

Musculoskeletal chest wall pain



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Background

Chest pain is a common general practice presentation that requires careful diagnostic assessment because of its diverse and potentially serious causes.

Objective

This article describes the causes, assessment and differential diagnosis of musculoskeletal chest wall pain, and the management of its most common causes.

Discussion

It is critical to rule out non-musculoskeletal causes of chest pain, particularly those requiring urgent intervention such as ischaemic heart disease. However, once this has been done, most musculoskeletal diagnoses can be made from a thorough history and examination. Further investigations are often unnecessary and should only be used when the provisional diagnosis suggests they are needed, for example, when systemic or rheumatological causes are suspected. The evidence underpinning the treatment of specific localised causes of musculoskeletal chest wall pain is very limited.

Chest pain is a common general practice presentation, which, because of its diverse and potentially serious causes, requires careful and often urgent assessment. Although it is critical to rule out potentially life-threatening conditions, in the general practice/primary care setting, musculoskeletal conditions are the most common causes of chest pain. Estimates of their prevalence in the general practice setting range from 20.6%¹ to 46.6%.² By contrast, musculoskeletal conditions were diagnosed in only 6.2% of patients presenting to the hospital emergency department with chest pain¹ but in this setting, serious causes such as cardiovascular disease were far more common.¹ This article focuses on musculoskeletal chest wall pain (MCWP), particularly its causes, assessment and management of the most common causes.

Causes

The chest wall contains a range of bony and soft tissue structures, including the spine. It may be difficult, therefore, to pinpoint the exact source of pain in an individual patient. As a result, it has been proposed that disorders causing anterior chest wall pain should be grouped as an entity called 'chest wall syndrome',³ but this is not widely accepted and the clinical implications of this approach are unclear.

More commonly, general practitioners (GPs) seek to determine the specific cause. Sometimes this is obvious, as in the case of acute trauma or injuries including rib fracture or contusion and muscular strains in, for example, pectoral or intercostal muscles. In other cases, identifying the cause of isolated MCWP can be problematic because even if general clinical characteristics are described, there is no clear and consistent definition and usually no gold standard diagnostic test to confirm a diagnosis. This also makes it difficult to estimate prevalence of individual conditions accurately. It has been suggested that causes of MCWP can be grouped into three categories⁴ and individual conditions can be broadly considered as more and less common conditions (*Table 1*):

- conditions causing isolated musculoskeletal pain
- rheumatic diseases
- systemic non-rheumatological conditions.

In one general practice sample, costochondritis, also known as costosternal syndrome and anterior chest wall syndrome, was the most common specific cause of anterior musculoskeletal chest pain, with a prevalence of 13%.⁵ Patients with costochondritis typically present with multiple areas of tenderness without swelling over the costochondral or costosternal junctions, palpation of which reproduces their pain. Most commonly, the cause is unknown.⁴ It differs from the rarer Tietze's disease, which typically involves only one area with associated painful, localised swelling.⁴

Lower rib pain syndrome (also termed painful rib syndrome, rib-tip syndrome, slipping rib, twelfth rib and clicking rib) typically presents with lower chest or upper abdominal pain. There is a tender spot on the costal margin and pressing on this reproduces the pain.⁶ The cause is unknown,⁶ but it has been suggested that inadequacy or rupture of the interchondral fibrous attachments of the anterior ribs can allow subluxation of the costal cartilage tips, impinging on the intercostal nerves.⁷

Posterior chest pain may arise from the thoracic spine, from structures including intervertebral discs and facet (zygapophyseal),

costotransverse and costovertebral joints. Anecdotally, the thoracic spine is considered a common source of anterior chest wall pain in patients presenting to general practice,⁸ although we are unaware of any incidence or prevalence data. In one study in four pain-free individuals, injecting facet joints⁹ with contrast medium failed to cause anterior chest wall pain; however, two participants reported referral patterns towards the sternum. In a similar study, injection into the costotransverse joints did not produce chest wall pain.¹⁰ The innervation of the costovertebral joints suggests that pain in these joints could be referred to the anterior chest¹¹ but this has not been tested. The segmental referral patterns of the thoracic interspinous ligaments¹² and paravertebral muscles (innervated by the posterior rami of the spinal nerves)¹³ have been investigated using injections of hypertonic saline, which has shown referral to the anterior, lateral and posterior chest, and lower thoracic segments referring lower on the chest.

Sternalis syndrome presents with anterior chest pain associated with localised tenderness over the body of the sternum or overlying sternalis muscle; palpation often causes radiation of pain bilaterally. It may be under-recognised – it has been considered 'rarely described'¹⁴ but in a Swiss general practice study, it was found to be common, being seen in 14.4% of 672 chest wall syndrome presentations.¹⁴ The cause of sternalis syndrome is unknown but it is thought to be a self-limiting condition and unlikely to cause persistent pain.⁴

Table 1. Musculoskeletal causes of chest wall pain

Isolated musculoskeletal pain

More common

- Costochondritis
- Lower rib pain syndromes
- Pain from thoracic spine/costovertebral joints
- Sternalis syndrome

Less common

- Stress fractures
- Tietze's syndrome
- Xiphoidalgia
- Spontaneous sternoclavicular subluxation

Rheumatic diseases

More common

- Fibromyalgia
- Rheumatoid arthritis
- Axial spondyloarthritis (including ankylosing spondylitis)
- Psoriatic arthritis

Less common

- Sternoclavicular hyperostosis
- Systemic lupus erythematosus
- Septic arthritis of the chest wall
- Relapsing polychondritis

Non-rheumatic systemic causes

- Osteoporotic fracture
- Neoplasms
 - Pathological fracture
 - Bone pain
- Sickle cell disease (rare)

Assessment and differential diagnosis

It is critical to rule out life-threatening causes of chest pain, such as ischaemic heart disease and pulmonary embolus, and non-musculoskeletal causes, such as gastro-oesophageal reflux disease, through appropriate clinical assessment and investigations.¹⁵ Current methods for scoring features of musculoskeletal causes of chest pain that differentiate them from cardiovascular causes have had inadequate diagnostic performance.¹⁶ The clinician's thorough assessment, therefore, remains the best approach. In particular, the localisation of pain² and presence of chest wall tenderness or reproduction of pain by movements¹⁷ are insufficient to justify ruling out serious non-musculoskeletal causes.

Having ruled out non-musculoskeletal causes, much of the further assessment can be accomplished solely by history and examination. Key features of the more common causes are shown in *Table 2*. In some instances, investigation appropriate to the clinical features/provisional diagnosis may be required to complete the diagnosis of rheumatic and systemic causes. Results from the main investigations for the more common conditions are also shown in *Table 2*. A chest X-ray or bone scan may be indicated to rule out a specific diagnosis such as a traumatic rib fracture or stress fracture.

The history and examination targets the musculoskeletal system as well as other systems that may provide diagnostic

information for rheumatic or non-rheumatic systemic causes. The chest pain needs to be fully characterised in terms of onset, site(s), radiation, and relieving and exacerbating factors (in particular, any relationship to postures, specific activities or acute trauma). Atypical symptoms, such as night pain or severe pain, alert the GP to look for systemic causes such as fractures, infection or neoplasms. The presence of other musculoskeletal or other symptoms assists diagnosis of other conditions. For example, low back pain raises the possibility of spondyloarthropathy; involvement of multiple synovial joints the possibility of rheumatoid arthritis (although this rarely affects the chest wall); rashes may suggest psoriatic arthritis; sleep disturbance and fatigue, with widespread pain and trigger points suggest fibromyalgia.

The musculoskeletal examination includes the ribs, chest wall and cervical, thoracic and lumbar muscles and vertebrae. A key point is to identify areas of tenderness or active or passive movements (flexion, extension, lateral flexion and rotation) that reproduce the patient's pain. Important areas to palpate include costochondral joints, sternum, ribs, thoracic vertebrae and the intercostal, paraspinal, trapezius and pectoral muscles. The approach to thoracic palpation needs to be systematic, to assess each structure at each thoracic level, such as to palpate centrally over the spinous processes, then 2–3 cm laterally on each side (zygapophyseal joints), then transversely on the side of the spinous processes, then 4–5 cm from midline (costotransverse junctions) and, finally, over the posterior ribs.⁸ Inspiratory, cervical, thoracic and shoulder movements, as well as cough, should be

Table 2. Key features of common causes of musculoskeletal chest wall pain

Condition	Key features
Isolated musculoskeletal chest wall pain	
Costochondritis	Tenderness in multiple areas over the costochondral or costosternal junctions; palpation reproduces the pain No associated swelling; mostly affects 2nd to 5th ribs ²²
Lower rib pain syndrome	Pain in the lower chest or upper abdomen with a tender spot on the costal margin; ⁶ pain reproduced by pressing on the spot
Sternalis syndrome	Localised tenderness over the body of the sternum or sternalis muscle; palpation often causes radiation of pain bilaterally
Thoracic costovertebral joint dysfunction	Localised pain approximately 3–4 cm from the midline and possibly referred pain ranging from the posterior midline to the lateral chest wall, and anterior chest pain Movement of the rib provokes pain at the costovertebral joint and reproduces referred pain ⁸
Rheumatic causes	
Fibromyalgia	Widespread musculoskeletal pain and tenderness, poor quality, unrefreshing sleep, fatigue and cognitive disturbances, ^{25,31} not accounted for by another condition Diagnosed by American College of Rheumatology criteria ³¹
Rheumatoid arthritis	Swelling and/or tenderness of multiple small and/or large synovial joints, positive for rheumatoid factor and/or anti-citrullinated protein antibody, and abnormal C-reactive protein or erythrocyte sedimentation rate Diagnosed by American College of Rheumatology criteria ³²
Axial spondyloarthropathy (including ankylosing spondylitis)	Back pain for 3 months or longer with onset under 45 years of age, together with either: <ul style="list-style-type: none"> • imaging features of sacroiliitis on MRI or X-ray, and one other feature of SpA* • HLA-B27 and two other features of SpA*³³
Psoriatic arthritis	Inflammatory articular disease (joint, spine, or enthesal) with three out of five of the following: 1) evidence of current psoriasis, past history or a family history of psoriasis, 2) current psoriatic nail changes, 3) negative for rheumatoid factor, 4) current or a history of dactylitis, 5) radiographic evidence of juxta-articular new bone formation on plain radiographs of the hand or foot ³⁴
Non-rheumatic systemic causes	
Osteoporotic fracture	Acute back pain, loss of height or kyphosis for thoracic spine fractures, ²⁹ acute localised pain for rib fractures Corticosteroid use and other osteoporosis risk factors for both.
Neoplasm with pathological fracture or bone pain	Severe and/or night pain, and associated non-musculoskeletal symptoms

*SpA, spondyloarthritis: features are inflammatory low back pain, arthritis, enthesitis, uveitis, dactylitis, psoriasis, inflammatory bowel disease, good response to non-steroidal anti-inflammatory drugs, family history of SpA, HLA-B27, elevated C-reactive protein

assessed. The general examination includes the skin and eyes to detect spondyloarthropathy.

Management of common causes

The evidence base for interventions specifically targeting MCWP is very limited. A recent systematic review of interventions for non-cardiac chest pain identified only two randomised controlled trials (RCTs)^{18,19} addressing musculoskeletal causes. In an RCT in 114 female patients with pain in the thoracic area, facet-traction manipulation of the thoracic spine by an experienced physiotherapist was only modestly superior to placebo treatment with sham interference-electrotherapy for short-term (4 week) pain reduction (decreases of 3.2, compared with 2.3 units on a 10-point visual analogue pain scale).¹⁹ In the same study, acupuncture was not effective.

A second trial assessed chiropractic treatment for acute musculoskeletal chest pain.^{20,21} This trial compared 4 weeks of chiropractic treatment, including spinal manipulation, with self-management advice including home exercises. Importantly, there was a high risk of bias in this study because the patients, who were not blinded, self-reported pain outcomes. Thus, the results should be interpreted cautiously. At best, there was only a minimal short-term benefit from chiropractic treatment. Compared with those in the self-management groups, patients who received chiropractic treatment were more likely to report their pain as 'much better' or 'better' at 4 weeks (60% with self-management, compared with 82% with chiropractic treatment). By 12 weeks, however, there was no difference between groups. For pain intensity measured on an 11-point scale, reductions in intensity were similar in both groups at 4 weeks, and the small effect in favour of chiropractic treatment (1.1 on an 11-point scale) at 12 weeks²¹ is of doubtful clinical importance. By 12 months, there were no differences in either pain outcome between intervention groups.²⁰

There is a lack of clinical trials for costochondritis treatments and only low-level or consensus evidence for currently accepted treatment approaches. As far as we are aware, costochondritis is usually a self-limiting, benign condition and treatment, therefore, begins with reassurance and explanation of the condition to the patient. If needed, simple analgesics such as paracetamol, or nonsteroidal anti-inflammatory agents (oral or topical) can be tried.²² Patients can be advised to avoid activities provoking symptoms, and may find heat packs²² and stretching exercises helpful.²³ Rarely, if only one or two costochondral junctions are involved, injection of local anaesthetic/corticosteroid may be helpful.

A general recommended approach to other causes of isolated musculoskeletal chest pain is similar to that for costochondritis (Table 3).²⁴ Clinical judgement is required to decide which options will be most helpful for an individual patient. These options also apply to injuries such as muscle strains. Traumatic rib fractures are often very painful and remain so for several weeks.

In addition to analgesia, encouragement of deep breathing may be required to avoid localised collapse of the lung. Even rib contusions may be painful and require similar treatment.

For the major rheumatic conditions, treatment of chest pain forms part of the overall management of each condition. Readers are referred to further information for fibromyalgia,²⁵ rheumatoid arthritis,²⁶ ankylosing spondylitis²⁷ and systemic lupus erythmatosus.²⁸ Treatment of non-rheumatic causes also is dependent on the particular condition. However, as there is a large evidence-treatment gap in the secondary prevention of osteoporotic fracture, we highlight that a rib fracture due to osteoporosis must trigger action to prevent further more serious fractures, for example, of the hip.²⁹ This includes bone densitometry and appropriate prescribing of a specific osteoporosis treatment, such as a bisphosphonate, unless contraindicated.

Uncommonly, MCWP can lead to chronic pain. The approach should be similar to management of other types of chronic pain³⁰ and might include anticonvulsants, antidepressants, behavioural therapy and physical therapies. Where possible, opioids should be avoided. In the case of severe, chronic MCWP, it is important to consider a missed diagnosis (eg underlying cancer, infection or fracture) and exclude this by appropriate clinical assessment and imaging.²⁴ For persistent symptoms, the possibility of fibromyalgia should also be reconsidered as this is a common cause in that situation.

Key points

- Musculoskeletal conditions are the most common cause of chest pain presenting to general practice.
- It is critical to rule out other serious conditions, such as cardiovascular disease, before making a diagnosis of MCWP.
- More common, localised causes include costochondritis, painful rib syndrome, sternalis syndrome and thoracic spine dysfunction.

Table 3. Treatment options for isolated musculoskeletal chest wall pain*

- Reassurance and explanation for all patients
- Temporarily avoiding aggravating activities
- Stretching
- Application of heat for muscle spasm or ice for swelling
- Simple analgesia
- Consideration of formal physiotherapy if symptoms persist²⁴ (this may include biomechanical assessment with relevant stretching and strengthening exercises, mobilisation and soft tissue therapy, and advice regarding posture and return to normal activities including sport)
- Injection of local anaesthetic/corticosteroid (this may occasionally be indicated and helpful for persistent pain, especially with night pain and morning stiffness)

*Stress fracture of the ribs from sport requires rest, biomechanical assessment and review of training load by a physiotherapist in conjunction with the athlete's coach

Common rheumatic causes include fibromyalgia, rheumatoid arthritis, axial spondyloarthritis and psoriatic arthritis.

- Once non-musculoskeletal causes have been ruled out, further diagnosis can mostly be made by history and examination.
- Reproducing the patient's pain by palpation or by movement is a key diagnostic feature for isolated musculoskeletal chest pain.
- Investigations may be needed if rheumatic or other systemic diseases are suspected.
- The evidence for treatment of the different conditions causing isolated musculoskeletal chest pain is poor. All patients require reassurance and an explanation of their condition. Other options include temporarily avoiding aggravating activities, stretching, simple analgesia, physiotherapy and, rarely, localised injections of local anaesthetic/corticosteroids.

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Competing interests: Graeme Jones is paid as a board member of Abbvie, Roche, Hospira and Janssen; receives consultancy fees from Roche, Pfizer, Abbvie and Axsome; has grants from Abbvie, Auxilium and Astrazeneca; and is paid for speaking engagements by Roche, Novartis, Abbvie, Pfizer and Janssen.

Provenance and peer review: Commissioned, externally peer reviewed.

Acknowledgements

Tania Winzenberg receives a National Health and Medical Research Council (NHMRC)/ Primary Health Care Research, Evaluation and Development (PHCRED) Career Development Fellowship, Graeme Jones an NHMRC Practitioner Fellowship and Michele Callisaya an NHMRC Early Career Fellowship.

References

1. Buntz F, Knockaert D, Bruyninckx R, et al. Chest pain in general practice or in the hospital emergency department: is it the same? *Fam Pract* 2001;18:586–89.
2. Bosner S, Becker A, Haasenritter J, et al. Chest pain in primary care: Epidemiology and pre-work-up probabilities. *Eur J Gen Pract* 2009;15:141–46.
3. Bosner S, Becker A, Hani MA, et al. Chest wall syndrome in primary care patients with chest pain: Presentation, associated features and diagnosis. *Fam Pract* 2010;27:363–69.
4. Wise C. Major causes of musculoskeletal chest pain in adults. In: Romain PL, editor. *UpToDate*. Waltham, MA: Wolters Kluwer Health, 2014.
5. Klinkman MS, Stevens D, Gorenflo DW. Episodes of care for chest pain: a preliminary report from MIRNET. Michigan Research Network. *J Fam Pract* 1994;38:345–52.
6. Scott EM, Scott BB. Painful rib syndrome – A review of 76 cases. *Gut* 1993;34:1006–08.
7. Kumar R, Ganghi R, Rana V, Bose M. The painful rib syndrome. *Indian J Anaesth* 2013;57:311–13.
8. Murtagh J. John Murtagh's general practice [electronic resource]. North Ryde, NSW: McGraw-Hill, 2011.
9. Dreyfuss P, Tibiletti C, Dreyer SJ. Thoracic zygapophyseal joint pain patterns. A study in normal volunteers. *Spine (Phila Pa 1976)* 1994;19:807–11.
10. Young BA, Gill HE, Wainner RS, Flynn TW. Thoracic costotransverse joint pain patterns: a study in normal volunteers. *BMC Musculoskelet Disord* 2008;9:140.

11. Erwin WM, Jackson PC, Homonko DA. Innervation of the human costovertebral joint: Implications for clinical back pain syndromes. *J Manipulative Physiol Ther* 2000;23:395–403.
12. Kellgren JH. On the distribution of pain arising from deep somatic structures with charts of segmental pain areas. *Clinical Science* 1939;4:35–46.
13. Feinstein B, Langton JN, Jameson RM, Schiller F. Experiments on pain referred from deep somatic tissues. *J Bone Joint Surg Am* 1954;36-A:981–97.
14. Verdon F, Burnand B, Herzig L, Junod M, Pecoud A, Favrat B. Chest wall syndrome among primary care patients: a cohort study. *BMC Fam Pract* 2007;8:51.
15. Meisel JL. Diagnostic approach to chest pain in adults. In: Park L, editor. *UpToDate*. Waltham, MA: Wolters Kluwer Health, 2014.
16. Wertli MM, Ruchti KB, Steurer J, Held U. Diagnostic indicators of non-cardiovascular chest pain: A systematic review and meta-analysis. *BMC Med* 2013;11:239.
17. Lee TH, Cook EF, Weisberg M, Sargent RK, Wilson C, Goldman L. Acute chest pain in the emergency room. Identification and examination of low-risk patients. *Arch Intern Med* 1985;145:65–69.
18. Burgstaller JM, Jenni BF, Steurer J, Held U, Wertli MM. Treatment efficacy for non-cardiovascular chest pain: a systematic review and meta-analysis. *PLoS One* 2014;9:e104722.
19. Lehtola VV, Korhonen I, Airaksinen O. A randomised, placebo-controlled, clinical trial for the short-term effectiveness of manipulative therapy and acupuncture on pain caused by mechanical thoracic spine dysfunction. *Int Musculoskelet Med* 2010;32:25–32.
20. Stockendahl MJ, Christensen HW, Vach W, Hoiland-Carlsen PF, Haghfelt T, Hartvigsen J. A randomized clinical trial of chiropractic treatment and self-management in patients with acute musculoskeletal chest pain: 1-year follow-up. *J Manipulative Physiol Ther* 2012;35:254–62.
21. Stockendahl MJ, Christensen HW, Vach W, Hoiland-Carlsen PF, Haghfelt T, Hartvigsen J. Chiropractic treatment vs self-management in patients with acute chest pain: A randomized controlled trial of patients without acute coronary syndrome. *J Manipulative Physiol Ther* 2012;35:7–17.
22. Proulx AM, Zryd TW. Costochondritis: diagnosis and treatment. *Am Fam Physician* 2009;80:617–20.
23. Rovetta G, Sessarego P, Monteforte P. Stretching exercises for costochondritis pain. *G Ital Med Lav Ergon* 2009;31:169–71.
24. Phillips K, Schur PH. Treatment of musculoskeletal chest pain. In: Goldenberg DL, editor. *UpToDate*. Waltham, MA: Wolters Kluwer Health, 2015.
25. Guymer E, Littlejohn G. Fibromyalgia. *Aust Fam Physician* 2013;42:690–94.
26. The Royal Australian College of General Practitioners. Clinical guideline for the diagnosis and management of early rheumatoid arthritis. Melbourne: RACGP, 2009.
27. Golder V, Schachna L. Ankylosing spondylitis: an update. *Aust Fam Physician* 2013;42:780–84.
28. Apostolopoulos D, Hoi AY. Systemic lupus erythematous - When to consider and management options. *Aust Fam Physician* 2013;42:696–700.
29. The Royal Australian College of General Practitioners. Clinical guideline for the prevention and treatment of osteoporosis in postmenopausal women and older men. Melbourne: RACGP, 2010.
30. Rosenquist EWK. Overview of the treatment of chronic pain. In: Aronson MD, editor. *UpToDate*. Waltham, MA: Wolters Kluwer Health, 2015.
31. Wolfe F, Clauw DJ, Fitzcharles MA, et al. The American College of Rheumatology preliminary diagnostic criteria for fibromyalgia and measurement of symptom severity. *Arthritis Care Res (Hoboken)* 2010;62:600–10.
32. Aletaha D, Neogi T, Silman AJ, et al. 2010 rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Ann Rheum Dis* 2010;69:1580–88.
33. Sieper J, Rudwaleit M, Baraliakos X, et al. The Assessment of SpondyloArthritis international Society (ASAS) handbook: a guide to assess spondyloarthritis. *Ann Rheum Dis* 2009;68 Suppl 2:ii1–44.
34. Taylor W, Gladman D, Helliwell P, Marchesoni A, Mease P, Mielants H. Classification criteria for psoriatic arthritis: development of new criteria from a large international study. *Arthritis Rheum* 2006;54:2665–73.

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