American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Chronic Neck Pain**

Variant 1: **Patient of any age, without or with a history of previous trauma, first study**.

Radiologic Procedure	Rating	Comments	RRL*
X-ray cervical spine AP lateral open mouth	9		Low
MRI cervical spine	2		None
X-ray cervical spine AP lateral open mouth obliques flexion/extension	2		Low
CT myelography cervical spine	2		Med
CT cervical spine	2		Low
X-ray cervical spine flexion/extension	2		Low
X-ray myelography cervical spine	2		Low
NUC bone scan targeted	2		Med
INV facet injection/arthrography cervical spine	2		IP
X-ray cervical spine AP lateral open mouth obliques	No Consensus	At discretion of clinician.	Low
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 2: **Patient of any age, history of previous malignancy, first study.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray cervical spine AP lateral open mouth	9		Low
X-ray cervical spine AP lateral open mouth obliques flexion/extension	2		Low
CT cervical spine	2		Low
X-ray myelography cervical spine	2		Low
CT myelography cervical spine	2		Med
X-ray cervical spine flexion/extension	2		Low
X-ray cervical spine AP lateral open mouth obliques	2		Low
NUC bone scan targeted	2		Med
MRI cervical spine	No Consensus		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Clinical Condition: **Chronic Neck Pain**

Variant 3: **Patient of any age, history of previous neck surgery, first study.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray cervical spine AP lateral open mouth	9		Low
X-ray cervical spine AP lateral open mouth obliques	2		Low
X-ray cervical spine AP lateral open mouth obliques flexion/extension	2		Low
NUC bone scan targeted	2		Med
CT myelography cervical spine	2		Med
MRI cervical spine	2		None
X-ray cervical spine flexion/extension	2		Low
X-ray myelography cervical spine	2		Low
CT cervical spine	2		Low
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 4: **Radiographs normal. No neurologic findings.**

Radiologic Procedure	Rating	Comments	RRL*
CT cervical spine	2		Low
X-ray myelography cervical spine	2		Low
INV facet injection/arthrography cervical spine	2		IP
CT myelography cervical spine	2		Med
MRI cervical spine	2		None
NUC bone scan targeted	2		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Clinical Condition: **Chronic Neck Pain**

Variant 5: **Radiographs normal. Neurologic signs or symptoms present.**

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine	9		None
INV facet injection/arthrography cervical spine	2		IP
X-ray myelography cervical spine	2		Low
CT cervical spine	2		Low
CT myelography cervical spine	2	Indicated if patient cannot undergo MRI.	Med
NUC bone scan targeted	2		Med
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 6: **Radiographs show spondylosis. No neurologic findings.**

Radiologic Procedure	Rating	Comments	RRL*
INV facet injection/arthrography cervical spine	2		IP
CT myelography cervical spine	2		Med
CT cervical spine	2		Low
MRI cervical spine	2		None
X-ray myelography cervical spine	2		Low
NUC bone scan targeted	2		Med
INV discography cervical spine	1		IP
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 7: **Radiographs show spondylosis. Neurologic signs or symptoms present.**

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine	9		None
X-ray myelography cervical spine	2		Low
CT cervical spine	2		Low
NUC bone scan targeted	2		Med
INV facet injection/arthrography cervical spine	2		IP
CT myelography cervical spine	2	Indicated if MRI cannot be performed.	Med
INV discography cervical spine	1		IP
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Clinical Condition: **Chronic Neck Pain**

Variant 8: **Radiographs show old trauma. No neurologic findings.**

Radiologic Procedure	Rating	Comments	RRL*
INV facet injection/arthrography cervical spine	2		IP
NUC bone scan targeted	2		Med
CT cervical spine	2		Low
X-ray myelography cervical spine	2		Low
MRI cervical spine	2		None
CT myelography cervical spine	2		Med
INV discography cervical spine	1		IP
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Variant 9: **Radiographs show old trauma. Neurologic signs or symptoms present.**

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spin	9		None
CT myelography cervical spine	2	Indicated if MRI cannot be performed.	Med
X-ray myelography cervical spine	2		Low
NUC bone scan targeted	2		Med
INV facet injection/arthrography cervical spine	2		IP
CT cervical spine	2		Low
INV discography cervical spine	1		IP
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

Variant 10: **Radiographs show bone or disc margin destruction.**

Radiologic Procedure	Rating	Comments	RRL*
MRI cervical spine	9		None
NUC bone scan targeted	2		Med
CT cervical spine	2		Low
CT myelography cervical spine	2		Med
X-ray myelography cervical spine	2		Low
Rating Scale: 1=Least appropriate, 9=Most appropriate			***Relative Radiation Level**

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Summary of Literature Review

The patient with chronic neck pain presents both diagnostic and therapeutic dilemmas for the clinician. There is considerable controversy in the literature over the etiology of chronic neck pain. The literature focuses on two general categories: post-traumatic and degenerative. Post-traumatic etiologies include the so-called "whiplash" syndrome. Degenerative conditions include spondylosis, including degenerative disc disease and acute disc herniation.

There is little in the literature on the use of imaging modalities in the evaluation of patients with chronic neck pain. Most of the studies cite the use of plain radiographs, particularly to diagnose spondylosis, degenerative disc disease, or post-traumatic malalignment. From a radiographic standpoint, diagnosis of spondylosis may be made if any one of three findings is present: 1) osteophytes; 2) disc space narrowing; or 3) facet disease.

There are many anecdotal reports in the literature about other etiologies of chronic neck pain that include carotid or vertebral artery dissection, arteriovenous malformations, and neoplasms.

For this review, 17 papers are included in the bibliography. Three of these by van der Donk et al (5,440 patients), Mäkelä et al (7,270 patients), and the Quebec group led by Spitzer et al (3,014 patients) evaluated chronic neck pain. The Quebec study focused entirely on "whiplash." The other two studies discussed the etiology of neck pain in relation to other contributing factors.

The van der Donk study confirmed observations made by other investigators on smaller patient populations that disc disease is more likely to cause neck pain in men but not in women. In patients with spondylosis, the presence of pain is related more closely to personality traits, neuroticism, and the presence of previous injury.

The Mäkelä study, in a representative sample of Finnish adults, found the chronic neck syndrome occurring in 10% of men and 14% of women. Contributing features of symptoms included previous history of trauma and mental and physical stress at work.

The Quebec Task Force on "whiplash" evaluated their experience with the disorder. It was an excellent cooperative study using consensus methods similar to those used by the ACR Task Force on Appropriateness Criteria. They developed a flow sheet defining whiplash-associated disorders and made recommendations for diagnosis and management.

The overwhelming theme throughout the review was that there were no reliable radiologic or laboratory data to confirm or refute the diagnosis of "whiplash". Furthermore, there was little correlation between the presence of cervical spondylosis or degenerative disc disease and the severity or duration of patient symptoms. Personality traits and secondary gain (particularly in patients with post-traumatic neck pain) are prominent findings. While spondylosis and disc disease increase with age, and are frequently asymptomatic, "whiplash" can accelerate these processes and lead to symptoms.

In recent years there has been an increased emphasis on the use of provocative diagnostic discography and facet joint injections. These studies are purportedly indicated for those patients who have multilevel facet or disc disease, in which the offending disc or facet joint cannot be identified. Facet injection, with or without arthrography, may help identify the location of pain source. Of particular note, however, is that extensive research by Carragee and associates (with lumbar discography) has demonstrated that pain intensity during disc injection is most influenced by the emotional and psychological profiles of the patient as well as the influence of any ongoing compensation claims. They concluded that discography could not be used to reliably confirm the location of a pain source.

Our review considered a number of clinical scenarios in which patients presented with chronic neck pain. These included situations in which we attempted to determine the optimal first study to be performed. These included patients younger than and older than age 40 without or with a history of remote trauma and patients of any age

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with a history of previous malignancy or previous remote surgery.

Finally, seven clinical scenarios were considered that included patients in whom radiographs were normal, or showed cervical spondylosis, evidence of old trauma or deformity, or bony or disc margin destruction. Variants included patients without and with neurologic signs and symptoms.

Recommendations

- Patients of any age with chronic neck pain without or with a history of remote trauma should initially undergo a 3-view (anteroposterior (AP), lateral, open mouth) radiographic examination. Oblique radiographs may be performed at the discretion of the attending physician.
- Patients with a history of previous malignancy should initially undergo a 3-view radiographic examination. Radionuclide bone scanning should not be the initial procedure of choice.
- Patients with a history of neck surgery in the remote past should initially undergo a three view radiographic examination.
- Patients with normal radiographs and no neurologic signs or symptoms need no further imaging.
- Patients with normal radiographs and neurologic signs or symptoms should undergo MR imaging. If there is a contraindication to the MR examination such as a cardiac pacemaker or severe claustrophobia, CT myelography, preferably using spiral technology and multiplanar reconstruction is recommended.
- Patients with radiographic evidence of cervical spondylosis or of previous trauma without neurologic signs or symptoms need no further imaging.
- Patients with radiographic evidence of cervical spondylosis or of previous trauma and neurologic signs or symptoms should undergo MR imaging. If there is a contraindication to MR, CT myelography is recommended.
- Patients with radiographic evidence of bone or of disc margin destruction should undergo MR imaging. If an epidural abscess is suspected, the examination should be performed with intravenous contrast. CT is indicated only if MR cannot be performed.
- Facet injection and arthrography are useful for patients with multilevel disease diagnosed by any imaging modality to identify the specific level(s) producing symptoms.
- Discography is not recommended.

Summary

There are no existing guidelines for the evaluation of the patient with chronic neck pain.

All investigators generally agree that plain radiographs should be the initial study performed for evaluating these patients. However, there is no consensus on exactly which views should be obtained for the initial study. We recommend a basic 3-view study, with oblique radiographs added at the discretion of the attending physician.

MR imaging should be performed on all patients who have chronic neck pain with neurologic signs, or symptoms, or both. If there is a contraindication to MR, CT myelography is recommended.

The use of additional imaging procedures should be determined by case manner, and the evaluation of patients with chronic neck pain should follow this "tailor-made" approach. Discography is not recommended.

References

1. Aprill C, Bogduk N. The prevalence of cervical zygapophyseal joint pain. A first approximation. *Spine* 1992; 17(7):744-747.
2. Barton D, Allen M, Finlay D, Belton I. Evaluation of whiplash injuries by technetium 99m isotope scanning. *Arch Emerg Med* 1993; 10(3):197-202.
3. Bogduk N, Aprill C. On the nature of neck pain, discography and cervical zygapophysial joint blocks. Pain 1993; 54(2):213-217.
4. Deans GT, Magalliard JN, Kerr M, Rutherford WH. Neck sprain—a major cause of disability following car accidents. *Injury* 1987; 18(1):10-12.
5. van der Donk J, Schouten JS, Passchier J, et al. The associations of neck pain with radiological abnormalities of the cervical *Spine* and personality traits in a general population. *J Rheumatol* 1991; 18(12):1884-1889.
6. Evans RW. Some observations on whiplash injuries. *Neurol Clin* 1992; 10(4):975-997.
7. Gore DR, Sepic SB, Gardner GM, Murray MP. Neck pain: a long-term follow-up of 205 patients. *Spine* 1987; 12(1):1-5.
8. Mäkelä M, Heliövaara M, Sievers K, Impivaara O, Knekt P, Aromaa A. Prevalence, determinants, and consequences of chronic neck pain in Finland. *Am J Epidemiol* 1991; 134(11):1356-1367.
9. Pearce JM. Whiplash *Injury*: a reappraisal. *J Neurol Neurosurg Psychiatry* 1989; 52(12):1329-1331.
10. Robinson DD, Cassar-Pullicino VN. Acute neck sprain after road traffic accident: a long-term clinical and radiological review. *Injury* 1993; 24(2):79-82.
11. Spitzer WO, Skovron ML, Salmi LR, et al. Scientific monograph of the Quebec Task Force on whiplash-associated disorders: redefining "whiplash" and its management. *Spine* 1995; 20(8 Suppl):1S-73S.
12. Welch WC, Erhard R, Clyde B, Jacobs GB. Systemic malignancy presenting as neck and shoulder pain. *Arch Phys Med Rehabil* 1994; 75(8):918-920.
13. Roy DF, Fleury J, Fontaine SB, Dussault RG. Clinical evaluation of cervical facet joint infiltration. *Can Assoc Radiol J* 1988; 39(2):118-120.
14. Hove B, Gyldensted C. Cervical analgesic facet joint arthrography. *Neuroradiology* 1990; 32(6):456-459.
15. Ohnmeiss DD, Guyer RD, Mason SL. The relation between cervical discographic pain responses and radiographic images. *Clin J Pain* 2000; 16(1):1-5.
16. Ortiz AO, Johnson B. *Discography. Tech Vasc Interv Radiol* 2002; 5(4):207-216.
17. Tong C, Barest G. Approach to imaging the patient with neck pain. *J Neuroimaging* 2003; 13:5-16.
18. Grubb SA, Kelly CK. Cervical discography: clinical implications from 12 years of experience. *Spine* 2000; 25(11):1382-1389.

19. Carragee EJ, Alamin TF. Discography: a review. *Spine* J 2001; 1(5):364-372.
20. Carragee EJ, Chen Y, Tanner CM, et al. Provocative discography in patients after limited lumbar discectomy: A controlled randomized study of pain response in symptomatic and asymptomatic subjects. *Spine* 2000; 25(23):3065-3071.
21. Carragee EJ, Tanner CM, Yang B, et al. False-positive findings on lumbar discography. Reliability of subjective concordance assessment during provocative disc injection. *Spine* 1999; 26(8):2542-2547.