Cervical Zygapophyseal Joint Pain Patterns II:
A Clinical Evaluation

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To test the predictive value of segmental pain charts, ten patients with suspected cervical zygapophyseal pain were studied. Their pain distribution was recorded on a body diagram, and using pain charts derived from studies on normal volunteers, predictions were made by two observers of the segmental location of the symptomatic joint. Correct predictions were made in all nine patients who were shown to have symptomatic joints on the basis of diagnostic joint blocks. The results vindicate the accuracy of pain charts for predicting the segmental location of symptomatic joints in patients with cervical joint pain. [Key words: neck pain, cervical zygapophyseal joints, referred pain]

DISORDERS OF THE cervical zygapophyseal joints are attracting attention as possible causes of neck pain.[3–6,8–12] However, to date, the only means of establishing a diagnosis of cervical zygapophyseal joint pain have been diagnostic blocks of the putatively symptomatic joints[2–6,9,12]; but these blocks require specialized facilities and skills that are not generally available. Furthermore, because zygapophyseal joint blocks are invasive, it is not attractive to suggest that all patients with neck pain should undergo this procedure. What is required is some clinical noninvasive screening test that can either establish the diagnosis or, in the first instance, at least predict which patients would be likely to respond to confirmatory blocks.

A recent study has shown that physical examination by a well-qualified manipulative therapist can be as accurate as radiologically controlled diagnostic blocks in the diagnosis of cervical zygapophyseal joint pain,[9] but the skills involved require considerable training, and the services of a suitably skilled manipulative therapist are not universally available. A simpler diagnostic test would be desirable. To this end, we have sought to determine whether the distribution of a patient's neck pain might be indicative of its origin.

In the preceding study,[7] we determined the distribution of pain that occurs following noxious stimulation of selected cervical zygapophyseal joints in normal volunteers. We found that reasonably distinct patterns of pain-referral were associated with given joints. However, for ethical and logistic reasons, observations could be made only in a small number of volunteers. Consequently, the study did not provide a measure of biologic variation that, in principle, might affect the reliability of the referred pain charts we constructed. To overcome this limitation by increasing the number of volunteers and observations was impractical because of the lack of suitably qualified volunteers. Therefore, we undertook instead to test the reliability of our pain charts by a clinical trial.

The principle adopted was that if the pain patterns reported in normal volunteers were not characteristic, their use in a clinical setting would fail to predict the segmental origin of cervical zygapophyseal joint pain. Conversely, notwithstanding the limited number of observations on which they were based, if the pain patterns could correctly identify the source of neck pain, their validity would be vindicated. If so, recognition of pain patterns could be advocated as a diagnostic aid in the clinical assessment of neck pain.

METHODS

The study was conducted on ten consecutive patients referred to a radiology practice for investigation of putative zygapophyseal joint pain. All patients complained of neck pain and various patterns of referred pain to the head, chest, shoulders, or upper limb. None had neurologic signs or prior evidence of cervical fracture, tumor, or inflammatory disease. The patients selected for study were ones thought likely to have cervical joint disease by their referring physicians. In seven of the patients this decision was based largely on the elimination of disc disease as a diagnosis. Patients 3 and 10 had previously undergone anterior cervical fusion from C4 to C7; leaving the zygapophyseal joints as the most likely source of their persisting pain. Patients 4 and 7 had fusions at C5–6, C6–7, and C5–6, respectively. Patients 1, 5, and 9 had undergone negative provocation discography at C3–4 to C5–6, C4–5 to C6–7, and C5–6 to C7-T1, respectively. In the remaining three patients the referring physicians had suspected cervical zygapophyseal joint pain on the basis of the focal, posterior location of the pain, and had referred the patients for evaluation of this diagnosis before investigating the cervical intervertebral discs.

Before investigation, the radiologist (CA) interviewed each patient and recorded the distribution of their pain on a body diagram. By comparing the distribution of pain with the putatively characteristic segmental patterns established in normal volunteers (Figure 1), he decided what joint or joints would be responsible for the patient's pain and recorded this decision.

The criteria adopted for pain stemming from particular segmental levels were:

C2–3: pain located in the upper cervical region and extending at least onto the occiput. Extension further into the head: toward the ear, vertex, forehead, or eye (as reported in clinical studies of C2–3 pain[3]) was regarded as confirmatory but not essential.

C3–4: pain located over the posterolateral cervical region, extending cranially as far as the suboccipital region, but not intruding substantially into the occipital region, and extending caudally over the posterolateral aspect of the neck without entering the region of the shoulder girdle, following more or less the course of the levator scapulae muscle.

C4–5: pain located over a more or less triangular area with two sides consisting of the posterior midline and posterolateral border of the neck and a base running parallel to the spine of the scapula, but somewhat

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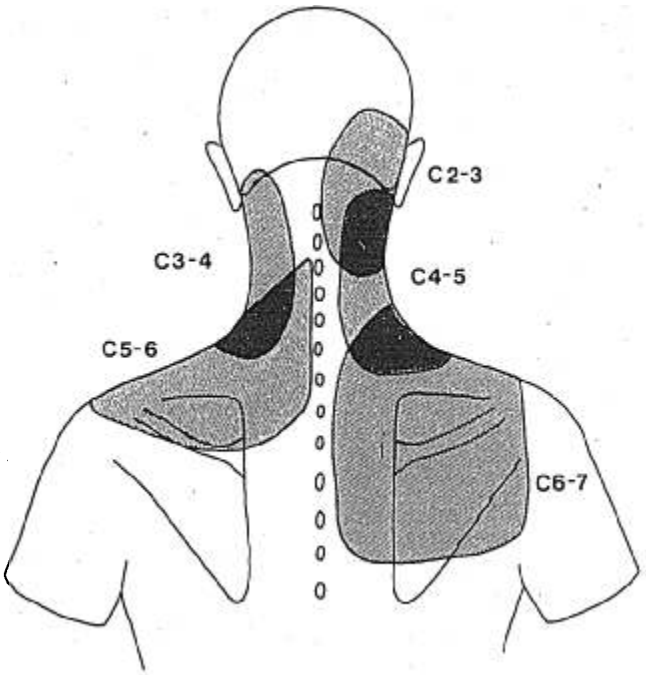

Fig 1. A map of the characteristic areas of pain referred from cervical zygapophyseal joints of C2–3 to C6–7. Taken from Dwyer et al.[7]

above it, more or less in the same horizontal plane as the lateral third of the clavicle.

C5–6: pain in a triangular, mantle-like distribution with an apex directed to the midcervical region posteriorly and the main area draping over the top, front, and back of the shoulder girdle, with a base coinciding with the spine of the scapula.

C6–7: pain over a more or less quadrangular area covering the supraspinous and infraspinous fossae.

C6–7 pain was distinguished from that of C5–6 by its extension below the spine of the scapula. C5–6 pain was characterized by its lateral extension over the shoulder and its extension as far as the spine of the scapula, and was distinguished from C4–5 pain in that the latter reached only the upper extent of the shoulder girdle. C3–4 pain was distinguished from C4–5 pain by its lesser caudal extension into the shoulder girdle and its greater cranial extension towards the occiput. The hallmark of C2–3 pain was its extension over the occiput, which distinguished it from C3–4 pain.

Pain from C7-T1 has not been recorded in normal volunteers, so no characteristic pain pattern for this level was available. However, this diagnosis was entertained for pain resembling that from higher levels but centered caudal to the distribution for C6–7.

If applicable, patients were allowed to describe what they considered to be their principal, primary, or worst pain, and to describe secondary areas into which their primary pain extended when it was severe. Both distributions were recorded, but predictions were based nominally on the location of the primary pain. If the patient's primary pain extended over what appeared to be two consecutive areas, symptomatic joints at two consecutive levels were suspected and a two-level prediction was recorded.

Once the diagnostic predictions had been recorded, the patients underwent diagnostic blocks. In four patients, blocks were undertaken solely at the single predicted level, unilaterally for unilateral pain and bilaterally for bilateral pain. A positive response was recorded if within 10 minutes the blocks provided complete relief of pain that lasted for the duration of action of the local anesthetic agent used.

In patients with suspected symptomatic joints at two levels, or in whom the secondary distribution of pain implied a second symptomatic level, blocks at multiple levels were undertaken. The first level to be blocked was the one implied by the secondary pain distribution (usually the lower part of the total distribution). If this block failed to relieve pain within 10 minutes, the predicted level then was blocked. If this subsequent block provided complete relief of pain, the second level blocked was interpreted as the symptomatic one. If the first block provided partial relief and the second block completed the relief, a diagnosis was made of symptomatic joints at two levels.

The diagnostic blocks used were cervical medial branch blocks performed under image intensifier using a lateral approach. Cervical medial branch blocks are described in detail elsewhere,[1,2,4] but in principle they involve anesthetization of the medial branches of the cervical dorsal rami that innervate the target joint. To anesthetize a typical cervical zygapophyseal joint, the nerve above and below the joint must be blocked, and suitable target points for such blocks are the waists of the articular pillars of the cervical vertebrae, where the nerves bear a constant relationship to bone.[1] To anesthetize the C2–3 zygapophyseal joint, the third occipital nerve must be blocked where it crosses the lateral margin of the joint.[3]

With the patient lying sideways on an x-ray table, the target joint was identified. A 25-gauge, 90-mm needle was inserted through the skin overlying the joint and then directed toward the waist of the articular pillar immediately below the joint. At this point, 0.5 ml of 0.5% bupivacaine was injected, the needle then was withdrawn slightly and redirected to the articular pillar above the target joint, where the related medial branch was anesthetized. In the case of C2–3 joints, the needle was directed onto the lateral aspect of the joint, where the related third occipital nerve was anesthetized.

As part of the procedure for which the patients were referred, all underwent arthrography of the symptomatic joint followed by injection into the joint of 0.5 ml of 0.5% bupivacaine and 2 mg of betamethasone. However, for the purposes of the present study, the therapeutic response to these injections was disregarded. Only the immediate response to the diagnostic blocks was used.

Correlations between the predicted and observed responses were recorded by the radiologist, but were subsequently also submitted to a single-blind analysis by a second observer (NB). This observer examined the areas of pain recorded in the body diagrams and independently recorded his interpretation and predicted symptomatic levels. By comparing the predictions of the first and second observers, the accuracy of the diagnostic criteria adopted could be evaluated.

RESULTS

The pain patterns reported by the patients are illustrated in Figure 2 together with the predicted levels of the first and second observers. Their responses to diagnostic blocks are shown in Table 1. The patients were not numbered in order of presentation, but were ordered by segmental level of their symptomatic joints, so that for clarity of presentation the results could be displayed systematically.

In eight cases there was complete concordance in the predicted levels between first and second observers. In the remaining two cases, the first observer anticipated symptomatic joints at two consecutive levels, but the second observer predicted only one level. In both cases, however, there was concordance between the observers on one of the two levels predicted by the first observer.

In nine of ten patients there was complete concordance between the predicted level and the positive response to blocks. The remaining patient was not relieved by blocks of either of the joints predicted.

Patients 4 and 7 exhibited pain patterns that were clearly unisegmental, and both were correctly predicted by both observers. Patient 10 exhibited a pain pattern that has not been observed in normal volunteers. This was interpreted and confirmed as pain stemming from the C7–T1 zygapophyseal joints. Patients 2, 3, 8, and 9 reported secondary pains that suggested that a second level might be symptomatic, but on the basis of the distribution of their primary pain, both observers predicted only a single level. Blocks of the secondary level did not relieve any

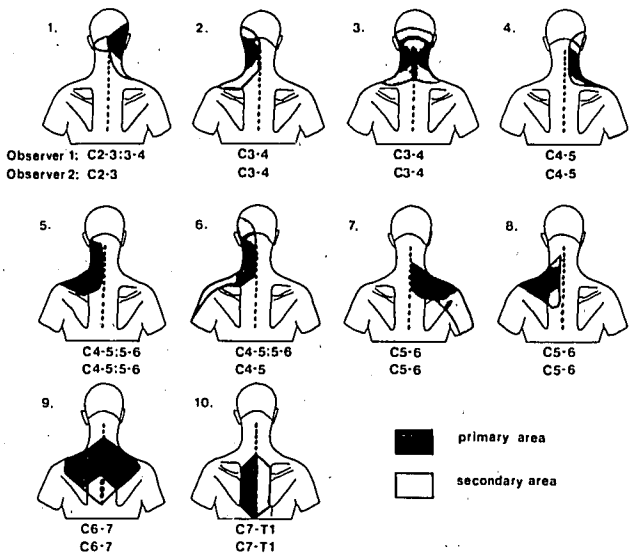

Fig 2. Illustration of the primary and secondary areas of pain reported by patients numbers 1–10, together with the predictions made by Observers 1 and 2 of the segmental location of the symptomatic zygapophyseal joint in each patient. The patients were numbered so as to present the results systematically by segmental level and not by order of presentation.

pain, but blocks of the single predicted level completely relieved the pain. Patient 5 exhibited primary pain that embraced two segmental levels as interpreted by both observers, and both levels had to be blocked to achieve complete relief.

DISCUSSION

Cervical medial branch blocks were used in this study because they constitute a relatively simple screening test for putative cervical zygapophyseal joint pain, and were routinely in use in the practice from which the patients were drawn. They carry less risk than intra-articular blocks and technically are easier to perform. For the diagnosis of symptomatic cervical zygapophyseal joints they are equally as specific as intra-articular blocks.[4]

When patients reported pain in areas virtually identical to those described by normal volunteers, there was no difficulty in predicting the symptomatic level. However, most patients reported areas that were more extensive than those seen in normal volunteers. While their primary pain coincided with a characteristic segmental pain, their secondary pain overflowed into areas suggestive of a second segmental level; but anesthetization of this second level did not affect their pain. This apparent anomaly is probably due to differences in intensity of the pain suffered by patients and normal volunteers.

In our previous study,[7] normal volunteers were only minimally stimulated, and consequently the pain pattern they reported probably represents the critical or core area characteristic of the segment stimulated. It would appear that, with stronger stimuli, the pain can spread beyond the core area, overlapping into adjacent zones. Consequently, for diagnostic purposes one should focus on the region of primary pain and not be distracted by secondary extensions.

When this guideline was employed in the present study, the symptomatic level was always correctly predicted. Distraction by the secondary pain area proved to be the reason for the two cases in which the two observers disagreed in the present study. For Patient 6 the first observer predicted not only C4–5 but also C5–6 because of the extension of secondary pain over the top of the shoulder, but the second observer predicted only C4–5 because the primary pain fell short of the spine of the scapula. Unfortunately, this patient did not respond to diagnostic blocks and the predictions of both observers were proved false. Disc disease was suspected as the actual source of pain in this patient, but this was not confirmed, as she had been referred from "out of town" and was not available for subsequent further investigation.

The pain reported by Patient 1 seemed ambiguous to the first observer, who suspected an origin at both C2–3 and C3–4, the latter prediction being based on the caudal extent of the patient's secondary pain. The correct single, symptomatic level was predicted by the second observer, who focused only on the area of primary pain.

The failure of diagnostic blocks to confirm the source of pain in Patient 6 indicates that other conditions may mimic zygapophyseal joint pain. However, our study was not designed to evaluate criteria by which zygapophyseal pain could be distinguished from other causes of pain. It was designed only to test accuracy of predicting the correct symptomatic level in patients likely to have cervical zygapophyseal joint pain. It was for this reason that the patients selected for study were ones thought likely to have symptomatic cervical zygapophyseal joints. Although denied in Patient 6, this suspicion was confirmed in the other nine patients.

In these patients, our results show that the segmental pain charts established in normal volunteers (Figure 1) could be used with good accuracy to predict the segmental location of the symptomatic joint. We submit that this validates the results of our study in normal volunteers.[7] The successful use of pain charts in a clinical setting implicitly confirms their reliability and circumvents the need to study a larger number of volunteers.

We emphasize that our study was designed only to test the ability to predict the segmental location of symptomatic joints. We did not set out to test criteria whereby zygapophyseal pain could be distinguished from other forms of neck pain. This is a separate issue still to be explored. However, in this regard the clinical profiles of our patients and the results of related studies provide some clues.

Zygapophyseal joint pain should at least be suspected in patients with negative provocation discograms or in patients with persistent pain following anterior cervical fusion. The latter observation underscores a previous report[4] that zygapophyseal joint pain can occur despite seemingly adequate anterior fusion at the symptomatic level. Zygapophyseal joint pain should also be suspected if manual examination of the neck reveals joint signs that have been shown to be pathognomonic of symptomatic zygapophyseal joints.[9] Otherwise, zygapophyseal joint pain should be considered with a high index of suspicion in patients with otherwise inexplicable neck pain.

The actual incidence of cervical zygapophyseal joint pain syndromes is not known, although one study records a high incidence of this

Table 1. Correlations between Predicted and Observed Responses to Diagnostic Blocks

Patient number	*Predicted levels*		*Response to blocks*	
	Observer 1	*Observer 2*	*Positive*	*Negative*
1	C2-3, C3-4	C2-3	C2-3	C3-4, C4-5
2	C3-4	C3-4	C3-4	C4-5
3	C3-4	C3-4	C3-4	C4-5
4	C4-5	C4-5	C4-5	
5	C4-5, C5-6	C4-5, C5-6	C4-5, C5-6	
6	C4-5, C5-6	C4-5		C4-5, C5-6
7	C5-6	C5-6	C5-6	
8	C5-6	C5-6	C5-6	C6-7
9	C6-7	C6-7	C6-7	C5-6
10	C7-T1	C7-T1	C7-T1	

condition among patients presenting to a pain clinic.[4] The condition may well be more common than is currently believed, and there is a need for a formal, epidemiologic study in a previously uninvestigated population of patients presenting with idiopathic neck pain to determine the relative incidence of symptomatic zygapophyseal joints, disc disease, combined states, or other conditions. To this end, we commend the use of pain charts as a means for screening patients to determine the likely segmental location of symptomatic cervical zygapophyseal joints.

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