ability to cope with everyday life. Each question is answered on a 10 cm horizontal visual analog scale, the mean of which gives the BASFI score (0–10). The questionnaire was completed 257 times in total: once by 116 outpatients and by 47 inpatients on 3 occasions over a 3-week intensive physiotherapy course. In addition, the instrument was compared with the Dougados functional index.

Results. Patient scores covered 95% of the BASFI range, giving a normal distribution of results. In contrast only 65% of the Dougados functional index scale was used. Furthermore, over the 3 week period of inpatient treatment, the BASFI revealed a significant improvement in function (20%, p = 0.004) while there was a less impressive change in the Dougados functional index (6%, p = 0.03). This demonstrates the superior sensitivity of the BASFI. Consistency was good for both indices (p < 0.001), as was the relationship between patient perception of function and function as assessed by an external observer (p < 0.001).

Conclusion. The BASFI satisfies the criteria required of a functional index: it is quick and easy to complete, is reliable and is sensitive to change across the whole spectrum of disease. (J Rheumatol 1994;21:2281–5)

Key Indexing Terms:
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The control of pain and the preservation of function remain the goals of treatment in ankylosing spondylitis (AS). Non-steroidal antiinflammatory drugs (NSAID) and physiotherapy, in the form of specific exercises, are the main methods of therapy. However the relationship between disease activity, disease progression and its functional consequences is tenuous. Clinical and laboratory indicators of disease activity are poor predictors of radiological damage. The maintenance of optimal function is of paramount importance to the patient, thus any method of assessing function must be clinically relevant and reflect the patient’s point of view.

The ideal self-administered instrument should satisfy validity criteria: content [the choice and relative importance of each component is appropriate for the purpose of the index]; face [the methods of weighting and aggregating components into an index are sensible]; criterion [the index produces consistent results that reflect the true clinical state of the patient]; discriminant [the index detects the smallest clinically significant differences between and within patients]; construct [the index agrees with expected results based on the hypothesis of the investigator]. The index should be reliable, reproducible and reflect the entire spectrum of the disease, in addition to being quick and simple. A number of self-assessment instruments for measuring function already exist, including the functional index produced by Dougados, et al which is widely used. However, although validated, the index has a number of weaknesses such as its scoring system, which affects both sensitivity and score distribution.

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In addition, many of the questions are not sufficiently specific in their instruction. We have therefore developed the Bath AS Functional Index (BASFI) as a new approach to defining and monitoring functional ability in patients with AS.

MATERIALS AND METHODS
The BASFI was designed, through extensive discussion, by a team of rheumatologists, physiotherapists and research associates with a major input from patients with AS. Initially, over 20 questions were considered, encompassing a wide range of activities. Questions which were either repetitive in terms of requiring the same movement, or which were ambiguous/not entirely clear to patients were excluded. The final version consists of 8 questions on activities relating to the functional anatomy of patients, and 2 additional questions that assess the patient’s ability to cope with everyday life. The questions reflect activities of daily living and include: “putting on socks or tights without help or aids”; “bending forward from the waist to pick up a pen from the floor without an aid”; “reaching up to a high shelf”; “getting out of an armless dining-room chair without using your hands”; “getting up off the floor without help from lying on your back”; “standing unsupported for 10 minutes without discomfort”; “climbing 12-15 steps without using a handrail or walking aid”; “looking over your shoulder without turning your body”; “doing physically demanding activities (e.g., physiotherapy exercises, sports and gardening)”; and “doing a full day’s activities whether at home or at work” (Figure 1). The questions are simple to understand, specific in relation to a particular action and relevant to assessment of function in AS.

Each question is answered on a 10 cm visual analog scale (VAS), as this improves both the sensitivity of the index to change and its capacity to elicit a range of responses across the entire scale. The VAS have no distinguishing marks, in accordance with previous work, the only guidelines being the words “Easy” and “Impossible” at either end of the line to indicate the direction of severity (Figure 1). The mean of the 10 scales gives the BASFI score (0-10).

A total of 163 patients took part in the study (47 consecutive inpatients, on an intensive 3 week physiotherapy course and 116 randomly selected outpatients). The patients included in the study reflect the whole range of disease from early AS to established late disease. The BASFI was analyzed in terms of all validity criteria and was compared with a published functional index (Douglasod). The 0-40 scoring system of the latter was converted to a 0-10 scale for ease of comparison. All 163 patients were given both indices and a direct comparison was made, using the 149 patients who fully completed the questionnaires. Both the BASFI and Douglas functional index were completed by 30 inpatients at the start, 2nd day and end of the 3-week period of physiotherapy. To assess reproducibility of the 2 indices, inpatient scores taken 24 hours apart (Day 0 and Day 1 of treatment), at about the same time of day, were compared. An external validation of both indices was performed on 20 of the inpatients. On completion of 8 specific tasks by each of the patients, 2 physiotherapists independently scored the relevant questions of the BASFI and the Douglas functional index. The patients completed the questionnaires separately. Finally, sensitivity to change over the 3 weeks of intensive physiotherapy was analyzed for both indices by comparing the inpatient scores on Day 0 and Day 18 of treatment.

The analyses were carried out using the UNISTAT statistical software on an IBM compatible PC. Correlations were performed using the Pearson correlation coefficient and analyses of difference using the Kruskal-Wallis one-way ANOVA and the Wilcoxon ranked sign test.

RESULTS
The mean age of the 163 patients (123 men: 40 women - a 3:1:1 ratio) who completed the BASFI and Douglas functional index was 47.7 (SD 11.13; inpatients: 47.12, outpatients: 47.32), with a mean age at disease onset of 23.0 (SD 8.07; inpatients: 23.8, outpatients: 22.7), and a mean disease duration of 24.7 years (inpatients: 23.2, outpatients: 24.6).

The BASFI and Douglas functional index took an equivalent amount of time to complete (100 s maximum) and no preference was expressed for either instrument by the patients. However, the distribution of the BASFI scores was superior to that of the Douglas functional index: range 0-9.5 (mean 4.03, SD 2.16) compared to 0-6.5 (mean 2.58, SD 1.68), respectively (Figures 2 and 3).

In a comparison between the BASFI scores of hospital inpatients and those of the outpatients, the mean BASFI score of the former was significantly higher than that of the latter [hospital patients: mean score = 5.06 (SD 2.0) vs outpatients: mean score = 3.55 (SD 2.0); p < 0.001]. The mean score for the Douglas functional index was also higher among the inpatients than the outpatients [mean score = 3.36 (SD 1.56) vs mean score = 2.29 (SD 1.62); p = 0.001].

The reproducibility of both instruments was good in terms of consistency of inpatient scores taken 24 h apart at the same time of the day (BASFI: mean at time zero = 5.19 (SD 2.05) vs mean at +24 h = 5.26 (SD 1.93); r = 0.89, p < 0.001. DouglasFI: mean at time zero = 3.46 (SD 1.52) vs mean at +24 h = 3.46 (SD 1.55); r = 0.96, p < 0.001).

An external validation of the BASFI demonstrated patient and observer scores to be reliably consistent (mean Patient score = 2.76 vs mean Observer A score = 2.33 vs mean Observer B score = 2.65; r = 0.87-0.89, p < 0.001). The same interobserver consistency was found in the DouglasFI (mean Patient score = 1.93 vs mean Observer A score = 2.29; r = 0.9, p < 0.001).

Over an intensive 3 week treatment period the BASFI scores improved significantly from a mean of 4.82 (SD 2.04) on Day 0 to 3.75 (SD 2.11) on Day 18 (p = 0.004; mean score change = -1.07 [19.6% improvement]; range = -5.15 to +3.23). The DouglasFI however, showed no significant change over the same period of time (Day 0: mean = 3.09 (SD 1.43) vs Day 18: mean = 2.77 (SD 1.64); p = 0.19, mean score change = -0.32 [5.9% improvement]; range = -4.0 to +3.0).

DISCUSSION
The aims of treatment in AS are to control pain and to maintain or improve function, and thus quality of life. Mobility and function are improved by physiotherapy and specific exercise programmes. Function is an important outcome measure in AS. Most of the previous functional assessments have been directed towards patients with peripheral joint disease, primarily assessing the function of hands and feet, e.g., Steinbrocker and the Stanford Health Assessment Questionnaire (HAQ). Since AS predominantly affects the spine, these assessments have only limited value. Generic measures of health status such as the Sickness Impact Profile, Arthritis Impact Measurement Scale and the more specific...
PLEASE DRAW A MARK ON EACH LINE BELOW TO INDICATE YOUR LEVEL OF ABILITY WITH EACH OF THE FOLLOWING ACTIVITIES, DURING THE LAST WEEK.

N.B An aid is a piece of equipment which helps you to perform an action or movement

EXAMPLE:

EASY __________________________________________ IMPOSSIBLE

1) Putting on your socks or tights without help or aids (e.g. sock aid)

EASY __________________________________________ IMPOSSIBLE

2) Bending forward from the waist to pick up a pen from the floor without an aid

EASY __________________________________________ IMPOSSIBLE

3) Reaching up to a high shelf without help or aids (e.g. helping hand)

EASY __________________________________________ IMPOSSIBLE

4) Getting up out of an armless dining room chair without using your hands or any other help

EASY __________________________________________ IMPOSSIBLE

5) Getting up off the floor without help from lying in your back

EASY __________________________________________ IMPOSSIBLE

6) Standing unsupported for 10 minutes without discomfort

EASY __________________________________________ IMPOSSIBLE

7) Climbing 12 - 15 steps without using a handrail or walking aid. **One foot on each step**

EASY __________________________________________ IMPOSSIBLE

8) Looking over your shoulder without turning your body

EASY __________________________________________ IMPOSSIBLE

9) Doing physically demanding activities (e.g. physiotherapy exercises, gardening or sports)

EASY __________________________________________ IMPOSSIBLE

10) Doing a full day activities whether it be at home or at work

EASY __________________________________________ IMPOSSIBLE

Fig. 1. A copy of the BASFI.

indices such as the HAQ-S may not be sensitive enough to detect change in patients with AS. Indeed the value of such functional outcome measures in AS has been questioned by some. However, most physicians are aware of the importance of function and realize that the main problem of measurement relates to the fact that the present indices are either inappropriate or insensitive.

As a result, recent efforts, such as the Dougados FP, have focussed on more specific measures of function regarding AS. This functional index is a valid measure of disabili-
Fig. 2. Title: Dougados functional index; score distribution, showing the distribution of the Dougados Functional Index scores among 149 patients (mean score = 2.58; 65% of scale used).

Fig. 3. Title: BASFI: score distribution, showing the distribution of BASFI scores among 149 patients (mean score = 4.03; 95% of scale used).

Fig. 4. Title: BASFI: sensitivity to change over 3 weeks of intensive inpatient physiotherapy treatment showing the pre and posttreatment (Day 0 and Day 18) score distributions of 39 inpatients.

ty and consists of 20 questions corresponding to activities of daily living. A score of 0 is given if the task can be accomplished without difficulty, 1 if it is possible but difficult and 2 if it is impossible. The answers are added to give a total score of dysfunction. The Dougados FI was designed by physicians with a specialist interest in AS. Apparently there was no input from physiotherapists, who are closely involved with the monitoring of patient function, or from the patients themselves. The importance of the patient's point of view has recently been stressed. Other problems encountered with this particular functional index include the fact that patients often find the questions difficult to answer without qualification. Many of the questions are not specific enough in terms of the exact movement or task required and, in addition, the index does not account for the possible use of help or aids by the patients when carrying out the activities listed. Furthermore, movements are seldom impossible and patients can often perform a task by 'getting round' the difficulty — for example, flexing hips and knees in order to bend over and pick up an object. These weaknesses tend to restrict the sensitivity and its capacity to elicit a range of responses across the scale of this particular functional index. Confusion also occurs because of designated clothing such as trousers or pullower, with patients often substituting items of clothing without the action performed being similar. In addition, some of the questions appear to be assessing roughly the same function e.g., "putting on shoes" and "putting on trousers," "lie down" and "sleep on your back", "sit down" and "crouch", and "run" and "climb a flight of stairs," suggesting an element of redundancy.

A further problem with the instrument lies in its scoring system. Patients are given only 3 choices of answer to the question "can you?" for each of the 20 activities listed. The possibilities available are: "yes with no difficulty", "yes but with difficulty" and "no". The middle option covers a broad range of possible responses and cannot distinguish between patients able to fulfill a task with minimal difficulty and those who can only just manage an activity. Such a scoring method also makes the index relatively insensitive to change, since ability with a particular task would have to
alter dramatically in order for a response to change.

It was as a result of these apparent inadequacies in the current methods of assessing function in AS that a team of physiotherapists, physicians, research associates and patients designed a new functional index: the BASFI. This instrument consists of 10 questions, specific in their instruction, considered to be clinically relevant and to encompass the appropriate anatomy and reflect the overall level of function of the patient. The questions were answered on a 10 cm VAS in order to improve both the sensitivity of the index and its capacity to make use of the entire scale of the index. The questions relating to specific movements are concise and do not require further explanation. They specifically exclude the use of help or aids.

The BASFI scores produced a normal distribution which covered 95% of the total scale whereas the Dougados functional index used only 65% of the total range. This skew was highlighted by the low mean of the patient scores on the Dougados FI: (2.58), compared to that of the BASFI: (4.03). As the inpatients assessed covered a broad spectrum of disease severity, a full range of scores for both indices would be expected, with a mean score near the middle of the scale. The superior score distribution of the BASFI was demonstrated in almost 50 consecutive inpatients as well as over 100 randomly selected outpatients and gives it a distinct advantage over the existing functional index.

Patients did not express a preference for either the BASFI or Dougados FI in terms of time taken to complete them or overall user friendliness, but as explained above, some of the questions in the Dougados FI needed qualification in order to be answered accurately. The reproducibility of the BASFI is highly significant and, in addition, the patients’ perception of their level of function accurately mirrored that of external observers.

Any index which is to be used in the analysis of function needs not only to be accurate but also sensitive to change. The BASFI was shown to be sufficiently sensitive to demonstrate an improvement in the functional ability of patients over a 3 week period of inpatient therapy. This was not reflected by the Dougados FI. There is an inevitable trade-off between sensitivity to change and reproducibility: by increasing one, the other is usually decreased. This is reflected in the BASFI where its superior sensitivity is balanced against a lower degree of reproducibility compared to the Dougados index. However, the high degree of reproducibility shown by the Dougados is primarily a function of its low sensitivity, whereas the greatly increased sensitivity of the BASFI does not result in a comparable decrease in its reproducibility.

In conclusion, the BASFI satisfies the criteria considered necessary in the design of a functional index. Specifically, it is quick and easy to complete, is reliable and is sensitive to change across the whole spectrum of disease. Moreover, not only does the BASFI satisfy the needs of medical practitioners and their physiotherapy colleagues, but its clinical relevance is also heightened by the inclusion of advice given by patients with AS during its design and subsequent assessment.

REFERENCES


