

Missed Diagnosis

Costovertebral joint dysfunction: another misdiagnosed cause of atypical chest pain

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Summary: The diagnostic work-up of atypical chest pain frequently leads to invasive procedures. However, this painful symptomatology can sometimes be of benign origin and respond to simple therapeutic manoeuvres. A number of musculoskeletal conditions such as costovertebral joint dysfunctions should be carefully considered. We report five cases in which patient discomfort and high costs could have been avoided if awareness of these conditions had led to a correct diagnosis upon initial physical examination.

Introduction

Atypical chest pain unrelated to a cardiac or pleuro-pulmonary cause is a common symptom particularly in the emergency room.¹⁻⁴ However, little attention has been drawn in the medical literature to musculoskeletal causes.^{2,5,6} This can lead to repeated, sometimes invasive and often costly medical investigations.⁷ Even though emotional factors can play a role in such symptoms,^{1,7,8} it seems important to identify specific local musculoskeletal causes of atypical chest pain, which can be easily detected and treated.^{5,6,10} We report five cases of atypical chest pain related to a characteristic cause of rib strain: costovertebral joint dysfunction.

Case reports

Case 1

A 54 year old female patient underwent a right arthroscopic meniscectomy under general anaesthesia. In the recovery room, she experienced three episodes of atypical precordial pain, independent of respiratory movements. Clinical examination and electrocardiogram (ECG) were normal. Nitroglycerin produced no relief, and the pain subsided after a few minutes. She was transferred to the ward. Twenty-four hours later, the pain recurred,

this time located in the left basi-thoracic region. Routine diagnostic work-up was unrevealing. Since the patient was in the postoperative period, pulmonary embolism was suspected. She was anticoagulated with heparin. An isotopic ventilation/perfusion lung scan indicated low probability for pulmonary embolism. Nonetheless, in view of the high degree of clinical probability, pulmonary angiography was performed, which was normal. As the pain continued, the patient underwent a complete physical examination by a rheumatologist. An exquisitely tender thoracic paravertebral region at the T7 level was identified, whose palpation and rib mobilization precisely reproduced the patient's symptoms. There was an accompanying muscular contraction and cutaneous tenderness. The diagnosis was a T7 costovertebral joint dysfunction. The pain disappeared after intercostal nerve block with lidocaine and the patient was discharged from the hospital 48 hours later.

Case 2

A 42 year old woman with a history of slight chest contusion one month previously was admitted to the emergency room with a severe left basithoracic pain, increased by breathing movements, and accompanied by dyspnoea and tachycardia. Physical examination and laboratory and blood gas analyses were normal. The ECG revealed atrial fibrillation with a heart rate ranging from 120 to 145/min, spontaneously reverting to a normal sinus rhythm. Pulmonary embolism was suspected. The pulmonary scan yielded a low probability, promp-

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ting pulmonary angiography, which was normal. A complete diagnostic work-up including echocardiographic examination, serological testing for viral infection, vertebral X-rays and isotopic bone scan was normal. Upon re-examination, a left paravertebral muscular contracture extending from T4 to T7, with cutaneous hyperalgesia, was discovered. There was exquisite tenderness of the T6–T7 region as well as upon mobilization of the 6th rib. These painful symptoms were identical to those experienced by the patient during the previous days. A diagnosis of T6 costovertebral joint dysfunction was made. Intercostal nerve block with lidocaine completely relieved the symptoms.

Case 3

A 23 year old male patient was admitted to the emergency ward for acute dorsal and latero-thoracic pain, with a probable diagnosis of pericarditis. His history was free of recent 'flu-like symptoms, cough or chest pain. He complained of severe, burning pain, increased by breathing and movements of the torso, the latter producing left antero-lateral radiation. The initial diagnostic work-up was inconclusive, and the patient was hospitalized. He described a similar episode one year previously, for which he had also been hospitalized. No clue had been found as to the cause of the symptoms, which had spontaneously disappeared. He indicated that his present symptoms had appeared after having spent a few hours studying in a prone position, followed by stretching exercises. There was a paravertebral muscular contracture in the T5–T8 region. A skin-pinch test produced localized dysaesthesia. Posterior palpation of the 6th left rib initiated sharp pain, radiating anteriorly. Costovertebral dysfunction of the 6th rib was diagnosed. An intercostal block with lidocaine relieved the patient immediately. He left the hospital after 48 hours, asymptomatic.

Case 4

A 36 year old male patient presented with right latero-thoracic pain of acute onset. He had no past cardio-respiratory problems. He described his pain as mostly dull and deep, with occasional sharp, knife-like, characteristics. He was dyspnoeic. Dorsal or right lateral decubitus decreased the symptoms. The emergency ward evaluation was that of a possible pulmonary embolism. Anticoagulation with heparin was started. However, an isotopic ventilation/perfusion lung scan was normal, and heparin was thus discontinued. A physical re-examination indicated that the pain appeared upon inspiration and rotation of the torso. There was a paravertebral muscular contracture and tenderness

at the T8 level. Palpation at that level reproduced the patient's pain. After various dorsal musculoskeletal physical examination procedures, the patient described partial relief of his symptoms. Costovertebral dysfunction was diagnosed, and a treatment of non-steroidal anti-inflammatory drugs and muscle relaxants started. The symptoms disappeared within 48 hours, and the patient left the hospital.

Case 5

A 70 year old female patient presented with sudden left basithoracic pain, increased by breathing movements. She had been experiencing similar, although less intense, symptoms for one month. The pain was usually deep, dull, and increased by inspiration and anterior flexion of the torso. At times, she felt intensely dyspnoeic. The dyspnoea was accompanied by palpitation and diaphoresis. As with the other four patients, the initial emergency ward evaluation was inconclusive, but the symptoms were interpreted as possibly related to pulmonary embolism, and the patient was anticoagulated with heparin. An isotopic ventilation/perfusion lung scan was normal. Anticoagulation was stopped. Further evaluation revealed left paravertebral muscular contracture at the T5–T7 levels. Skin-pinch testing caused dysaesthesia and local hyperalgesia, and palpation of the posterior left 6th rib reproduced the pain with its characteristic antero-lateral radiation. Costovertebral dysfunction was diagnosed and the symptoms were totally relieved by an intercostal nerve block at the T6 level, and the patient left the hospital after 48 hours.

Discussion

We have reported five characteristic cases of atypical chest pain due to a misdiagnosed musculoskeletal aetiology, which led to needless, and sometimes invasive, investigations. Patients were hospitalized for a cumulative number of 26 days. A total of 14 ECGs, seven chest and spine X-rays, four isotopic ventilation/perfusion lung scans, two pulmonary angiographies, one cardiac echography and one isotopic bone scan were performed.

All patients presented with atypical chest pain related to a poorly known aetiopathogenic cause: costovertebral joint derangements.^{9–14} This condition refers to an abnormal mobility and/or a posterior subluxation of the rib producing a functional disruption between the rib and its two vertebral joints: costovertebral and costotransversal articulations (the latter is nonexistent in the two floating ribs). Both these joints are reinforced by a

strong ligamental apparatus and are under control of certain muscles (especially ilio-costalis).

Poorly recognized by physicians, costovertebral dysfunctions, as a particular posterior rib strain, are well described in manual medicine textbooks¹⁰⁻¹² and mentioned in some clinical observations.^{9,10,13,14} As reported in our patients, the failure to identify such lesions can lead to an erroneous diagnostic work-up.

As true diarthrodial synovial-lined joints, costovertebral and costotransversal articulations are richly innervated by collateral branches of the intercostal nerve. Excessive strain in such joints after trauma, effort or false movement, leads to an abnormal firing of nociceptive impulses from the deep musculoskeletal structures involved with, sometimes, longlasting local and referred pain.^{10,14} Elements of relevance in atypical chest pain related to rib strains are reported in Table I. As observed by others,^{2,5,6,10} the clinical history as well as the description of the pain appear to be helpful diagnostic aids. Positional pain of a sharp and stabbing nature, as well as the absence of any prior history of ischaemic heart disease, provide elements against angina pectoris.² In addition, a recent history of minor chest trauma or constraining postures, as was the case in three of our five patients, are highly indicative of a musculoskeletal origin, and should prompt a very careful clinical examination. This frequently shows a characteristic increase in pain, radiating laterally to the trunk in a dermatomal distribution, upon deep breathing and movements of lateral flexion and rotation. Reproducing symptoms by a careful mobilization of the rib, and the search of a local segmental skin irritation (hyperalgesia and dysaesthesiae induced by a skin pinch test)¹⁰⁻¹² are also essential diagnostic procedures.

Table I Relevant elements of chest pain related to costovertebral joint dysfunctions

Prior history of pain with similar characteristics
Quality of the pain (burning, sharp or stabbing)
Recent history of (minor) trauma or constraining postures
Pain fluctuation with rotation of the torso (positional pain)
Pain fluctuation with breathing movements
Variable periods of spontaneous improvement
Reproduction of symptoms by mobilizing/palpating the rib
Pain radiating into apparent radicular segmental distribution
Localized skin hyperalgesia/dysaesthesia induced by skin pinch manoeuvre
Sudden improvement induced by clinical examination ('manipulation-like' effect)
Total relief of symptoms after lidocaine block

Nevertheless, in some cases, a differential diagnosis must be considered, with regards to other such musculoskeletal conditions: Firstly, intervertebral facet joint derangements can also be a potent source of local and referred pain,^{10-12,15} in spite of minimal biomechanical strains in such small joints, particularly at the cervical and lumbar levels.¹⁶⁻¹⁸ The vertebral segments involved elicit pain upon active mobilization. Positions that ease the pain are common, as well as localized muscular contractures which could introduce an additional source of nociceptive impulses as observed in several myofascial pain syndromes.¹⁵ However, in these cases the pain is not elicited by the mobilization of the rib and usually spreads into a few dermatomal areas, poorly defined and frequently distant. Secondly, interspinous ligament disruptions can also trigger local and diffuse pain.^{10,19} A prior history of trauma or sudden abrupt movement is usually reported by the patient, who considers it causal. The pain is frequently persistent, and varies neither spontaneously nor with breathing. Local dermatomal skin hyperaesthesia is unusual and the mobilization of the rib does not induce the symptoms, which are clearly reproduced by the palpation of the interspinous space, particularly during anterior flexion of the torso.¹⁰ Thirdly, costovertebral dysfunctions affecting the inferior ribs can generate pain radiating anteriorly in the upper abdominal wall.¹⁰ However, clinical examination allows differentiation with other conditions such as the slipping rib syndrome^{20,21} and the complete subluxation of a floating rib.²² Lastly, the protrusion of an intervertebral disc with true radicular pain must also be considered, in spite of its very unusual occurrence at the dorsal level.²³ In such cases, the pain, of neurogenic quality, is not influenced by mobilization of the ribs. Also, a specific dermatomal sensory deficit is usually present, and is frequently associated with intense local hyperaesthesia. In addition, more than 70% of these cases show neurological signs suggesting medullar compression at the time of diagnosis.²³ In these cases, as well as in other local inflammatory or tumoural processes, a satisfactory relief of the symptoms cannot be obtained by simple antalgic manoeuvres, and persistence of pain should lead to further diagnostic work-up.

In costovertebral dysfunctions, accompanying neurovegetative signs such as nausea, mimicking a visceral origin to the complaints, can be present, and could be related to the proximity of the intercostal nerves to afferent sympathetic fibres.^{10,12} Patient 4 reported spontaneous relief after clinical examination which in our experience is not an unusual finding. It can also be reported by patients suffering from minimal facet joint derangements. In the other four patients, radicular nerve blockade (10 ml lidocaine, 1%) was per-

formed as a diagnostic procedure, followed by the permanent disappearance of symptoms. Different techniques of intercostal nerve blocks have been described and widely used in several clinical conditions.^{24,25} However, it is not clearly established how nerve blockade procedures can produce long-lasting relief of pain in this as well as in other similar painful conditions.^{16,20} A hypothetical explanation could be that a significant reduction in pain by a local anaesthetic allows a normal mobility of disrupted joints which can finally exert their normal biomechanical activity. This results in a reduction in the joints' strain and subsequent abolition of local nociceptive impulses. A self-perpetuating cycle of pain-spasm-pain is broken, with a considerable reduction in pain and, perhaps, in local sympathetic overactivity when present. Beneficial effects of manipulations, when accurately performed, emphasize such a biomechanical approach,¹⁰⁻¹² although the precise analgesic effects of manipulations have not been clearly established yet.²⁶

An additional question could be addressed concerning the potential interest of X-ray investigation in order to achieve a complete diagnostic work-up in such cases, as has been proposed.^{13,14} In our experience, in the presence of characteristic history and clinical examination (Table I) and no recurrence of symptoms after a significant clinical effect of lidocaine block, X-ray investigation can be delayed. Indeed, as observed in other spinal pain disorders related to the facet joints, it must be pointed out that their minimal strain can be a source of local and/or referred pain without any visible alteration.^{10,12,16-18} Conversely, some

patients exhibit abnormal computed tomographic scan findings without experiencing any pain.²⁷ The value of invasive diagnostic and therapeutic measures by local injections into these facet joints remains highly controversial, and the subject of much debate.²⁸⁻³⁰ The same questions can be put forward concerning costovertebral joints.

On the other hand, repeated X-rays in such patients could also be an added source of diagnostic error. Asymptomatic subjects can present a localized hyperostosis of the posterior ribs, and articulating transverse processes related to the activity and insertions of iliocostalis muscle without any clinical translation.³¹ Nevertheless, any mechanical manipulation must be avoided in such patients in the absence of evidence for rib and vertebral body integrity.

In conclusion, we have reported five characteristic cases of atypical thoracic pain in which extensive medical investigations failed to make an accurate diagnosis. We emphasize that the lack of knowledge of the existence of such costovertebral joint strains¹⁰⁻¹⁴ and other musculoskeletal causes of atypical thoracic pain,^{5,6} could be responsible for inappropriate, repetitive, potentially dangerous and costly investigative procedures. This could in turn lead to a vicious cycle whereby patients' anxiety, fuelled by recurring symptoms in the face of negative examinations, will trigger additional diagnostic work-ups, thus further increasing risks and costs.^{1,3,7,8} We suggest that further investigation of these painful conditions be pursued, in order to improve physiopathological knowledge of their causative mechanisms, and, most of all, increase physicians' awareness of their existence.

References

- Pearce, M.J., Mayou, R.A. & Klimes, I. The management of atypical non-cardiac chest pain. *Q J Med* 1990, **76**: 991-996.
- Lee, T.H., Cook, E.F., Weisberg, M. *et al.* Acute chest pain in the emergency room. Identification and examination of low-risk patients. *Arch Intern Med* 1985, **145**: 65-69.
- Sox, H.C., Margulies, I. & Sox, C.H. Psychologically mediated effects of diagnostic tests. *Ann Intern Med* 1981, **95**: 680-685.
- Herlitz, J., Hjalmarson, A., Karlson, B.W. & Nyberg, G. Long-term morbidity in patients where initial suspicion of myocardial infarction was not confirmed. *Clin Cardiol* 1988, **11**: 209-214.
- Fam, A.G. Chest wall pain: if not cardiac disease, then what? (Part 1: pain arising from the ribs and sternum). *J Musculoskel Med* 1987, **4**: 65-74.
- Fam, A.G. Approach to musculoskeletal chest wall pain. *Primary Care* 1988, **15**: 767-782.
- Raymond, C. Chest pain not always what it seems: panic disorder may be cause in some. *JAMA* 1989, **261**: 1101-1102.
- Katon, W., Hall, M.L., Russo, J. *et al.* Chest pain: relationship of psychiatric illness to coronary arteriographic results. *Am J Med* 1988, **84**: 1-9.
- Maigne, R. *Douleurs d'Origine Vertébrale et Traitement par Manipulations*, 3rd ed. Expansion Scientifique Française, Paris, 1977, pp 32-50, 417-433.
- Goldthwait, J.E. The rib joints. *N Engl J Med* 1940, **223**: 568-573.
- Maigne, R. Manipulation of the spine. In: Rogoff, J.B. (ed.) *Manipulation Traction and Massage*. Williams & Wilkins, Baltimore, 1980, pp. 59-120.
- Neumann, H.D. In: Gilliar, W.G. (ed.) *Introduction to Manual Medicine*. Springer-Verlag, New York, 1989, pp. 2-53.
- Benhamou, C.L., Roux, C.H., Gervais, T. & Viala, J.F. Costo-vertebral arthropathy. Diagnostic and therapeutic value of arthrography. *Clin Rheumatol* 1988, **7**: 220-223.
- Raney, F.L. Costo-vertebral - costotransverse joint complex as the source of local or referred pain. *J Bone Joint Surg [Am]* 1966, **48**: 1451-1452.
- Simons, D.G. & Travell, J.G. Myofascial pain syndromes. In: Wall, P.D. & Melzack, R. (eds) *Textbook of Pain*, 2nd ed. Churchill Livingstone, London, 1989, pp 368-385.
- Bogduk, N. & Marsland, A. The cervical zygapophyseal joints as a source of neck pain. *Spine* 1988, **13**: 610-617.

17. Bogduk, N. The rationale for patterns of neck and back pain. *Patient Management* 1984, **8**: 13–21.
18. Arroyo, J.F., Cohen, M.L. & Champion, G.D. Les cervicobrachialgies occupationnelles chroniques (CBOC): éléments sémiologiques et mécanismes nociceptifs. *Doul Analg* 1989, **2**: 137–146.
19. Kellgren, J.H. On the distribution of pain arising from deep somatic structures with charts of segmental pain areas. *Clin Sci* 1939–1942, **4**: 35–46.
20. Wright, J.T. Slipping rib syndrome. *Lancet* 1980, **ii**: 632–633.
21. Spence, E.K. & Rosato, E.F. The slipping rib syndrome. *Arch Surg* 1983, **118**: 1330–1332.
22. Jalovaara, P., Rämö, J. & Lindholm, R. Twelfth-rib syndrome simulating intra-abdominal disease. *Acta Chir Scand* 1988, **154**: 407–408.
23. Arce, C.A. & Dohrmann, G.J. Thoracic disc herniation. Improved diagnosis with computed tomographic scanning and a review of the literature. *Surg Neurol* 1985, **23**: 356–361.
24. Bonica, J.J. Local anaesthesia and regional blocks. In: Wall, P.D. & Melzack, R. (eds) *Textbook of Pain*, 2nd ed. Churchill Livingstone, London, 1989, pp 724–743.
25. Thompson, G.E. Celiac plexus, intercostal and minor peripheral blockade. In: Cousins, M.J. & Bridenbaugh, P.O. (eds) *Neural Blockade in Clinical Anesthesia and Management of Pain*. J.B. Lippincott, Philadelphia, 1980, pp. 384–404.
26. Haldeman, S. Manipulation and massage for the relief of pain. In: Wall, P.D. & Melzack, R. (eds) *Textbook of Pain*, 2nd ed. Churchill Livingstone, London, 1989, pp. 942–951.
27. Wiesel, S.W., Tsourmas, N., Feffer, H.L. *et al.* A study of computer-assisted tomography. I. The incidence of positive CAT scans in an asymptomatic group of patients. *Spine* 1984, **9**: 549–551.
28. Deyo, R.A. Fads in the treatment of low back pain (editorial). *N Engl J Med* 1991, **325**: 1039–1040.
29. Carette, S., Marcoux, S., Truchon, R. *et al.* A controlled trial of corticosteroid injections into facet joints for chronic low back pain. *N Engl J Med* 1991, **325**: 1002–1007.
30. Culling, R.D. & Rice, J.H. Corticosteroid injections for chronic low back pain (letter). *N Engl J Med* 1992, **326**: 834.
31. Macones, A.J., Fisher, M.S. & Locke, J.L. Stress-related rib and vertebral changes. *Radiology* 1989, **170**: 117–119.