A controlled study of hand function in nodal and erosive osteoarthritis

MARTIN PATTRICK,1 SHARMAN ALDRIDGE,2 EDITH HAMILTON,1 ADRIAN MANHIRE,3 AND MICHAEL DOHERTY1

From the 1Rheumatology Unit, 2Occupational Therapy Unit, and 3Radiology Department, City Hospital, Nottingham

SUMMARY Hand function using a standardised test of activities of daily living was assessed in (a) 57 patients (53 female, four male; mean age 69 years) with established (that is, symptom onset >10 years before) nodal generalised osteoarthritis (NGOA); (b) 10 patients (nine female, one male; mean age 70 years) with established erosive osteoarthritis (EOA); and (c) 52 matched controls (48 female, four male; mean age 71 years) with asymptomatic, clinically normal hands. Although significant differences between controls and patient groups were observed for individual tasks, only minor global impairment was seen, the worst function occurring in patients with EOA. There was no consistent correlation between tested aspects of hand function and the extent of radiographic change assessed by summed graded score for separate osteoarthritic features in individual joints. In controls increasing age correlated with longer time to complete all tasks and weaker power grip; a similar, less pronounced correlation occurred in patients. Differences between controls and patients with NGOA were most apparent in younger subjects, and in the elderly (>80 years) hand function was essentially the same. This study shows good functional outcome for patients with NGOA, and suggests that the OA process is of little functional importance to the aging hand.

Osteoarthritis (OA) is a heterogeneous condition showing a wide spectrum of clinical manifestations. The hand is commonly involved, and polyarticular interphalangeal OA is taken as the marker for predisposition to OA at multiple sites ('generalised OA'); such symptomatic involvement in conjunction with Heberden’s or Bouchard’s nodes, or both, is recognised as ‘nodal generalised OA’ (NGOA). Symptoms of NGOA typically accompany the appearance of clinical and radiographic osteoarthritic changes in the fifth to sixth decades but may then subside once the condition is established. There is a strong clinical impression that the eventual prognosis is favourable, but we are unaware of data to substantiate this belief. Discordance between radiographic appearance, symptoms, signs, and functional impairment in OA is well recognised,2 3 but symptoms and functional impairment remain the most important outcome measures.4 It is known that the normal hand undergoes functional changes with aging5-10 but the effect of OA on these normal processes is unknown.

Erosive osteoarthritis (EOA)11 is a less common form of generalised OA that differs from NGOA in having a more florid inflammatory component, prominent subchondral erosive change, and tendency to instability and ankylosis. Such changes may delineate a subgroup of patients with NGOA and might be expected to affect hand function adversely. We therefore compared hand function, pain, and radiographic change between patients with later established NGOA and a group matched for age and sex with clinically normal hands. A smaller number of patients with EOA were additionally studied.

Patients and methods
The study was approved by the local ethical committee.

PATIENTS AND CONTROLS
Fifty seven Caucasian patients (53 women, four men; mean age 69; range 50–89 years) attending the rheumatology unit in Nottingham with diversesubjects...
Hand function in osteoarthritis

Clinical problems and NGOA were included. All had polyarticular interphalangeal OA affecting more than three rays of each hand with Heberden's node formation, unrelated to obvious trauma, and at least a 10 year history of symptoms. Ten other patients (all Caucasian: nine women, one man; mean age 70, range 53–90 years) having the above characteristics and, in addition, marked radiographic subchondral erosive changes in more than three rays of each hand (classified therefore as EOA) were also studied. Many of the 67 patients had clinical and radiographic OA at other sites, but no attempt was made to subclassify further on the basis of large joint distribution or crystal presence. Apart from OA there was no clinical, radiographic, or serological evidence of additional arthropathy—for example, rheumatoid disease or psoriatic arthropathy.

Fifty two matched controls (48 women, four men; mean age 71, range 47–94 years) were recruited from two general medical clinics. Inclusion criteria were clinically normal hands, absence of hand symptoms, absence of malignancy or other myopathic condition, and no history of steroid treatment. All subjects (patients and controls) were right handed and normal on neurological examination.

Hand Function

For each subject both hands were assessed by a standardised test including many activities of daily living. Each activity was timed and assessed for presence or absence of pain; difficulty; inability to complete; and use of trick movement. Several activities were pooled to measure certain mechanical aspects of hand function (Table 1). Grip strength of each hand was assessed at 30 mmHg (mean of three maximal attempts). For light pinch, heavy pinch, and dexterity the timings for right and left hands were added to give a summed time for each function; tripod pinch and lateral grip were measured on the right hand only. A total time to completion was calculated by adding together all the timed functions. All tests were performed by a single trained observer using the same equipment, after 10 am to allow adequate warm up.

Radiology

Plain anteroposterior radiographs of both hands (to include wrists) were taken on the same day that hand function was assessed. Radiographs were examined by two observers who were unaware of clinical details. For each joint examined individual features of OA (joint space narrowing, osteophyte, sclerosis, and cyst) were scored 0–3; subchondral erosion, attrition, and remodelling were each scored 1 if present. Each interphalangeal, metacarpophalangeal, carpometacarpal, scaphotrapezial, and radiocarpal joint in both hands was scored by this method (a modification of that used by Thomas et al13). A summated score for both hands was produced by adding the scores for individual joints.

Statistics

Comparison of prevalences was by χ² test with Yates's continuity correction or by Fisher's exact test. Differences in numerically graded data were compared by the Wilcoxon rank sum test. Association of variables was tested by Pearson correlation coefficient and significance of this determined by t test.

Results

Patient and Control Characteristics

Table 2 shows the characteristics of patients and controls. There were no significant differences

### Table 1 Hand function assessment: tasks performed to measure mechanical function

<table>
<thead>
<tr>
<th>Mechanical function</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light pinch</td>
<td>Pick up and manipulate solitary beads</td>
</tr>
<tr>
<td>Heavy pinch</td>
<td>Pick up and manipulate 10 clothes pegs</td>
</tr>
<tr>
<td>Tripod pinch (right hand only)</td>
<td>Pick up a pencil</td>
</tr>
<tr>
<td>Lateral grip (right hand only)</td>
<td>Pick up and manipulate scissors</td>
</tr>
<tr>
<td>Dexterity</td>
<td>Pick up 10 tablets</td>
</tr>
<tr>
<td></td>
<td>Fasten 4 buttons</td>
</tr>
<tr>
<td></td>
<td>Unscrew a coffee jar</td>
</tr>
<tr>
<td>Power grip</td>
<td>Grip strength at 30 mmHg</td>
</tr>
</tbody>
</table>

### Table 2 Patient/control characteristics

<table>
<thead>
<tr>
<th></th>
<th>Normal (n=52)</th>
<th>NGOA (n=57)</th>
<th>EOA (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>71 (47–94)</td>
<td>69 (50–89)</td>
<td>70 (53–90)</td>
</tr>
<tr>
<td>F:M</td>
<td>12:1</td>
<td>13:1</td>
<td>9:1</td>
</tr>
<tr>
<td>Symptom duration (years)</td>
<td>15</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>(Range)</td>
<td>(10–40)</td>
<td>(3–38)</td>
<td></td>
</tr>
</tbody>
</table>

*NGOA=nodal generalised osteoarthritis; EOA=erosive osteoarthritis.
between the NGOA and EOA groups compared with controls for age (p=0-73 and p=0-64 respectively) and sex (χ²=0-05, p=0-18 and χ²=0-51, p=0-52 respectively). Comparison between the two patient groups, however, showed longer symptom duration in the subjects with EOA (p<0-05).

**Hand function**

**Pain, trick movements, difficulty, inability to complete**

Pain, use of trick movements, and difficulty performing tasks were most common in the patients with EOA and least common in controls (Fig. 1), with significant differences between the three groups for individual aspects (Fig. 1). The patients with NGOA and EOA, however, did not differ from controls in their ability to complete any aspect of the hand assessment (Fig. 1).

**Time to complete**

Patients with NGOA did not differ from controls in any task except dexterity (p<0-05), with no differences in total time to complete the assessment (Fig. 2). Patients with EOA, however, took longer than controls for light pinch, lateral grip, dexterity, and total time, and longer than patients with NGOA for lateral grip and dexterity (all p<0-05).

**Power grip**

Mean summated grip strengths in patients with NGOA (304 (SD 124) mmHg) and EOA (256 (96) mmHg) were reduced compared with normal subjects (373 (166) mmHg; p<0-03 for both comparisons). There was no significant difference between the NGOA and EOA groups.

**Effect of aging**

In the control group overall increasing age was strongly correlated with (a) longer time to complete for all tasks and (b) weaker power grip (Table 3). A similar, but less marked association was seen in the NGOA and EOA groups (Table 3); there was no

---

**Table 3** Correlation of age and hand function

<table>
<thead>
<tr>
<th>Task</th>
<th>Normal</th>
<th>NGOA*</th>
<th>EOA*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>r</td>
<td>r</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>p</td>
<td>p</td>
</tr>
<tr>
<td>Light pinch</td>
<td>0.57</td>
<td>0.32</td>
<td>0.77</td>
</tr>
<tr>
<td>Heavy pinch</td>
<td>0.40</td>
<td>0.42</td>
<td>0.014</td>
</tr>
<tr>
<td>Tripod pinch</td>
<td>0.27</td>
<td>0.15</td>
<td>0.55</td>
</tr>
<tr>
<td>Lateral grip</td>
<td>0.38</td>
<td>0.45</td>
<td>0.65</td>
</tr>
<tr>
<td>Dexterity</td>
<td>0.29</td>
<td>0.27</td>
<td>0.67</td>
</tr>
<tr>
<td>Total time</td>
<td>0.65</td>
<td>0.48</td>
<td>0.75</td>
</tr>
<tr>
<td>Grip strength</td>
<td>0.59</td>
<td>0.37</td>
<td>0.81</td>
</tr>
</tbody>
</table>

*NGOA= nodal generalised osteoarthritis; EOA= erosive osteoarthritis.
association with age for pain, use of trick movement, difficulty, or inability to perform. Interestingly, however, when the oldest controls and patients with NGOA (>80 years) were compared their assessments were identical apart from one variable (light pinch; p=0.03, Table 4).

RADIOGRAPHIC FINDINGS (Fig. 3)

As expected, total radiographic scores were greater in both patient groups than in controls (p<0.001). Patients with EOA had higher scores than those with NGOA, even after exclusion of scores for erosion (p<0.001). Comparison of right first carpometacarpal joint scores showed similar ranking with significant differences (p<0.001) between each group (median, range: EOA 4, 1–7; NGOA 2, 0–9; normal subjects 0, 0–3); interestingly, no erosive change was observed in first carpometacarpal joints. No differences in total radiographic scores were apparent between right and left hands in any group.

Discussion

Pain and functional impairment for daily activities are the two outcome measures of most relevance to the patient. In this study, therefore, these clinical variables were used in preference to purely biomechanical measurements. Although patients with NGOA had more pain and difficulty, used more trick movements, and had reduced grip strength, they were similar to controls in being able to complete tested daily activities. These findings therefore support the clinical impression of a generally good outcome for hand involvement in NGOA. Patients with EOA, similarly, completed the tested activities, but with more pain, difficulty,
and use of trick movement than patients with non-erosive NGOA. The presence of subchondral erosions may therefore increase the likelihood of clinical consequence.

The cause of the relatively minor impairment in the two patient groups is unknown. Although pain may inhibit or slow certain movements, not all patients experienced pain, and mechanical factors resulting from cartilage loss, bone remodelling, capsular fibrosis, and associated periarticular changes may be more important. Patients in this study had, established NGOA and EOA, and the degree of functional impairment during the earlier, more inflammatory development phase remains unknown.

The prevalence of asymptomatic, clinically undetectable radiographic OA in the normal controls accords with previous studies. In OA, discordance between radiographic appearance and clinical significance is well recognised at sites such as the hip and knee, and in this hand study a similar lack of association was found between radiographic OA scores and both pain and functional impairment. The higher radiographic OA scores in patients with EOA than in those with NGOA is of interest, and to our knowledge previously unreported; this excess was not explained by the presence of erosions in themselves. Although longer symptom duration in patients with EOA might have permitted greater osteoarthritic change, lack of correlation between age and radiographic score in patients with EOA and NGOA makes this unlikely. The effect of handedness, usage, or occupation on distribution and severity of OA has previously been investigated and was not the subject of our study. Interestingly, however, we found similar total OA scores in dominant and non-dominant hands, a finding that accords with one previous report.

In the normal population deterioration of hand function with age is well described. This has been attributed to altered neurological function rather than locomotor impairment. In our study age related functional impairment was less apparent in patients with NGOA than in controls, but significant correlation remained for the group overall. Differences between controls and patients with NGOA, however, were only really apparent in younger subjects. In elderly subjects hand function was essentially the same; indeed, of the many variables examined, the one difference in those over 80 years favoured the NGOA cohort (Table 4). This supports the concept that the process recognised as 'NGOA' is of little functional importance to the aging hand. A prospective study is required to show whether such interphalangeal changes reflect the inherent repair process of synovial joints that may compensate for initiating (as yet unidentified) articular insult with good eventual outcome.

We thank the Arthritis and Rheumatism Council for financial support. Dr Peter Berman and Dr Dennis Shale for allowing us access to their patients, and Mrs Caroline Bloomfield for secretarial support.

References