The validity of manual examination in assessing patients with neck pain

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Received 28 April 2005; accepted 19 July 2006

Abstract

BACKGROUND CONTEXT: Although manual therapists believe that they can diagnose symptomatic joints in the neck by manual examination, that conviction is based on only one study. That study claimed that manual examination of the neck had 100% sensitivity and 100% specificity for diagnosing painful zygapophyseal joints. However, the study indicated that its results should be reproduced before they could be generalized.

PURPOSE: The present study was undertaken to answer the call for replication studies. The objective was to determine the sensitivity, specificity, and likelihood ratio of manual examination for the diagnosis of cervical zygapophyseal joint pain.

STUDY DESIGN: The study was conducted in a private practice located in a rural town. The practice specialized in musculoskeletal pain problems.

PATIENT SAMPLE: The study sample was 173 patients with neck pain in whom cervical zygapophyseal joint pain was suspected on clinical examination, and who were willing to undergo controlled diagnostic blocks of the suspected joint or joints.

OUTCOME MEASURES: The validity of manual diagnosis was determined by calculating its sensitivity, specificity, and positive likelihood ratio.

METHODS: Patients who exhibited the putatively diagnostic physical signs of cervical zygapophyseal joint pain were referred to a radiologist who performed controlled, diagnostic blocks of the suspected joint, and other joints if indicated. The results of the blocks constituted the criterion standard, against which the clinical diagnosis was compared, by creating contingency tables.

RESULTS: Manual examination had a high sensitivity for cervical zygapophyseal joint pain, at the segmental levels commonly symptomatic, but its specificity was poor. Likelihood ratios barely greater than 1.0 indicated that manual examination lacked validity. Although the results obtained were less favorable than those of the previous study, paradoxically they were statistically not different.

CONCLUSIONS: The present study found manual examination of the cervical spine to lack validity for the diagnosis of cervical zygapophyseal joint pain. It refutes the conclusion of the one previous study. The paradoxical lack of statistical difference between the two studies is accounted for by the small sample size of the previous study. © 2007 Elsevier Inc. All rights reserved.

Keywords: Cervical spine; Neck pain; Diagnosis; Physical examination; Manual therapy; Zygapophyseal joint

Introduction

Physical examination is a hallowed component of medical diagnosis. In the context of an appropriate history, a physician is expected to be able to detect the presence of certain disorders, or to exclude others, by finding particular physical signs. In other areas of medicine, this paradigm has been shown to be valid, or is assumed to be so.

The role of physical examination in detecting sources of neck pain is less certain.

Traditionally, examination of the cervical spine may involve: assessing active and passive ranges of movement, palpation for tenderness, testing muscle strength, and assessing intersegmental movements. Manual therapists, in particular, have relied on testing both physiological and accessory, passive intersegmental movements.

Several studies have addressed the reliability of clinical examination of the cervical spine. For signs such as muscle tenderness, joint play, restriction, and passive intervertebral movements, interobserver agreement is either poor, or at best fair [1–7]. The only sign on which observers appear to agree is tenderness over the articular pillars [8]. However, although there has been an abundance of studies concerning reliability, only one study has tested the validity of manual examination for diagnosis.

In a landmark study of 16 patients, Jull et al. [9] reported that an experienced manual therapist could accurately identify symptomatic vertebral segments in patients with neck pain. The diagnosis required finding three signs: unusual resistance to passive movement of the joint, abnormal ''end-feel'', and reproduction of pain on testing of passive accessory movements. The validity of these signs was tested against a criterion standard of response to diagnostic blocks of the cervical zygapophyseal joints. The manual therapist correctly identified all patients shown to have cervical zygapophyseal joint pain, as well as those found not to have zygapophyseal joint pain. For the manual diagnosis of cervical zygapophyseal joint pain, the study claimed 100% sensitivity and 100% specificity.

Since its publication in 1988, that study has been used as evidence of the validity of manual examination, and has become the cornerstone of practice and training in manual therapy. However, the study has not been repeated, and the results have not been replicated. No other validity studies have been published comparing manual diagnosis of patients with neck pain, or pain in any part of the spine, with an accepted criterion standard. This leaves manual examination with a very fragile scientific foundation. Indeed, a systematic review found the available evidence for validity to be unconvincing [10].

Since 1988 several developments have occurred. Studies have shown that single, diagnostic blocks of the cervical zygapophyseal joints are subject to false-positive responses [11]; and that diagnostic blocks are valid only if performed under controlled conditions [12–15]. The blocks used in the study of Jull et al. [9] were not controlled and, therefore, the criterion standard against which manual examination was tested could have been flawed.

As well, epidemiological studies have shown that cervical zygapophyseal joint pain is common [16–20], and that it occurs most commonly at the C2–C3 and C5–C6 levels [15,16,17,21]. These were the levels most often diagnosed by Jull et al. [9]. Furthermore, it has been shown that cervical zygapophyseal joint pain presents with patterns of pain characteristic of the segment that is the source of pain [22–24]. Thus, the high pretest probability and the characteristic pain pattern might allow an examiner to establish a diagnosis without relying on manual skills.

The discussion section of the paper by Jull et al. [9] emphasized that the results applied only to the manual therapist tested, and could not be generalized. The discussion indicated that the results should be replicated for other manual therapists before the validity of manual examination could be generalized.

The present study was undertaken in answer to the call by Jull et al. [9] for further research. Moreover, it was undertaken with the benefit of contemporary knowledge of the validity of diagnostic blocks and the nature of cervical zygapophyseal joint pain, as well as an appreciation of the contemporary statistical rigor that applies to testing a clinical test.

Methods

The study sample was a consecutive series of patients presenting to a private, community practice with a local reputation for an interest in musculoskeletal medicine. The eligibility criteria were that the patient had neck pain which had been present for longer than 3 months and had not responded to conventional conservative treatment; furthermore, the patients had to be willing to undergo diagnostic blocks of their cervical zygapophyseal joints. Exclusion criteria were neurological signs of radiculopathy, previous cervical spine surgery, and unwillingness to undergo diagnostic blocks. These criteria provided a study population of 173 patients (95 females and 78 males), aged between 19 and 75 years, with a median age of 42, and an interquartile range of 34–52 years.

Of the 173 patients, 65 (38%) were involved in litigation related to their neck pain, mainly because their symptoms were associated with motor vehicle accidents or industrial injuries; the other 108 patients (62%) were not involved in litigation.

Clinical assessment was undertaken by the senior author, who had undertaken several courses of postgraduate training in manual diagnosis, was accredited to teach the techniques involved, and had 20 years of experience in their clinical application. In each patient's case, a medical history was elicited and particular note taken of the distribution, quality, and duration of the patient's pain. Physical examination was then performed, focusing on the presence or absence of the ''segmental signs'' described by Jull et al. [9].

If all the physical signs under study were present in patterns consistent with impairment of one or more cervical zygapophyseal joints, the patient was deemed ''clinically positive'' for that joint or joints. By corollary, they were also deemed ''clinically negative'' for the other cervical joints for which the clinical features were absent.

After the examination findings were recorded, previous medical imaging was reviewed, in order to exclude contra-indications for the safe conduct of diagnostic blocks. Imaging results were not taken into account in determining the pain source, because the literature shows that imaging is not valid for that purpose [25–28].

Those patients with ''clinically positive'' joints were then offered testing by cervical zygapophyseal joint blocks. Those who were ''clinically negative'' at all cervical levels were not offered investigation by neural blockade as there was no legitimate reason for doing so.

Diagnostic blocks were used as the criterion standard for manual diagnosis for three reasons. First, no other standard for a source of neck pain has been tendered, validated, or used. Second, it was the criterion standard used by Jull et al. [9]. Third, diagnostic blocks are the essential criterion for cervical zygapophyseal joint pain stipulated by the International Association for the Study of Pain in its Classification of Chronic Pain [29].

The diagnostic blocks were performed by interventional radiologists trained and experienced in their performance (the second and third authors), and in accordance with the guidelines recommended by the International Spine Intervention Society [30]. For a given joint, the medial branches of the dorsal rami that innervate the joint were anesthetized. For a joint to be diagnosed definitively as symptomatic, the patient had to obtain complete relief of pain on each occasion that the joint was blocked, but also short-lasting relief when a short-acting agent (2% lignocaine) was used, and long-lasting relief when a long-acting agent (0.5% bupivacaine) was used. Any other pattern of response was considered negative.

Blocks were undertaken initially to test the cervical joints deemed ''clinically positive''. If the results were positive, the joint was deemed ''block positive'' and no further tests were done. If the results were negative, the joint was deemed ''block negative'', and further blocks were undertaken to test other joints likely to be associated with the patient's pain pattern. Up to three or four joints might be tested in this way, until one was found to be ''block positive'', but if all responses were negative, the blocks were discontinued.

The results of clinical examination and the responses to diagnostic blocks were tallied according to the cervical segmental level to which they applied. For each level, the data were entered into contingency tables. From these tables, the sensitivity, specificity, and positive likelihood ratio of clinical examination were calculated, as well as their 95% confidence intervals.

Results

Both by clinical examination and by diagnostic blocks, the C2–C3 and C5–C6 spinal motion segments were found to be most commonly symptomatic. Of the 173 patients,

133 had positive responses to comparative medial branch blocks, which amounts to a prevalence of zygapophyseal joint pain of 77% in this sample. Of these patients, 50 were positive to comparative medial branch blocks at the C2–C3 level and 66 positive to blocks at C5–C6. Nine of these patients were positive at both C2–C3 and C5–C6. Only one was positive to blocks at C3–C4; 12 were positive at C4–C5; and 29 at the C6–C7 level. Between one and three patients were positive at various other combinations of levels, such as C4–C5 and C5–C6, or C5–C6 and C6–C7.

For the C2–C3 level, clinical assessment was positive in 64 cases but blocks were positive in only 44 of these cases (Table 1). Reciprocally, of 19 cases in which clinical assessment was negative, 6 proved positive to blocks. These figures showed the sensitivity of clinical assessment to be 0.88 (95% confidence interval [CI]: 0.79–0.97), its specificity to be 0.39 (95% CI: 0.22–0.56), and its likelihood ratio to be 1.4 (95% CI: 0.87–2.40).

For the C5–C6 level, clinical assessment was positive in 90 cases but blocks were positive in only 59 (Table 2). Of 38 cases in which clinical assessment was negative, 7 proved positive to blocks. The sensitivity of clinical assessment was 0.89 (95% CI: 0.81–0.97), its specificity was 0.50 (95% CI: 0.38–0.62), and its likelihood ratio was 1.8 (95% CI: 1.05–3.02).

Pooling the results from C2–C3 and C5–C6 did not alter the resultant statistics. The sensitivity was 0.89 (95% CI: 0.82–0.96); specificity was 0.47 (95% CI: 0.37–0.57); and the likelihood ratio was 1.7 (95% CI: 1.2–2.5).

The small numbers of patients found to be positive at C3–C4, C4–C5, and C6–C7 precluded meaningful statistical analysis. Nevertheless, the correlations at these levels showed similar patterns to those encountered for C2–C3 and C5–C6.

Discussion

The prevalence of cervical zygapophyseal joint pain in the present study (77%) was comparable to that encountered in other studies [17,18,20]. The sample studied, therefore, would seem representative of typical patients with chronic neck pain. Furthermore, the higher prevalence of symptomatic joints at C2–C3 and C5–C6 is also consistent with previous studies [16,17,21]. The low prevalence of symptomatic joints at C3–C4, C4–C5, and C6–C7 was

Table 1
The contingency between the results of manual examination and diagnostic blocks in patients symptomatic at C2–C3

	Blocks		
Manual examination	Positive	Negative	
Positive	44	20	64
Negative	6	13	19
Total	50	33	83

Sensitivity=0.88; specificity=0.39; likelihood ratio=1.4.

Table 2
The contingency between the results of manual examination
and diagnostic blocks in patients symptomatic at C5–C6

Manual examination	Blocks		
	Positive	Negative	
Positive	59	31	90
Negative	7	31	38
Total	66	62	128

Sensitivity=0.89; specificity=0.50; likelihood ratio=1.8.

disappointing for academic purposes, in that it did not allow for analyses at these segmental levels, but nevertheless that prevalence reflects the natural epidemiology of cervical zygapophyseal joint pain, and reinforces the generalizability of the study population.

Litigation was not used as an exclusion criterion for two reasons. First, no patient was seen because they were involved in litigation; it was a policy of the practice to see patients seeking treatment, and not to see people for medicolegal assessment only; in fact, in many cases in which litigation was involved, the litigation started after the initial examination on which the study was based. The other reason is that while involvement in litigation may (arguably) influence the way patients express symptoms, it can hardly affect objective findings such as how passive movements feel to an observer.

Three statistical features emerge from the data. Manual examination had a high sensitivity, but a low specificity, and poor likelihood ratios.

The sensitivities encountered in the present study (0.88 and 0.89) fall short of the value of 1.00 reported by Jull et al. [9]. The latter estimate, however, was based on a sample size of 16, and they did not calculate a 95% confidence interval. Proportions can be misleading if reported only as unqualified numbers. They are affected by the sample size. Calculating the 95% confidence intervals of a proportion corrects for sample size. In retrospect, the sensitivities found in the study of Jull et al. [9] would have been 0.81 to 1.00, which overlaps the range (0.79–0.97) found in the present study. The present values are probably more realistic, because they were based on larger sample sizes (50 and 66), and they do not imply infallibility, which a value of 1.00 does.

The high sensitivities of manual examination, however, do not imply strong validity. The high pretest probability of symptomatic joints at C2–C3 and C5–C6 virtually ensures a high sensitivity for an examiner accustomed to diagnosing these levels as positive. Under these conditions, the real measure of validity lies in the specificity of the test.

The specificities encountered in the present study (0.39 and 0.50) are substantially less than the perfect score reported by Jull et al. [9]. The latter score, however was based on only four cases, giving it a 95% confidence interval of 0.51–1.00. This range overlaps those found in the present study (0.22–0.56 and 0.38–0.62). Thus, despite the apparent dissonance in conclusions between the two studies, it is notable that statistically the data are not different. This statistical equivalence, plus the larger sample size of the present study, suggest that the specificity values found in the present study are more realistic estimates.

These lower specificities seriously compromise the validity of manual examination, which is reflected in the low values of the positive likelihood ratios (1.4 and 1.8). These values indicate that the test is not valid, for it cannot discriminate between presence and absence of the condition.

These results place the evidence on manual examination in a new light. The one previous, but small, study announced a positive result [9]: it concluded that manual examination was valid for the diagnosis of painful zygapophyseal joints, and not only valid but perfectly so. The present, larger study announces a negative result: it concludes that that manual examination is not valid for the diagnosis of painful zygapophyseal joints. The data on which these opposing conclusions were based are not statistically different.

Methodologically, the present study is sound. It used a large sample size; it used comparative, controlled blocks as the criterion standard; it submitted its data to rigorous statistical analysis. Each of these measures serves to render its results more generalizable than those of the only previous study.

The previous study relied on single, diagnostic blocks as the criterion standard, but since its publication single blocks have been shown to carry a false-positive response rate of 27% [11]. That factor alone undermines the perfect sensitivity and specificity scores claimed in the earlier study.

Controlled diagnostic blocks, as used in the present study, are the only available, and validated, criterion standard for cervical zygapophyseal joint pain. The present study shows that manual examination is not valid against this criterion standard. If manual examination does point to a diagnosable entity in the cervical spine, that entity has not yet been defined, and no criterion standard has been established for it.

The present study has answered the call by Jull et al. [9] for further validation studies, but its results were negative. This outcome leaves manual examination without a sound scientific basis, and calls into question much of what is done in manual medicine and manual therapy. If manual diagnosis is not valid, manual methods of treatment based on it are not likely to be valid either. The only way manual examination could be legitimized would be by publication of further scientific data that support its validity. Unless or until that is done, manual diagnosis of sources of neck pain must be considered to lack validity.

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